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Global environment-related initiatives and green growth – investigating the integration of their goals into government policies and prospects for delivery

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Thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy in Sustainable Futures
under the supervision of Professor Dr. Damien Giurco and Adjunct Associate Professor Dr. Scott Kelly

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Certificate of original authorship

I, *Bishal Baniya* declare that this thesis, is submitted in fulfilment of the requirements for the award of *Doctor of Philosophy (Sustainable Futures)*, in the *Institute for Sustainable Futures* at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis. This document has not been submitted for qualifications at any other academic institution.

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This thesis consists of three published papers, (I) as Chapter 4, (II) as Chapter 5 and (IV) as Chapter 7 and one paper (III) under review as Chapter 6 accompanied by an exegesis. The list of published and to-be-published papers is as follows:

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The undersigned agree that the nature and extent of the contributions to the work was as follows:

Co-author	Nature of contribution	Extent of contribution (%)	Signature	Date
Bishal Baniya	Conceptualization, Methodology, Software, Formal Analysis, Investigation, Writing – original draft, Visualization, Project administration.	80	Production Note: Signature removed prior to publication.	30/6/2021
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Table of Contents

Certificate of original authorship ... *i*

Acknowledgement ... *ii*

List of Publications ... *iii*

Declaration by co-authors ... *iv*

Table of Contents ... *viii*

List of Tables ... *xi*

List of Figures ... *xii*

Glossary ... *xiv*

Abbreviations ... *xvi*

Abstract ... *xvii*

Chapter 1: Introduction ... 1

1.1. Research background and thesis focus ... 1

1.2. Relationship between income and resource consumption in Nepal and Bangladesh ... 13

1.3. Research gaps ... 15

1.4. Overall research objective ... 20

1.5. Research questions ... 21

1.6. Significance of the research ... 22

1.7. Thesis layout ... 24

Chapter 2: Literature Review ... 29

2.1. Global environmental assessments (GEAs) ... 31

2.2. Global environment-related initiatives – international climate agreements and Sustainable Development Goals 7, 12 and 13 ... 34

2.3. Green growth and competing growth models ... 39

2.4. Policy paradigms ... 44

2.5. Integrative policy approach across policy formulation and implementation ... 53

2.6. Energy and material consumption models for Bangladesh and Nepal ... 59

2.7. Summary of literature review ... 61

Chapter 3: Research Design ... 64

3.1. Overview of the mixed-method research approach ... 64

3.2. Qualitative research methods ... 67

3.3. Quantitative research methods ... 75

3.4. Limitation of this thesis' methodological approach ... 79

Chapter 4: Changing policy paradigms: How are the climate change mitigation-oriented policies evolving in Nepal and Bangladesh? ... 81
4.1. Introduction ... 83
4.2. Policy paradigm: concept and analytical framework ... 85
4.3. Methodology ... 89
4.4. Results ... 92
4.5. Discussion ... 101
4.6. Conclusion ... 104
Supplementary materials to Chapter 4 ... 106
Chapter 4 to Chapter 5 transition paragraphs ... 109
Chapter 5: Mainstreaming climate change mitigation actions in Nepal: influencing factors and processes ... 111
5.1. Introduction ... 113
5.2. Theoretical foundations and conceptual framework ... 116
5.3. Methodology ... 120
5.4. Results ... 124
5.5. Discussion ... 133
5.6. Conclusion ... 137
Supplementary material to Chapter 5 ... 139
Semi-structured interview questions ... 141
Supplementary material to Chapter 4 and Chapter 5 ... 144
Chapter 5 to Chapter 6 transition paragraphs ... 149
Chapter 6: Linking climate policy across economic sectors: green growth potential in Nepal ... 150
6.1. Introduction ... 152
6.2. Methods ... 154
6.3. Results and discussion ... 168
6.4. Conclusion ... 182
Supplementary materials to Chapter 6 ... 184
Chapter 6 to Chapter 7 transition paragraphs ... 190
Chapter 7: Green growth in Nepal and Bangladesh: empirical analysis and future prospects ... 191
7.1. Introduction ... 193
7.2. Methodology ... 195
7.3. Results and discussion ... 201
7.4. Conclusions and policy implication ... 218

Chapter 8: Discussion 221
8.1. Key features of the new climate mitigation-based policy paradigms in Nepal and Bangladesh 222
8.2. Mainstreaming climate mitigation actions into sectoral policies in Nepal 228
8.3. Linking climate mitigation actions with sectoral policy goals 240
8.4. Greening of growth in Nepal and Bangladesh 247
8.5. Conceptual contributions: Extending the knowledge on climate mitigation policy paradigm and mainstreaming. 253
Chapter 9: Conclusion 259
Future recommendations 266
References 269

List of Tables

Table 3.1. Methods used in each of the research findings chapters.	67
Table 3.2. Type and number of research participants (Policy actors).	71
Table 4.1. Key aspects of changes in policy paradigm.	88
Table 4.2. Change in policy paradigms for two periods between 1992 and 2018 for Nepal and Bangladesh.	93
Table 5.1. Conceptual criteria for discussing the mainstreaming of climate change mitigation action.	119
Table 5.2. Findings from the review of non-environment sector policies of Nepal.	132
Table 6.1. Estimated sectoral energy consumption values in 2030 for Nepal.	159
Table 6.2. Key socioeconomic parameters, and input and output data for four scenarios under study.	161
Table 6.3. Scenarios descriptions, model inputs, and model outputs for Energy and Agriculture, Forest, and Other Land-Use (AFOLU) sectors of Nepal.	166
Table 6.4 Percentage change in Total Energy Demand (TED) and greenhouse gas (GHG) emissions between 2015 and 2030 for Nepal.	169
Table 6.5. Energy loss and potential value loss in four scenarios between 2015 and 2030 for Nepal.	173
Table 7.1. Energy use and material consumption models for Nepal and Bangladesh.	207
Table 7.2. Projected values of energy and material productivity of Nepal and Bangladesh for four scenarios in 2030.	210
Table 7.3. Results from Ridge Regression analysis of domestic material consumption for Nepal and Bangladesh.	213
Table 7.4. Linking the environmental and economic goals for Nepal and Bangladesh.	218

List of Figures

Figure 1.1. Total and per capita greenhouse gas (GHG) emissions of Nepal and Bangladesh.	4
Figure 1.2. Overview of the research focus	9
Figure 1.3. Relationship between GDP per capita, TPEC, and DMC for Nepal and Bangladesh.	15
Figure 1.4. Structure of the thesis	25
Figure 2.1. Emerging growth models and their goals.	40
Figure 3.1. Qualitative and quantitative research methods	66
Figure 4.1. Key aspects of changes in policy paradigms	89
Figure 4.2. Methods used for data collection, extraction, and analysis for observing the changes in policy paradigms in Nepal and Bangladesh.	91
Table 4.3. Change in policy paradigms for two periods between 1992 and 2018 for Nepal and Bangladesh.	104
Figure 5.1 Conceptualisation of the climate change mitigation mainstreaming	120
Figure 5.2. Methodological approach for data collection and analysis.	121
Figure 5.3 Causal relationship between influencing factors, knowledge and ideas of policy actors, policymaking approaches, and collaborative governance.	126
Figure 6.1. Methods used for estimating future energy use and GHG emissions from energy and agriculture, forest, and other land-use sectors	158
Figure 6.2. Change in Total Energy Demand (TED) in million gigajoules (GJ) for four different scenarios between 2015 and 2030	168
Figure 6.3. Changes in the Total Energy Demand (TED) in million gigajoules (GJ) between 2015 and 2030 for four scenarios, and the change in demand for major energy consuming sectors for Nepal	170
Figure 6.4. Energy resource requirements in million gigajoules (GJ) allocated to demands for four scenarios between 2015 and 2030 based on fuel type for Nepal.	171
Figure 6.5. Greenhouse gas (GHG) emissions in million tons of carbon dioxide equivalent from energy sector and AFOLU sector for Nepal	172
Figure 6.6. Carbon productivity (Energy sector), carbon productivity (Economy-wide), and energy productivity values for base year (2015) and four scenarios in 2030.	174
Figure 6.7. Greenhouse gas (GHG) emissions in million tons of carbon dioxide equivalent from the Agriculture sector in 2015 and in 2030 for four different scenarios	177

Figure 7.1. Alignment of chosen green growth indicators with the goals of three strategic priorities – low income country (LDC) graduation, nationally determined contributions (NDCs) and sustainable development goals (SDGs).	198
Figure 7.2. Change in the Normalized Index (NI) values of selected green growth indicators for Nepal and Bangladesh between 1985 and 2016.	201
Figure 7.3. Correlation heat maps of green growth indicators for Nepal and Bangladesh for three periods between 1985 and 2016	203
Figure 7.4. Change in TPEC values of Nepal and Bangladesh between 2016 and 2030	208
Figure 7.5. Change in DMC values of Nepal and Bangladesh between 2016 and 2030	208
Figure 7.6. Total primary energy consumption (TPEC) per capita versus income per capita between 1985 and 2030 for Nepal and Bangladesh.	215
Figure 7.7. Domestic material consumption (DMC) per capita versus income per capita between 1985 and 2030 for Nepal and Bangladesh.	215
Figure 8.1. Causal effect across policy formulation and implementation from policy discourse on global environment-related initiatives and green growth.	222
Figure 8.2. Climate change policy paradigms, their drivers, motivation and implications	256

Glossary

Carbon productivity	Carbon productivity is defined as the specific value of economic output (GDP) generated per unit of carbon dioxide emissions equivalent over the same period (Kaya and Yokobori, 1999; Lu et al., 2018).
Domestic Material Consumption (DMC)	Domestic material consumption measures the total amount of materials directly used by an economy and is calculated as the annual quantity of raw materials extracted from domestic territories, plus all physical imports minus physical exports (Eurostat, 2021). In this thesis, DMC includes biomass, fossil fuels, metal ores, and construction materials.
Energy productivity	Energy productivity is expressed as the amount of economic output generated in terms of gross domestic product (GDP) per unit of energy consumed in terms of TPEC (AAEP, 201).
Environmental policy integration	Environmental policy integration refers to the incorporation of environmental objectives in non-environmental policy sectors, such as energy, forestry, agriculture, industry, and transport (Lafferty and Hovden, 2010).
Government policies	In this research, government policies refer to environment and climate-specific policies and non-environment sector policies.
Green growth	In a general sense, green growth refers to the model of economic growth, which also aims to achieve significant environmental protection (Jacobs, 2013).
Mainstreaming	Mainstreaming refers to integrating environmental and climate-specific objectives, policies and strategies into sectoral planning and decision-making processes (Saito, 2013; Rauken et al., 2015).
Material productivity	Material productivity is expressed as the amount of economic output generated in terms of gross domestic product (GDP) per unit of materials consumed in terms of DMC (OECD, 2021).
Non-environment sector policies	Non-environment sector policies are the policies of non-environmental policy areas, such as energy, forestry, agriculture, industry, and transport (Persson et al., 2018).
Policy coherence	Policy coherence refers to reducing conflicts and promoting synergies between and within different sectoral policies for achieving jointly agreed policy goals (Nilsson et al., 2012).
Resource	In the literature, resource as a term has been used to refer to the combination of biomass, metal ores, industrial minerals, construction minerals, and fossil fuels (Schandl and West, 2010) and in a broader sense, resource can also include water

	and land (van Ewijk, 2018). However, in this thesis, the specific focus is on energy resources comprising biomass and fossil fuels. Therefore, this research uses the term 'resource' to refer to biomass and fossil fuels.
Resource efficiency	Resource efficiency refers to minimising material inputs and maximising economic outputs via material loss prevention (van Ewijk, 2018). If resource efficiency improves, more economic prosperity can be attained without increasing overall resource use (Duro et al., 2018).
Resource productivity	Resource productivity describes the economic output generated per unit of resource use. Resource productivity is a widely used sustainability indicator that combines economic and environmental information, and a high value signals a resource-efficient economy (Steinberger and Krausmann, 2011).
Total Primary Energy Consumption (TPEC)	Total primary energy consumption refers to the total energy demand of a country, which covers consumption of the energy sector itself, transformation and distribution losses, and the final consumption by end users (Eurostat, 2021). In this thesis, TPEC includes all forms of energy resources.

Abbreviations

GJ	Gigajoule (= 10^9 joule)
ha/year	Hectare per year
km	Kilometre (= 10^3 metre)
koe	Kilogram of oil equivalent (= 10^3 grams of oil equivalent)
ktoe	Kilo tonnes of oil equivalent (= 10^9 grams of oil equivalent)
ktons	Kilo tonnes (= 10^9 grams)
MJ	Mega joule (= 10^6 joules)
MtCO2e	Million tonnes of carbon dioxide equivalent (= 10^9 grams of carbon dioxide equivalent)
MW	Megawatt (10^6 watts)
tCO2e	Tonnes of carbon dioxide equivalent (10^3 grams of carbon dioxide equivalent)
USD	United States Dollars

Abstract

Global environment-related initiatives (GEI) such as international climate agreements and the Sustainable Development Goals (SDGs), together with the green growth (GG) model of economic development, are encouraging policymakers in Nepal and Bangladesh to deliver reductions in greenhouse gas (GHG) emissions. While the concept of green growth aims to reconcile the tension between policies focussed on economic growth and on delivering climate mitigation actions (e.g. reductions in GHG emissions and non-renewable resource), it has notable flaws in its application. For example, the application of green growth may not address the absolute reduction of non-renewable resource and GHG emissions issues while prioritising economic growth. Nonetheless, in addition to GEI, GG is often an important subject in both countries' environmental policy discourse. For low-income countries such as Nepal and Bangladesh, we know little about how the GEI and GG related policy discourse influences the knowledge and ideas of policy actors, the policymaking processes, or the extent to which it incentivises government policies to incorporate common objectives of GEI and GG such as climate mitigation actions. There is also a lack of sufficient country-specific studies about GG despite it being an important agenda for notable international development organisations active in many low-income and developing countries.

While delivering climate mitigation objectives of the GEI and GG, Nepal and Bangladesh venture to achieve transition from United Nations least developed country (LDC) status by increasing their economic output (e.g. gross national income per capita). Therefore, to identify ways to navigate the complexity of implementing policies focusing on economic growth and climate mitigation objectives, this study uses quantitative empirical research and predictive modelling of resource use and GHG emissions for a range of future policy and economic growth rate scenarios. Content analysis of existing sectoral, climate, and environmental policies of Nepal (n=17) and Bangladesh (n=18) that consider the inclusion of climate mitigation actions provide insights into a reorientation of the focus of policies, their goals, and the extent to which government policies frame climate mitigation actions. Semi-structured interviews (n=12) with policy actors in Nepal, including central and local level policymakers, and

representatives from the private sector and non-government international development organisations provided insights regarding the influence of GEI and GG narratives on government policies.

This research generated two key findings. First, national policy discourse on GEI and GG influences policy actors' knowledge and ideas, thereby changing the national policy paradigm, which is the model for policy formulation. A new climate mitigation-based policy paradigm that emerged post-2005 now co-exists with the previous climate adaptation-based policy paradigm in both countries. The new climate mitigation-based policy paradigm has three key features: 1) a shift from finance via official development assistance (ODA) to internal funding; 2) a focus on other benefits of climate mitigation such as access to clean energy, sustainable transportation, and sustainable agriculture; and 3) higher transparency of climate actions that are communicated to the global community. However, the trend of rising GHG emissions in both Nepal and Bangladesh in the last two decades contradicts the presence of climate mitigation-based policy paradigms. The contradiction contributes to the long-standing debate about when to consider a paradigmatic change from adaptation to mitigation in government policies and highlight the need to link the framing and delivery of climate mitigation actions.

This research found that the framing of climate mitigation actions into government policies, without sufficiently considering the delivery prospect, is largely a consequence of the requirements of GEI. Second, even with significant improvements in energy, material, and carbon productivity, and despite structural changes in both Nepal and Bangladesh economies, the greening of growth does not appear sufficient in the absolute sense. For example, the projected increase in total primary energy consumption will range from 8-15% for Nepal and 46-68% for Bangladesh between 2016 and 2030. Similarly, the absolute increase in domestic material consumption will range from 26-40% for Nepal and 56-61% for Bangladesh between 2016 and 2030. This finding corroborates the empirical limitation of GG in delivering the climate mitigation objectives in an absolute sense. Thus, this research suggests two key actions to deliver climate mitigation objectives in an absolute sense, which will also enable the new climate mitigation-based policy paradigms to function effectively in both countries whilst graduating from the LDC status.

The first action is mainstreaming climate mitigation across policies of various economic sectors. Mainstreaming climate mitigation implies prioritisation of climate mitigation objectives, making them overriding objectives. The prioritisation of climate mitigation as an overriding objective in sectoral policies presents a better solution than simply framing climate mitigation objectives into sectoral policies, which pertains to the concept of policy integration. This research explored the conceptual limitation of policy integration to find that mainstreaming, which is often used interchangeably with policy integration, is different and better because sectoral policies make climate mitigation objectives their key focus. For example, despite contributing almost half of the nation's GHG emissions, the agriculture sector policies and NDCs (2016 and 2020) of Nepal have framed climate mitigation objectives without sufficiently including the climate mitigation targets. In the business-as-usual (BAU) scenario, GHG emissions from the agriculture sector are likely to increase by 8.5 MtCO2e in 2030 compared to 2015. In the nationally determined contribution (NDC) scenario, the increase in GHG emissions from Nepal's agriculture sector is same as in the BAU scenario, as the NDC documents (2016 and 2020) have insufficiently considered mitigation actions in this sector. Thus, the GHG emissions from Nepal's agriculture sector are projected to remain the same (33.5 MtCO2e) in both the NDC scenario in 2030 and the BAU scenario in 2030. It implies that even if the NDC is implemented, the agricultural sector's GHG emissions are unlikely to reduce. Further, this research found that policy integration is primarily policy formulation-oriented, whereas mainstreaming has some focus on policy implementation, thus shedding light on the conceptual nuance between the two concepts. The second action, for Nepal, is a renewable energy transition—from low-energy intensity biomass-based to high-intensity hydroelectricity—coupled with minimising transmission and distribution electricity. For Bangladesh, the suggested action is a transition from using biomass and fossil fuels to using more renewable energy resources, which will reduce biomass and fossil fuels use and the associated GHG emissions.

Chapter 1: Introduction

1.1. Research background and thesis focus

The 1972 United Nations Conference on the Human Environment kick-started the trend of international environmental agreements (Joyner 2005, p.198). However, it was the late 1980s that saw a significant rise in such agreements (Mitchell et al., 2020) with sustainability emerging as one of the leading global priorities in 1987, after publication of the report, 'Our Common Future', by the World Business Council on Sustainable Development (WBCSD). Five years later, the United Nations Conference on Environment and Development, held in Rio de Janeiro, stressed achieving sustainable development in the 21st century (UNCED, 1992). One hundred and eight countries signed the Rio Declaration on Environment and Development (Jang et al., 2015) and Agenda 21 of the Declaration identified measures to enhance international cooperation for accelerating sustainable development in both developed and developing countries. Further, integrating environment and development in decision-making and targeting a reduction in unsustainable production and consumption patterns were identified as key to protecting the environment. The United Nations Framework Convention on Climate Change (UNFCCC) was an international environmental agreement signed by 154 countries at the Rio 1992 Earth Summit. This treaty aimed to stabilise greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent catastrophic impacts of climate change (UNFCCC, 1992, p.4).

Twenty-nine years after the Rio Earth Summit (1992), almost all countries around the world have become signatories to the UNFCCC's Paris Climate Agreement (2015) and the United Nations Sustainable Development Goals (SDGs) (UNDESA, 2021a). Multilateral international climate agreements[1], including the Paris Climate Agreement and the environment-related SDGs[2] (Goals 7, 12 and 13), encourage signatory countries to develop and implement plans, policies, and strategies to

[1] International climate agreements are grouped under international environmental agreements (Mitchell et al., 2020).
[2] Although the SDGs are not a legally binding international agreement and are largely socio-economically focused global goals, this research examines Goals 7, 12, and 13 as they relate to the climate change mitigation measures that signatories are encouraged to implement by the year 2030.

reduce GHG emissions and enhance sustainable resource consumption. Goal 7 is concerned with affordable and clean energy. Goal 12 aims to ensure sustainable consumption and production patterns, and Goal 13 aims to implement actions to combat climate change and its impacts. For this research, the term ‘global environment-related initiatives’ refers collectively to international climate agreements and the environment-related SDGs.

In addition to international climate agreements and the environment-related SDGs, the concept of ‘green growth’ emerged in international policy discourse during the early 2010s (Jacobs, 2012). While there exist multiple definitions of green growth, the core meaning of the concept is economic growth[3] which also aims to achieve significant environmental protection (Jacobs, 2013). The shift in the dominant economic model from conventional to environment-focused growth—in a manner that viewed environmental protection as a driver of economic growth—contributed to the emergence of the concept of green growth (Stevens, 2011, p. 3). Subsequently, international organisations[4] such as the World Bank (WB), the Organisation for Economic Cooperation and Development (OECD), the Asian Development Bank (ADB), the United Nations Environment Program (UNEP) and the Global Green Growth Institute (GGGI) embraced green growth and the related notion of “green economies” (Schmalensee, 2012). Thus, achieving green growth became a central objective of major international organisations (e.g. OECD, WB and UNEP). The three notable reports: UNEP's *Towards a Green Economy (2011)*, the World Bank's *Inclusive Green Growth (2012),* and the OECD's *Towards Green Growth (2011),* aim to provide a policy framework to help progress on green growth (Borel-Saladin and Turok, 2013). The reports mentioned above emphasise three key advantages of adopting green growth for government policymakers: 1) reduction in GHG emissions; 2) prevention of environmental degradation; and 3) sustainable use of natural resources.

[3] Economic growth refers to the annual growth in gross domestic product (GDP).
[4] International organisations are also referred to as international development organisations throughout this thesis because they foreground development agenda whilst providing technical and financial support in recipient countries.

Consequently, the concept of green growth moved up policymakers'[5] agendas for three main reasons: (i) economic growth became an important political imperative after the recession of 2008–09; (ii) economic growth promoted development in low-income countries[6]; and (iii) human-induced climate change brought the environment into the headlines (Bowen and Hepburn, 2014). This research focuses on the second and third reasons for focusing on the green growth and climate mitigation nexus, the policy narratives and implementation pathways in two low-income countries, Nepal and Bangladesh. These two South Asian countries are amongst the most vulnerable countries because of their exposure to climate change risks, such as floods, droughts, water security, extreme heat, conflicts and migration, economy and human health, and other water-related impacts (Vinke et al., 2017).

Their high vulnerability to the potential impacts of climate change is unjust in a natural sense because, in 2019, Nepal's contribution to global GHG emissions was 0.04%, and that of Bangladesh was 0.28% (Ritche and Roser, 2020). Figure 1.1 shows the total and per capita GHG emissions for Nepal and Bangladesh between 1971 and 2016. The per capita GHG emissions of both Nepal (1.4 tonnes) and Bangladesh (0.8 tonnes) are lower than the current allocation of 2 tonnes per country under the contraction and convergence mechanism (Climate Change Connection, 2021). Being responsible for a tiny fraction of total global GHG emissions means that these two countries can continue their existing GHG emission trends under the contraction and convergence approach that allows countries with low per capita GHG emissions to seek equitable emissions entitlements (Meyer, 1999; Luukkanen, 2006). Nonetheless, despite having low historical GHG emissions per capita and low mitigative capacity (Ayers and Huq, 2009; Ritche and Roser, 2020), the traditional focus on climate adaptation (Vij et al., 2018; Shrestha and Dhakal, 2019), and their special circumstances as low-income countries (Paris

[5] I use the term 'policymakers' to refer specifically to both central and local government policymakers who are generally responsible for leading the policymaking process while involving other non-government stakeholders.
[6] In this thesis, low-income countries are often called as least developed countries (LDCs) to seek consistency in the use of LDCs by the United Nations. The World Bank uses low-income economies category, which is solely based on gross national income (GNI) per capita. The United Nations country category is based on GNI per capita, economic vulnerability index, and human asset index.

Agreement, Article 4.6), both countries have taken early steps towards framing[7] climate mitigation actions into their government policies.

Although this research has focused more on Nepal than Bangladesh, I chose two countries instead of one for the following three reasons. First, the comparison perspective based on the relatively larger empirical dataset from two countries can unearth more valuable insights. Second, focusing on two countries from the same geographical region (South Asia) will add to the rapidly growing literature on regional level studies. Finally, single country case studies require more in-depth analysis, thereby potentially compromising the breadth of the study. For single-case studies requiring more in-depth analysis, I have chosen Nepal whereas, for studies requiring consideration of a breadth of research themes covered, I have chosen both Nepal and Bangladesh. I chose the two South Asian countries for their policymakers' interest in communicating their intended climate actions to the global community. Bangladesh and Nepal are amongst the first 17 countries from the Asia-Pacific region to submit their revised second Nationally Determined Contributions (NDCs) to the UNFCCC between 2020 and 2021. For a single case country study requiring in-depth analysis, I chose Nepal because of the dedicated green growth program in Nepal, which is supported directly by the Global Green Growth Institute (GGGI) – one important member of the international development organisations group advocating green growth.

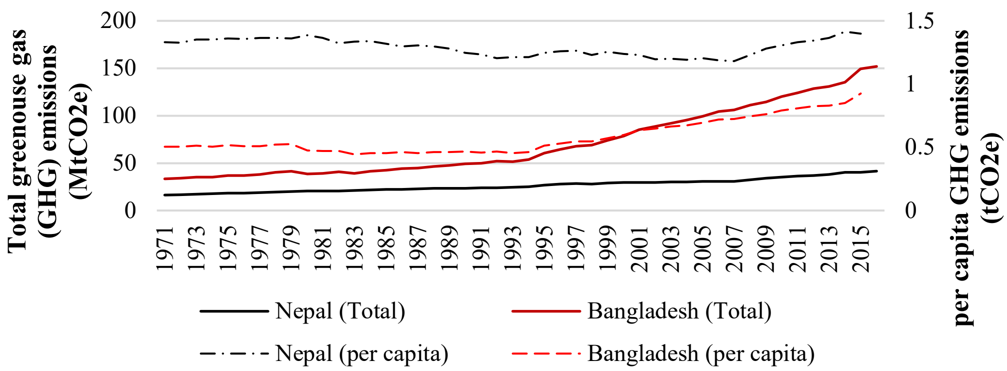

Figure 1.1. Total and per capita greenhouse gas (GHG) emissions of Nepal and Bangladesh between 1971 and 2016 (Source of data: The Shift Data Portal).

[7] In this thesis, I use the following terms, 'framing', 'integration', 'inclusion', and 'incorporation' as substitutes, which means integration of a certain issue in a policy in a general sense. However, a word 'mainstreaming' is used for a different purpose, which is explained in detail in later sections.

Environmental policymaking, including the framing of climate mitigation actions into government policies in the Global South,[8] depends on official development assistance (ODA) from international agencies and global environmental discourse (Shrestha and McManus, 2005; Karkee and Comfort, 2016; Vij et al., 2018). ODA is defined as government aid from developed countries to promote and target the economic development and welfare of developing countries. These external factors have added extra responsibilities to focus on climate mitigation in addition to a traditional focus on climate adaptation in low-income countries such as Nepal and Bangladesh. Amidst the additional responsibility to focus on climate mitigation, both countries are uniquely positioned to achieve graduation from United Nations least developed country (LDC) status by achieving higher economic growth. The United Nations Committee for Development Policy (CDP) has recommended both Nepal and Bangladesh for LDC graduation in early-2021 (UNDESA, 2021b). A higher average annual growth rate of gross national income (GNI) per capita was necessary for Nepal (more than 11%) and Bangladesh (more than 6.5%) to reach the income threshold for LDC graduation (Kawamura, 2014). Bangladesh is recommended for graduation after fulfilling all three criteria for LDC graduation: GNI per capita, Economic Vulnerability Index (EVI), and Human Asset Index (HAI). Nepal is recommended based on economic vulnerability and human asset indices. Both countries will officially graduate in 2026 (UNDESA, 2021b).

The adoption of the Paris Climate Agreement and the long-term growth strategy of most countries means that a new growth model (e.g. green growth) is expected to accelerate the deployment of climate mitigation actions (Kinley, 2017). Given the global environment-related initiatives and the policy discourse on potential growth models that emphasise climate mitigation actions, this research investigates the case for the greening of growth in Nepal and Bangladesh. In this research, 'climate mitigation actions' refers to both policy and non-policy actions[9] that aim to reduce GHG emissions, enhance the sustainable use of resources, improve resource efficiency, and transition to renewable

[8] The term 'Global South' is often used to refer all least developed countries (LDCs) collectively.
[9] Non-policy actions refers to actions that are intended for implementing the goals mentioned in the policies and are not directly linked to policy formulation.

energy. While climate mitigation actions—particularly resource efficiency improvement—form the core of the green growth tenet (Hellegatte et al., 2011), this research will also discuss the green growth narrative in the context of the LDC graduation of Nepal and Bangladesh. International organisations introduced the green growth narrative into the government policy landscape in many low-income countries around the world by giving assurances that it would reduce widespread poverty while at the same time improving economic output (Victor and Jackson, 2012; Faccer et al., 2014).

The role of international organisations is critical in the pursuit of sustainable development in Nepal and Bangladesh—including the shaping of environmental policies (Adele and Russel, 2013; Vij et al., 2018; Aryal et al., 2021)—and these two countries are signatories to global environment-related initiatives. Therefore, this research presumes that policy discourse on global environment-related initiatives and green growth influence environmental policymaking processes, and consequently, the national policy paradigms. A policy paradigm is a system of ideas that specifies policy goals and the instruments used to address specific problems (Hall, 1993). Ideas refer to the content, evidence, and values of policy actors[10] , which originates from their interest during institutional interactions. Interest is the balancing act between the 'logic of position' and the "logic of interpretation. While the 'logic of position' pertains to the institutional environment around policy actors, the 'logic of interpretation' pertains to the psychological and ideational perception of policy actors (Parsons, 2007). This research conceptualises institutions as systems of norms, rules, and decision-making procedures that generate social practices and assign roles to participants (e.g. policy actors) while also guiding the participants' interactions (Simmons and Martin, 2002, p.192; Biermann et al., 2009). Ideas, interest, and institutions are collectively referred to as the '3Is', which are key to explaining the policy change process (Walt, 1994; Shearer et al., 2016). Ideas refer to the contents, evidence, and preferences and values of policy actors, informed by their interests and institutional interactions. The role of ideas in policy is most prominent during the policy formulation stage, where there is explicit competition amongst policy actors' ideas

[10] The term 'policy actor' is frequently used in this thesis to refer to the government policymakers and people from private sector organisations, civil society organisations, and the international development organisations collectively.

(Béland, 2016). In the context of this research, the policy paradigm is understood as the policy formulation model with attributes such as policy goals and instruments used (e.g. regulatory, financial, market, and economy-based instruments).

The influence of global environmental governance and international organisations' bureaucracies on certain countries can be cognitive, normative or executive (Biermann et al., 2009). Cognitive influences foster the informational basis of policies, such as the synthesis and dissemination of scientific knowledge about environmental problems. Normative influence refers to the advancement of national and sub-national norm-setting for incorporating the 'objectives of the global environment-related initiatives and green growth'[11] in government policies. Executive influence relates to influencing of the policymaking process by international organisations' bureaucracies, during both policy formulation and policy implementation, by providing funding and other support (e.g. technical and institutional capacity building) for implementing environmental projects (Biermann et al., 2009). For example, the OECD and the UNEP have influenced many states and their actors (e.g. policymakers) in the area of environmental protection across three dimensions: cognitive, normative, and executive (Biermann and Siebenhüner, 2009; McLean, 2011).

Based on the premise that the policy discourse on global environment-related initiatives and green growth influences policymaking and national policy paradigms, Figure 1.2 depicts global environment-related initiatives and green growth as external drivers that impact policymaking processes by changing national policy paradigms. I have used the literature on Environmental Policy Integration (EPI) to understand the inclusion of climate mitigation actions in government policies. EPI is defined as the incorporation of environmental objectives into all stages of policymaking in non-environmental policy sectors, thereby minimising the contradictions between environmental and sectoral policies (Lafferty and Hovden, 2010). In a general sense, EPI is frequently referred to as policy integration in environmental policy studies. Policy integration is used in conjunction with concepts such as 'policy

[11] In this thesis, the 'objectives of global environment-related initiatives and green growth' and 'climate mitigation actions/objectives' are used interchangeably based on the context of the discussion.

coherence' and 'mainstreaming' because these concepts use a similar approach to frame environmental objectives (e.g. climate mitigation actions) into government policies. The concept of mainstreaming emphasises the incorporation of environmental objectives across policy formulation and implementation stages into policies with other disciplinary foci. Policy coherence is an attribute of a policy that systematically reduces conflicts and promotes synergies between different policy areas to achieve jointly agreed policy objectives (Nilsson et al., 2012). The literature review chapter (Chapter 2) provides more information about the conceptual nuances between the three concepts. For the case study countries of Nepal and Bangladesh, this research identifies EPI as the process to enable the integration of the objectives of the global environment-related initiatives and green growth into government policies, which is investigated in detail (in Chapter 4 and Chapter 5) by using the concepts of policy paradigms, policy integration, and mainstreaming.

I also discuss the co-benefits of climate mitigation actions from the following perspective. Nepal and Bangladesh do not contribute significantly to global GHG emissions and global resource use in either absolute terms or in per capita GHG emissions and per capita resource use (Figure 1.1). Therefore, policymakers' motivation to focus on climate mitigation in addition to climate adaptation could include non-climate benefits across economic, social, and environmental domains—for example, technological advantage, clean environment, access to international climate finance, and a socially responsible development pathway. These bring immediate and local benefits. Therefore, when incorporating the objectives of global environment-related initiatives and green growth into policies, I argue that policymakers can also consider the local benefits of climate mitigation actions.

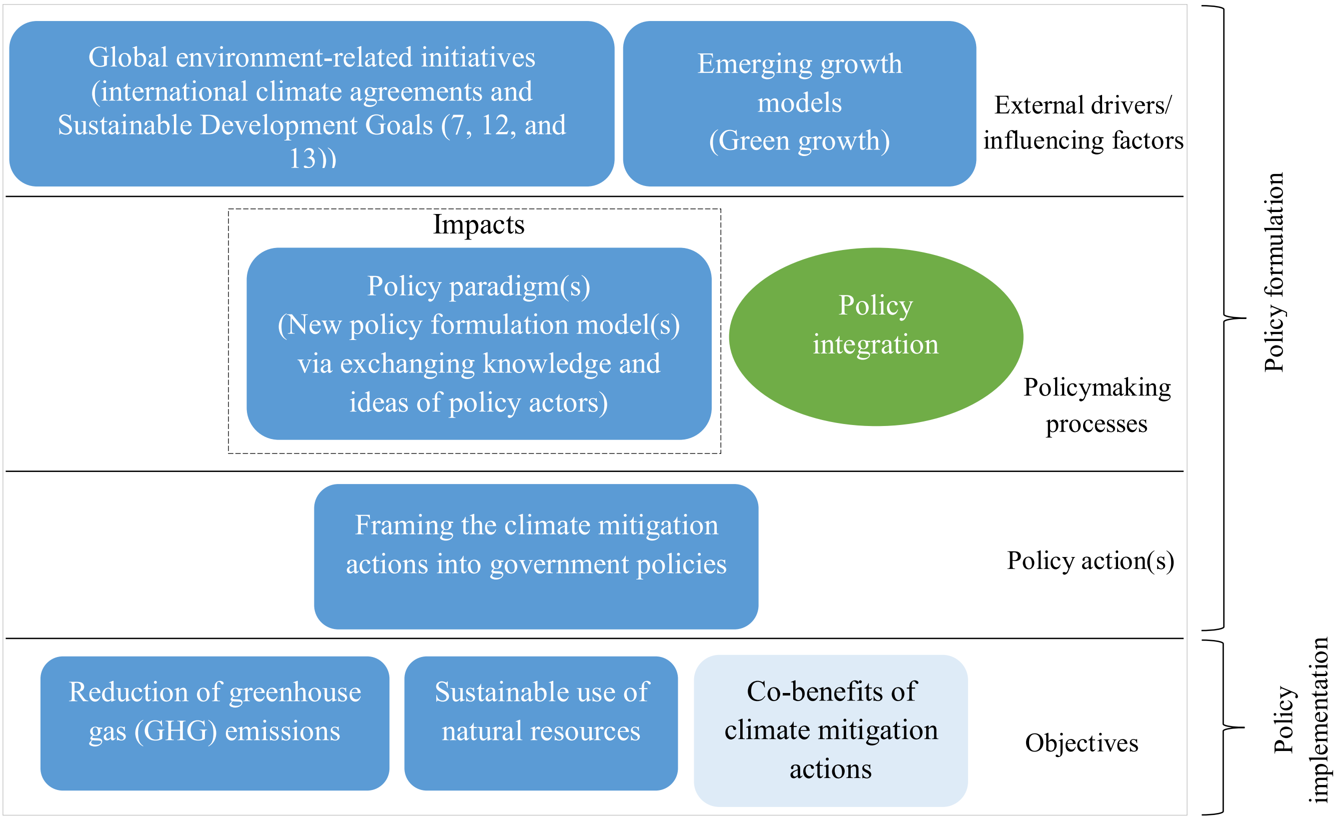

Figure 1.2. Overview of the research focus

1.1.1. Policy discourse on global environment-related initiatives and green growth

The 2010 Cancun Climate Agreement had initially stressed consideration of climate mitigation actions in developing countries via leveraging long-term financial options (e.g. Green Climate Fund), technology transfer between countries, and capacity building (UNFCCC, 2010). Developing countries were also encouraged to pledge on Nationally Appropriate Mitigation Actions (NAMAs) as most of the previous international climate conventions, up till the Copenhagen Climate Change Conference in 2009, focused on reducing GHG emissions in developed countries. While developing countries, including low-income countries, agreed to identify ways to reduce their GHG emissions, they did not make any specific commitments. Around the same time, green growth emerged as a new model of economic growth that emphasised a least GHG emissions growth pathway. Its proponents suggested it incorporated issues such as poverty alleviation, job creation and welfare benefits, at the same time promoting sustainable development (Skea et al., 2013). While the international organisations and their policies appear to overemphasise the concept of green growth, empirical evidence shows that green growth as a strategy is not compatible with the aims of the Paris Climate Agreement (Hickel and Kallis, 2019). Hickel and Kallis (2019) found that the assumption made under the concept of green growth, which is that continuous economic growth is compatible with the planet's ecology, did not concur with the empirical evidence on absolute decoupling GHG emissions from economic growth. Notwithstanding the conceptual and empirical limitations of green growth, managing both economic growth-related issues and climate mitigation objectives via delivering on commitments to international climate agreements remains highly relevant in the context of global climate change, even for low-income countries. Consequently, post-2010, new policy formulation models (policy paradigms) that frame climate mitigation actions in government policies were expected at both global and country levels.

A new climate policy paradigm emerged in an international arena in the mid-2010s that framed climate change as a transformational challenge across social, cultural and political domains (Hermwille, 2016). To achieve this transformation, international governance (e.g. governance of international climate agreements) that involves all stakeholders, including those most vulnerable to climate change (e.g. low-income countries), is useful for addressing environmental concerns concurrently with socio-economic challenges (Hermwille, 2016). The recent paradigm shift in international climate policy post-2015 focuses on an actor-centred[12] bottom-up approach that does not adequately consider long-term goals but focuses on politically feasible negotiation processes (Geden, 2016). Nonetheless, even the most vulnerable to climate change—for example, low-income countries such as Nepal and Bangladesh—participate in shaping the agenda on global climate change via forming a lobby group such as the least developed country (LDC) group on climate change[13]. The bottom-up approach to achieving the aims of the Paris Climate Agreement via NDCs means that policy actors across different economic sectors engage in identifying their sector-specific climate mitigation and adaptation actions. I presume that a growth pathway that manages both economic and climate mitigation issues is the topic of discussion

[12] Actor refers to different parties that participate in the climate change negotiation process for various international climate agreements.

[13] For more information on LDC group on climate change, please see https://www.un.org/ldcportal/tag/ldc-group-climate-negotiations/ and http://www.ldc-climate.org/

when policy actors from critical economic sectors deliberate on climate mitigation actions. Consequently, the national policy discourse influences and impacts the way non-environment sector policies (henceforth referred to as sectoral policies) frame climate mitigation actions as their policy goals.

1.1.2. Framing climate mitigation actions into government policies

Policies aiming to contribute to climate change mitigation have promoted green growth, energy security and GHG emissions reductions via framing these into a multi-objective policy paradigm (Halsnæs et al., 2014). The multi-objective policy paradigm is similar to the new international climate policy paradigm (Hermwille, 2016), which presents climate change as a transformative challenge and emphasises broader socio-economic objectives in addition to focusing on GHG emissions reduction. The concept of a policy paradigm emphasises policy actors' ideas and their problem-solving activities (Hall, 1993). Therefore, policy actors—such as national policymakers and stakeholders from the private sector, civil society and international development organisations—may exchange their ideas in an actor-centred policy environment to frame climate mitigation actions into government policies. Collaboration across non-government organisations and private sector organisations was initially encouraged by Agenda 21 of the 1992 United Nations Conference on Environment and Development (Florini and Pauli, 2018). However, adopting a new form of environmental governance involving non-state policy actors did not become prominent until after the enactment of the Sustainable Development Goals (SDGs) in 2015. Goal 17 encourages partnerships across global, national and local levels to strengthen international cooperation to support low- and middle-income countries financially.

The interaction between state and non-state policy actors contributes to their learning as the policymaking processes unfold via debates about contesting policy ideas and concepts and the pursuit of the interests and ideas of the policy actors (Howlett et al., 2017). In a policy domain such as climate change, a collaborative practice involving a range of policy actors is expected to support efficient, effective and inclusive policy responses (Pattberg and Widerberg, 2016). To formulate effective policies, the composition of the policy actors and the technical and financial capacity of the institutions they represent are key considerations, especially for issues related to global climate governance (Widerberg and Pattberg, 2015). For countries that lack technical, financial, and institutional capacity, the composition of the actors and their interactions becomes more important as they look to optimise their available resources while government policies frame climate mitigation actions. In this research, I present findings related to policy actors' learnings and changes in their knowledge, technical capacities, and financial resources. These changes come about as a result of interacting with international organisations, and they occur when sectoral and climate and environment-specific policies incorporate climate mitigation actions. This research also examines the way policy actors engage in global environment-related initiatives and green growth policy discourse and the key considerations when formulating and subsequently reflecting on the commitments made in the government policies to achieve reductions in GHG emissions and sustainable use of natural resources.

1.1.3. Expected benefits of climate mitigation actions into policies

Policy integration involves 'softer' modes of governance such as introducing climate-specific strategies, policy appraisal and voluntary instruments rather than command-and-control oriented traditional policies (Adelle and Russel, 2013). Therefore, the concept of policy integration appears to be highly relevant to an actor-centred, bottom-up response to global environment-related and green growth initiatives that are not legally binding, especially for low-income countries. However, while government policies frame climate mitigation actions, there remains a question—are policy actions[14] actually required from low-income countries that are insignificant contributors to global GHG emissions and global resource use? I argue that, as part of policy integration, policies can emphasise the non-climate benefits of climate mitigation actions. Longo et al. (2012) identify different non-climate benefits of climate change mitigation actions as ancillary, secondary, co-benefits and spill-over benefits. These

[14] In this thesis, policy actions pertain to any actions that policy actors initiate during policy formulation with a view to addressing climate mitigation issues later during policy implementation.

include the health benefits of GHG emissions reduction, and the employment and technological effects of green technologies and afforestation programs.

The notion of non-climate benefits is supported by Turner (2014, p. 5), who argues that climate mitigation and green growth policies have motivated governments in developing Asian countries to promote energy security access to clean energy, protect forest resources, pursue technological advantage, and address local environmental problems. Another non-climate benefit is that populated low-income countries can generate revenues from selling emissions permits to developed countries under mechanisms related to a contraction and convergence regime, which promotes fair distribution of GHG emissions per capita (Hübler, 2011). Further, the protection of forest resources by reducing biomass consumption can help insignificant contributors to global GHG emissions to enhance their carbon sink potential, thereby generating more opportunities to sell carbon credits. This research uses notions of non-climate and local benefits to argue that policies that promote climate mitigation actions are an attractive value proposition for policymakers, even in countries whose contributions to global GHG emissions are insignificant. Although the reduction in GHG emissions and a more sustainable use of natural resources remain the primary aims of climate mitigation actions, non-climate benefits are also useful. Non-climate and local benefits could be more significant in developing countries than in developed countries (Pittel and Rübbelke, 2008). Therefore, policy actors can share ideas related to the non-climate benefits linked to their sectors in an actor-centric approach to deciding on the framing of climate mitigation actions in government policies.

1.2. Relationship between income and resource consumption in Nepal and Bangladesh

Most of the existing government policies of Nepal and Bangladesh, such as the environment and climate-specific policies and sectoral policies, have referred to enhancing sustainable management of natural resources and reductions in GHG emissions. In both countries, consideration of climate mitigation actions in government policies shows policymakers' interest in addressing climate change mitigation issues. However, any emerging and new policy paradigms—models of policy formulation that frame climate mitigation actions into government policies—may ignore the fact that Nepal and Bangladesh will likely increase their economic output, and hence their resource use and GHG emissions in an absolute sense. The CDP of the United Nations has recommended both Nepal and Bangladesh to graduate from the LDC category and has also projected the economic growth rate of both countries to touch 8% in 2022, despite a lower economic growth rate in 2020 and 2021 because of COVID-19 (UNDESA, 2021c, p.11). The higher economic growth rate during a transition period for LDC graduation between 2021 and 2026 and beyond entails higher use of natural resources and GHG emissions in both Nepal and Bangladesh because of the causal relationship between economic output, energy consumption, and GHG emissions (Ahmad and Islam, 2011; Bastola and Sapkota, 2015; Nepal and Paija, 2019). Therefore, for the two low-income countries, there needs to be an in-depth analysis of how emerging and new policy paradigms can address resource use and GHG emissions issues under conditions of economic growth. This in-depth analysis is needed in order to explore the policy issues which, if addressed, could create synergetic effects and minimise trade-offs between efforts to honour the Paris Climate Agreement and meet SDGs on the one hand and help smooth both countries' transition and graduation from being ranked among the world's LDCs on the other.

Figure 1.3 depicts the dynamic relationship between changes in income and total primary energy consumption (TEPC) per capita and domestic material consumption (DMC) per capita via the Environmental Kuznets Curve (EKC). For this study, resource consumption, as expressed in measures such as TPEC and DMC is understood as leading to environmental pressures resulting from an increase in per capita income. The EKC hypothesis states that environmental pressures first increase with income and then decrease with further rises in income after a certain period and a certain income level (Grossman, 1995). While the proxies such as DMC and TPEC do not directly measure environmental pressures, Ahmed and Long (2012) and Shazbaz et al. (2014) have used the EKC hypothesis to explore the relationship between energy consumption and economic growth. I use the EKC to visualise the relationship between two resource consumption proxies and economic growth. The EKCs for Nepal and Bangladesh do not show the exact inverted-U relationship that the EKC hypothesis predicts. This implies that the TPEC per capita and DMC per capita will likely continue to drive an increase in GDP per capita, particularly under two conditions—first, in the absence of policy goals across sectoral policies that focus on absolute reductions in resource use and GHG emissions; second, where policy goals exist across sectoral policies. However, the delivery is weak, meaning that policies cannot deliver policy goals of achieving absolute reductions in resource use and GHG emissions. Therefore, there is a need to investigate the climate mitigation-oriented focus of existing sectoral policies, their incorporation of policy goals of achieving absolute reductions in resource use and GHG emissions and its extent across sector policies, and prospects for delivering the policy goals. The research findings chapters (Chapter 4 to Chapter 7) discuss these issues in detail.

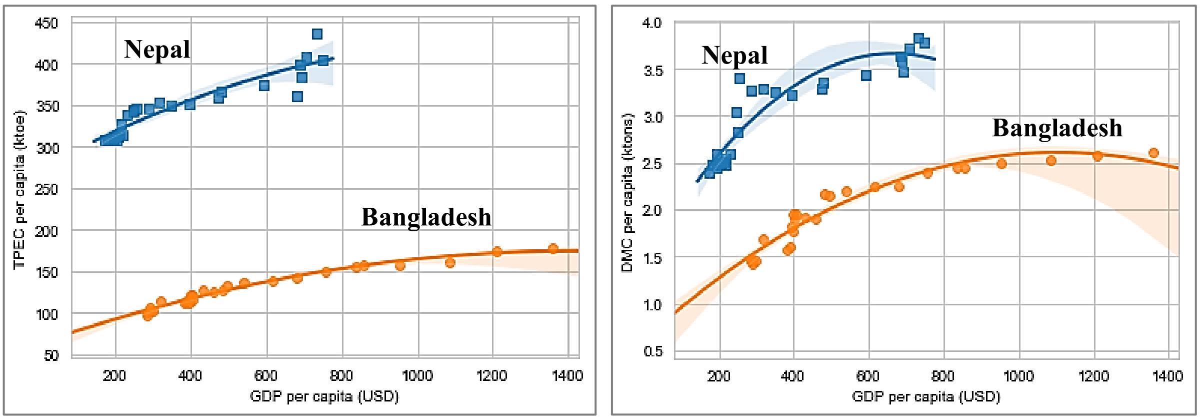

Figure 1.3. Relationship between GDP per capita, TPEC, and DMC for Nepal and Bangladesh.

1.3. Research gaps

The literature review (Chapter 2) identifies several research gaps. These research gaps fall into the following three themes: 1) policy paradigms; 2) policy integration and mainstreaming; and 3) green growth. The research findings chapters (Chapter 4 to Chapter 7) of this thesis elaborate on the research gaps discussed below.

1.3.1. Changes in policy paradigms

Historically, climate change research in Nepal and Bangladesh has focused more on climate adaptation than climate mitigation (Ayers and Huq, 2009; Shrestha and Dhakal, 2019). Likewise, the government policies and development programs supported by international development organisations have tended to focus more on climate change adaptation in both countries (Rahman and Giessen 2017). The main reason for this is that both countries have a high human and economic vulnerability to the impacts of climate change, such as droughts and flooding (Dewan, 2015; Miyan, 2015). In climate adaptation-related research, both Nepal and Bangladesh receive regular attention because both countries have high climate vulnerability (Krampe, 2014; Alvi et al., 2020). Therefore, this research domain has progressed significantly in both countries. However, the advent of the bottom-up model for addressing climate change via the Paris Climate Agreement and the SDGs (e.g. goals 7, 12, and 13) means that climate mitigation has started to gain traction in policy discourse in Nepal and Bangladesh, particularly post-2015 (Chowdhary et al., 2021). NDCs and dedicated climate policies are at the implementation stage in both countries. The strong presence of international development organisations in Nepal and Bangladesh, their roles as key policy actors in policy formulation (Rahman and Giessen 2017; Vij et al., 2018; Aryal et al., 2021; Laudari et al., 2021), and the financial support both countries receive in the form of ODA for climate mitigation actions (Halimanjaya, 2015; World Bank, 2021) have further encouraged policymakers to emphasise climate mitigation actions across government policies.

While the recent climate- and environment-specific policies have started to focus on climate mitigation actions in addition to climate adaptation, other sectoral policies may not have identified climate mitigation actions as one of their core objectives. As a result, there is a research gap in understanding how and to what extent sectoral policies in Nepal and Bangladesh have incorporated climate mitigation actions into their government policies. Another research gap is understanding how low-income countries with weak technical, financial and institutional capacities have used different policy instruments and financial mechanisms, and the institutional changes they have made for addressing mitigation issues. Understanding the climate mitigation-related policy endeavours of the past will better inform case countries' policymakers and researchers (focusing on South Asia and LDCs) to understand how climate mitigation-oriented actions can be better delivered alongside meeting their economic development objectives (e.g. LDC graduation). Further, it is important to understand how the LDCs, such as Nepal and Bangladesh, have assimilated information and knowledge resources pertaining to climate mitigation as they aim to deliver the goals of the Paris Climate Agreement and the SDGs, and how they are reflected into policies. Therefore, I study the policy paradigms literature to investigate how policy paradigms evolved between 1992 and 2018 for both Nepal and Bangladesh. I examine and compare previous and existing versions of the same government policies by developing and using an analytical framework to investigate changes in policy paradigms, the change mechanisms and the order of changes, for discussing how change occurs across four key aspects of the policies. The four key aspects of the policies investigated are the policy goals, the contents of the policies, the strategic and institutional interactions between policy actors' institutions, and the consideration of objectives of the global environment-related initiatives.

1.3.2. Integration and mainstreaming of climate mitigation actions into sectoral policies

Policy actors representing different sectors of the economy, different levels of government, private sector organisations, civil society organisations and international development organisations can engage in policymaking as part of considering global environment-related initiatives and green growth-focused policy agendas. Consequently, policy issues like the reduction of resource use (in this thesis particularly fossil fuels and forest biomass) and the reduction of GHG emissions, which are objectives of global environment-related initiatives and green growth, are then integrated into sectoral policies. While the integration process unfolds within the public policy domain, there are four crucial aspects of integration that have not received enough attention in climate mitigation-related research in low-income countries such as Nepal and Bangladesh. First, despite the vital role of international development organisations as technical and financial support providers in both countries, there is a lack of understanding about the role of external driving factors, such as global environment-related initiatives and green growth. The international development organisations active in Nepal and Bangladesh partner with government organisations, private sector organisations and local non-government organisations to initiate and deploy both policy and non-policy actions pertinent to climate mitigation (Vij et al., 2018; Adelle and Russel, 2013). Second, the process by which the integration of the objectives of global environment-related initiatives and green growth occurs in low-income countries, including Nepal and Bangladesh, has remained somewhat unexplored. For example, there has been insufficient research into the ways policy actors exchange their ideas and interest, establish norms for creating normative policy environments, and exercise executive power while integrating the objectives of global environment-related initiatives and green growth.

Third, the existing literature on policy integration shows that the ways researchers and policymakers understand policy integration varies significantly, which can be confusing. Policy integration, which is the integration of environmental objectives into non-environment sector policies, is often used interchangeably with other strands of environmental policy research, such as the mainstreaming of climate adaptation and mitigation actions. Policy integration is a concept distinct from mainstreaming—policy integration relates more to policy formulation, whereas mainstreaming extends its boundary up to policy implementation (Nilsson et al., 2012; Adelle and Russel, 2013). Policy integration emphasises objectives in decision-making, reflected in policy outputs, whereas mainstreaming considers factors leading to an effective delivery of environmental objectives makes it more implementation-focused (Dupont and Jordan, 2021). Using these two concepts interchangeably in environmental policy studies is problematic because the conceptual nuance is ignored. I build on the environmental and climate policy literature relating to both concepts mentioned above to create a conceptual framework that aims to help differentiate policy integration and mainstreaming.

Fourth, the concept of mainstreaming has rarely been applied in *climate mitigation*-related studies. This is because the concept of mainstreaming stems from development studies (e.g. gender mainstreaming in development planning) and is therefore often linked with the *climate adaptation* literature. To explore climate mitigation mainstreaming and its extent across government policies in Nepal, I borrow and use the concept of mainstreaming from another strand of literature—climate adaptation.

1.3.3. Prospects for greening growth in Nepal and Bangladesh

While notable international development organisations advocate green growth by delivering NDCs and the environment-related SDGs (7, 12 and 13), some observers (e.g. environmental policy scholars and climate change advocates) call for decelerating economic growth or adopting a degrowth model. The call for adopting a degrowth model is aimed at achieving quantitative changes like absolute reductions in resource use (e.g. biomass and fossil fuels) and lower GHG emissions (Juknys, 2018). However, degrowth does not seem to be an appropriate growth model for low-income countries such as Nepal and Bangladesh that will graduate from the LDC category of the United Nations in 2026. Both countries will aim to maintain at least a threshold level of GNI per capita until 2026. The possibility for developing countries to adopt degrowth is further weakened by the contraction and convergence narrative that is vocal about addressing an unequal distribution of resource use and GHG emissions (Hübler, 2011; Duro et al., 2018). Therefore, the concept of degrowth was proposed as a topic for further research, especially after 2010, to build on the work of Latouche (2010). However, there are some concerns about the negative impacts of the degrowth model on production factors such as capital, labour and technology (Drews and van den Bergh, 2016; Juknys et al., 2018). So, as an alternative to both green growth and degrowth, the concept of ‘agrowth’, focusing primarily on social issues, was introduced (van den Bergh, 2011; van den Bergh and Kallis, 2012).

Unlike growth and degrowth models that oppose each other in terms of their view on economic trends, agrowth attempts to reduce resistance to climate policies by focusing on social goals, such as human well-being, equity and employment. However, the problem with agrowth and degrowth as emerging growth models is that the theoretical development of these concepts is at an early stage. This is especially the case for agrowth, proposed specifically to reduce resistance to serious climate policies (van den Bergh, 2017). On the other hand, green growth is a more widespread concept, at least across the international development space. International development organisations such as the OECD, the United Nations Environment Program (UNEP), Global Green Growth Institute (GGGI), and the World Bank have been openly supporting the idea of achieving green growth, particularly after 2010. These prominent international development organisations have created a common Green Growth Knowledge Platform, which is a stage for generating, managing and sharing green growth-specific knowledge (GGKP, 2021).

The concept of green growth is a frequent topic of discussion in the economics and climate policy literature. However, most green growth-related research has focused on whether green growth could be a feasible option for countries around the world in the context of achieving the goals of the Paris Climate Agreement. The debate is about whether continuing or even increasing the economic growth rate (GDP growth rate) by increasing resource efficiency is compatible with keeping the global temperature rise in this century to well below 2^0 Celsius above pre-industrial levels. While the debate is highly relevant to middle- and high-income countries that contribute significantly to global GHG emissions and global resource consumption, many low-income countries may want to pursue economic growth while delivering climate adaptation and mitigation actions. However, there is a research gap in understanding how low-income countries will approach the challenge of achieving economic goals (for LDC graduation) and climate mitigation objectives by potentially adopting economic growth model like green growth. There is also a lack of sufficient country-specific studies about green growth even though green growth is an important agenda of notable international development organisations. Academic papers have focused more on green growth-related policy discourse. Therefore, I use a set of six green growth indicators selected from the OECD (2017b) green growth indicator framework to investigate if there exists any empirical evidence on the greening of growth in Nepal and Bangladesh. The six green growth indicators (energy productivity, carbon productivity, material productivity, percent GDP from services, share of renewable energy in the energy mix, and the proportion of land area covered by forest) are the most frequently used indicators by academic researchers and policymakers (Merino-Saum et al., 2018). I then build on the findings from the analysis of empirical evidence to investigate if Nepal and Bangladesh will be able to achieve the greening of their growth while meeting the goals of the Paris Climate Agreement and the environment-related SDGs by 2030.

1.4. Overall research objective

This research addresses the research gaps mentioned in Section 1.3 by answering the two main research questions and the concomitant sub-questions (Section 1.5). It endeavours to gain insights into leveraging global environment-related initiatives and green growth, and enabling any new policy paradigms in Nepal and Bangladesh while aiming to address the research gaps in the relevant literature as an overall objective.

1.5. Research questions

For countries that are pursuing both climate mitigation-specific and economic goals as part of delivering the aims of the Paris Climate Agreement and the SDGs while chasing higher economic growth for LDC graduation, better coordination between policy actors across economic sectors and levels of government is desirable. Consequently, policy actors participate in deliberation and coordination while seeking to incorporate the objectives of global environment-related initiatives and green growth into the sectoral policies in the policy formulation stage. Climate mitigation actions such as the reduction of GHG emissions, and resource-efficient and renewable energy transition are the objectives that sectoral policies aim to deliver during policy implementation. Therefore, this research seeks to answer the questions below.

- Can the objectives of global environment-related initiatives and green growth be effectively integrated into government policies across economic sectors to deliver a reduction of GHG emissions and resource-efficient and renewable energy transition?

- In what ways can policy actors in policy formulation maximise environmental and economic benefits of resource-efficient and renewable energy transition by 1) leveraging policy discourse on global environment-related initiatives and green growth models, and 2) enabling any new policy paradigms?

While responding to the two main research questions above, in the core research findings chapters (Chapter 4 to Chapter 7) I break the questions down to answer the following:

I. How are the policy paradigms pertaining to the environment and climate-specific policies and sectoral policies changing in Nepal and Bangladesh?

II. How are the objectives of global environment-related initiatives and green growth incorporated into sectoral policies?

III. How is policy integration conceptually different from mainstreaming in the context of integrating the objectives of global environment-related initiatives and green growth into sectoral policies?

IV. To what extent can adopting a green growth model contribute to achieving better policy coherence between the policies of different economic sectors and the broader environment and climate change policies?

V. Can low-income countries such as Nepal and Bangladesh achieve green growth in the absolute sense while meeting the goals of the Paris Climate Agreement and the environment-related SDGs?

1.6. Significance of the research

Since the 1970s, the literature on economic growth models has slowly evolved to produce concepts ranging from environmental and ecological economics to green growth, degrowth and the new economy (Spash, 2011). Whilst each concept is distinct, a common aspect is that they all explicitly value environmental goods and services (Saboori et al., 2012). Multilateral environmental agreements—a form of cross-border collaboration among low-, middle- and high-income countries for addressing global environmental issues—motivated many countries to explore the economy-wide application of these concepts (Tosun and Peters, 2017). However, the ways in which these concepts are discussed and applied at a strategic level by policymakers, and how they inform policymaking, and the prospects for delivering both economic growth and objectives related to global environmental issues in low-income countries, have not been studied in great detail. I focus on the green growth model and its relationship with international climate agreements, and the environment-related SDGs in the context of graduation from the LDC category by Nepal and Bangladesh. Significantly, in light of what is needed to simultaneously achieve climate mitigation and economic goals, this research navigates policy formulation and implementation issues related to global environment-related initiatives and green growth in Nepal and Bangladesh.

Emerging growth models and climate policy paradigms are becoming increasingly sensitive to incorporating resource constraints and climate change issues because of government policymakers' interest in implementing NDCs and the SDGs (Niedertscheider et al. 2018). Adopting non-conventional growth models (e.g. green growth) and changing climate policy paradigms are both necessary in order to fully align sectoral policy goals with climate policy goals (Simeonova and van der Valk, 2016; Gorg et al., 2017). There is a need for alignment of policy goals in sectoral policies and climate and environment-specific policies because the signatories of global environment-related initiatives have to consider multiple environment and climate-related agendas which are delivered through sectoral policies. Consequently, the sectoral policies incorporate the objectives of the global environment-related initiatives and green growth, thereby potentially creating new policy paradigms. However, creating and transiting into a new policy paradigm could be challenging for policymakers in low-income countries because of the weak technical, financial, and institutional capacity. Further, coordination amongst different policy actors across economic sectors with different but overlapping policy goals (e.g. absolute reduction of resources and GHG emissions) may entail conflicting priorities. With these as a backdrop, this research contributes to the literature on climate policy paradigms in Nepal and Bangladesh by discussing the following: 1) objectives of global environment-related initiatives and green growth as policy goals in manifesting through sectoral policies; 2) the financial mechanisms and policy instruments used by sectoral policies, and 3) the institutional changes made in order to deliver the objectives of global environment-related initiatives and green growth.

Another theoretical contribution is that the research presents a conceptual basis for differentiating between 'policy integration' and 'mainstreaming', terms that are often used interchangeably, especially in the climate adaptation-related literature. I found the interchangeable use of the two concepts to be problematic for environmental policy studies. Therefore, I discuss the mainstreaming of climate mitigation actions by creating a conceptual framework that builds on the policy integration literature and the climate adaptation-related literature. Climate mitigation mainstreaming is a new strand of research, particularly for low-income and developing countries for whom the climate adaptation literature has substantially progressed. This new strand of research is significant in the sense that many low-income countries, including Nepal and Bangladesh, have recently started to communicate their existing and intended climate mitigation actions to the global community. In light of the recent attention climate mitigation issues have received from policymakers in the two South Asian low-income countries, this research intends to contribute to the climate mitigation literature in South Asia. The climate mitigation literature in South Asia is relatively less progressed than the climate adaptation-related literature (Shrestha and Dhakal, 2019).

1.7. Thesis layout

This thesis includes three exegesis chapters in the form of an introduction, a literature review and a research design (methodology) chapter. Four core chapters then present the research findings. These chapters are presented as published and submitted research papers. Finally, the discussion and conclusion chapters follow the research findings chapters (See Figure 1.4).

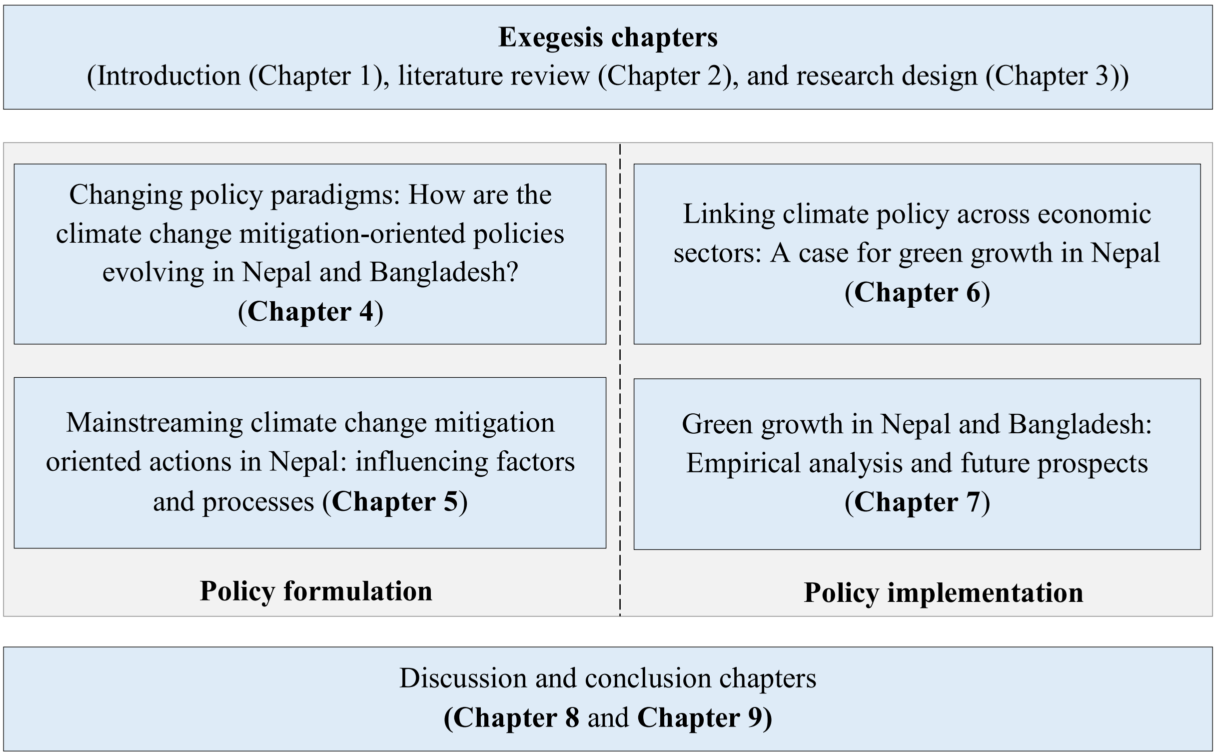

Figure 1.4. Structure of the thesis

The introduction chapter includes the following elements: (1) global environment-related initiatives and green growth-related policy discourse; (2) incorporating the objectives of global environment-related initiatives and green growth into government policies; and (3) the expected benefits of climate mitigation actions in low-income countries. This is followed by a brief elaboration on the economic growth-resource consumption nexus in case countries (Nepal and Bangladesh). Next, an overview of the research gaps, research questions, objectives, and the significance of the research highlights potential theoretical and practical contributions of the research in three main areas: i) policy paradigms; ii) policy integration and mainstreaming; and iii) green growth. The remainder of the thesis is structured as follows.

Chapter 2 presents a literature review that covers the following topics: international climate agreements, the SDGs, green growth and competing growth models, policy paradigms, environmental governance and policymaking processes, and integrative policy approaches. While the research focuses on climate mitigation actions in two low-income countries, the global literature review identifies several important research gaps. The research gaps are: 1) inadequate explanation of the conceptual difference between policy integration and mainstreaming; 2) the way climate policy paradigm changes, inexplicit understanding of the scale of changes, and when to consider paradigmatic change is still unclear to some extent; and 3) lack of country-specific studies focusing on prospects for greening the growth in low-income countries that are willing to embrace the idea of green growth. Consequently, the research background and objectives of the core research findings chapters build on these research gaps.

Chapter 3 presents the methodological approach that is overarching in nature—meaning that this chapter provides an outline of the research methods used in the research findings chapters based on their objectives. This chapter elucidates the use of a mixed-method research approach, the rationale of the chosen research methods (qualitative content analysis, semi-structured interviews, empirical research, and predictive modelling), and the epistemological paradigms associated with the chosen methods. The research findings chapters (Chapter 4 to Chapter 7) explain in detail the sources of data, the data collection methods and the data analysis approach.

Chapter 4 investigates the changes in policy paradigms pertaining to climate mitigation (i.e. climate mitigation facets of government policies in Nepal and Bangladesh between 1992 and 2018). This chapter aims to answer research question (I). The study develops and uses an analytical framework that considers four key aspects of the policies: 1) the problems that policies aim to address, and the focus of the policies; 2) the policy instruments used and financial mechanisms; 3) institutional and strategic interactions amongst policy actors and their institutions; and 4) the influence and relevance of global environment-related initiatives as a driving factor. Based on the analytical framework, the chapter identifies new policy paradigms, change mechanisms, and the scale of changes for each of Nepal and Bangladesh. The chapter finds that to enable the new climate mitigation-based policy paradigm in both countries, there is a need for institutional strengthening and strategic interactions between institutions, accompanied by a shift in funding from external (e.g. ODA-based) to internal funding (government-based).

Chapter 5 details the results from semi-structured interviews conducted in Nepal with policy actors representing central and local government policymakers and representatives from the private sector and international development organisations. This chapter aims to answer research questions (I) and (II). The study investigates whether the international climate agreements and the environment-related SDGs, together with the green growth narrative, are influencing the policymaking processes in Nepal, and the processes by which sectoral policies there incorporate climate mitigation actions. The research proceeds in three steps. First, it highlights the knowledge and ideas of policy actors as critical areas of influence in policymaking. Second, the research uses the 'policy integration' and 'climate adaptation mainstreaming' literature to develop a conceptual framework that enables me to investigate the climate mitigation actions integration process, the entry-points for integration, the policy actors involved, and the drivers based on four criteria. The four criteria are: i) policy objectives and impacts; ii) sector and multi-level governance; iii) financial and human resources; and iv) institutional changes. Finally, by using the policy integration and climate adaptation mainstreaming literature, the chapter discusses the conceptualisation of climate change mitigation mainstreaming for low-income countries.

Chapter 6 uses the green growth approach to create policy coherence across sectoral policies in Nepal. This chapter aims to answer research question (IV). The study details result from the analysis of resource use and GHG emissions for four climate policy scenarios for Nepal between 2015 and 2030: a business-as-usual (BAU) scenario, a nationally determined contributions (NDC) scenario, a 'beyond NDC' scenario, and an 'other policies' scenario. The discussion of the results emphasises the need to create policy coherence between climate policies such as NDC and sector policies as they aim to deliver economy-wide reductions in GHG emissions while improving energy and carbon productivity[15] by reducing energy losses from transmission and distribution.

Chapter 7 investigates the empirical evidence and future prospects for green growth in Nepal and Bangladesh. This chapter aims to answer research question (V). The chapter analyses the six specific

[15] Energy productivity is expressed as the ratio of unit GDP generated for each unit of energy consumed, and carbon productivity as the ratio of GDP generated to each unit of GHG emissions generated.

green growth indicators: energy, carbon, material productivity[16], the share of GDP from services, forest area, and share of renewable energy in the energy mix in the context of LDC graduation for Nepal and Bangladesh. In addition, predictive modelling of energy and material consumption for different economic growth scenarios emphasises the need to look at the delivery of environmental goals such as commitments under the Paris Climate Agreement and the environment-related SDGs (7, 12, and 13). The results from this chapter highlight the need for technological changes across the energy system as the case countries face an unfamiliar scenario that requires the simultaneous delivery of both economic and climate mitigation goals. Based on the research findings, this chapter makes policy recommendations for achieving the goals of the Paris Climate Agreement and the SDGs for Nepal and Bangladesh while they pursue LDC graduation by increasing their economic growth/output.

Chapter 8 discusses the overall research findings from Chapters 4, 5, 6 and 7. The main purpose of the overall discussion is to create linkages between the policy formulation and policy implementation aspects of global environment-related initiatives and green growth. The discussion chapter highlights the important role of climate mitigation-based policy paradigms that are in line with the objectives of global environment-related initiatives and green growth. The chapter explores whether or not green growth is possible under the new climate mitigation-based policy paradigms. Further, the discussion emphasises changes in the policy formulation aspects of the policymaking, such as the mainstreaming of climate mitigation actions because of the need to achieve economic and climate mitigation goals at the same time for Nepal and Bangladesh in the context of LDC graduation. Finally, Chapter 9 presents the overall conclusions and recommendations for future research.

[16] Material productivity is the ratio of unit GDP generated for each unit material consumption.

Chapter 2: Literature Review

This chapter presents a review of the literature, which fulfils two main purposes. The first is to identify research gaps in three research fields: global environment-related initiatives (Paris Climate Agreements and SDGs 7, 12 and 13); emerging growth models; and policy paradigms regarding climate mitigation. The second purpose is to sufficiently establish a context in which to navigate through the identified research gaps based on existing concepts, theories and analytical frameworks related to the literature on integrative policy approaches. This research identifies three research areas within environmental policy studies—namely, 'environmental policy integration', 'policy coherence', and 'mainstreaming' as integrative policy approaches.

Global resource use and global GHG emissions are international environmental issues. To inform policymakers and other stakeholders across the world about these issues, global environmental assessment reports such as IPCC assessment reports (IPCC, 2021) and global environmental outlook reports (UNEP, 2019) are published and distributed. These reports serve as a source of important information and knowledge for many countries, including low-income countries like Nepal and Bangladesh. Section 2.1 reviews the literature on scientific findings and environmental policy topics that IPCC assessment reports and global environmental outlook reports together with various global environmental assessments (GEAs) generate. Based on the review, the section examines how these impact the policy discourse, collaboration and exchange of ideas between policy actors in Nepal and Bangladesh.

Section 2.2—on global environment-related initiatives—reviews the literature on collaboration and the participation of countries in addressing global environmental issues (e.g. climate change mitigation). Multilateral environmental agreements such as the Paris Climate Agreement and the SDGs 7, 12 and 13 encourage signatory countries to initiate both policy and non-policy actions with the aim of achieving the objectives of these transnational covenants (global environment-related initiatives). Groups of countries, similar in terms of their economic status—for example, the least developed countries (LDC) expert group—have formed coalitions to communicate at international forums about how they wish to pursue their pathways to achieving the goals of the Paris Climate Agreement and the SDGs. Subsequently, the objectives of global environment-related initiatives are discussed at the policy level and deliberated on for integration into government policies, both overarching and sectoral. As a topic for investigation, this research explains how the policy discourse on global environment-related initiatives informs and influences policymaking and the integration processes in two low-income countries, Nepal and Bangladesh.

The review of the literature on emerging growth models in Section 2.3 discusses the relevance of green growth, degrowth and agrowth as potential growth models that countries sensitive towards addressing global environmental issues can consider for adoption. Given the recent theoretical advancement of green growth over degrowth and agrowth, and the practical application of green growth by international development organisations (e.g. the World Bank, the OECD and the UNEP), it is often put forward as the preferred growth model for potential adoption by policymakers in many countries. Although adopting a green growth model may not help countries achieve the goals of the Paris Climate Agreement in an absolute sense, economy-wide efficiency of resource use and GHG emissions reductions are likely to increase under certain conditions. In light of their United Nations least developed country (LDC) graduation status, low-income countries such as Nepal and Bangladesh that are yet to achieve high levels of economic output may prefer efficiency improvements as a means of achieving both economic and environmental goals. Therefore, as a research gap, and as a topic for investigation, this research presents the empirical analysis and future prospects for green growth in these two low-income countries.

Section 2.4 on policy paradigms discusses the following: the concept of a policy paradigm; the ideational element and non-ideational elements (e.g. policymakers' knowledge and their institutions) of policymaking, which are essential aspects of policy paradigms; changes in policy paradigms (conditions, mechanisms and scales); and the institutionalist perspective and collaborative practices in policymaking. The concept of the policy paradigm that emerged in the early 1990s originates from the popular work of Hall (1993). Subsequently, climate and environmental policy scholars have thoroughly reviewed, discussed, criticised and applied the concept of what constitutes a policy paradigm. The ideational element (i.e. the way policy actors and their institutions exchange ideas about a given policy topic) is identified as important by this research in the context of deliberation regarding policy discourse on global environment-related initiatives and green growth in the case countries for two main reasons. First, the ideational element of a policy paradigm impacts the causal mechanisms related to the integration process. Second, the policy paradigm change mechanism and the scale of change are also dependent on the ideational element. While the policy paradigm literature and the related theoretical knowledge is progressing strongly, the literature on specific countries, and more particularly the applications of the concept, is lacking, which is discussed in detail in section 2.4. The institutional perspective and the determination for when a policy paradigm has occurred are also two recent topics of debate amongst climate and environmental policy researchers. This research addresses these research gaps by applying the concept in the context of climate mitigation-oriented policies in Nepal and Bangladesh.

Section 2.5 reviews and discusses the integrative policy approach used in policy formulation and policy implementation. Three concepts (policy integration, policy coherence and mainstreaming) are integrative in the sense that they refer to the integration of environmental policy goals into sectoral policies, create synergy amongst policies with a similar set of goals, and promote the integration process. While the theory on environmental policy integration is well developed, the concepts of policy coherence and mainstreaming are still evolving, and there exists a need for clarification about the conceptual differences between them, especially between policy integration and mainstreaming. Therefore, a detailed discussion will be presented, providing the main concepts that distinguish these different terms.

2.1. Global environmental assessments (GEAs)

The Global Environmental Outlook (GEO-6) report produced by the UNEP identified several global environmental issues such as climate change, environmental pollution, exploitation of natural resources and biodiversity loss (UNEP, 2016a; UNEP, 2019). The negative impacts of these global environmental issues on health, food systems and wellbeing have continuously created a need to act against any potential threats to the uninterrupted functioning of the ecological and socio-economic systems. To evaluate the impacts mentioned above and to inform and influence policy debate, policy discourse and policymaking processes, there have been efforts to study solution-oriented global environmental assessments (Alcamo, 2017; Riousset et al., 2017; Haas, 2017). Global environmental assessment (GEA) is a tool that enables policymakers to apply scientific knowledge to environmental policy topics for both global and country-level policy discourse (Alcamo, 2017; Haas, 2017).

GEAs are tools to integrate scientific knowledge into the policymaking process through inclusive policy discourse, with potential solutions to environmental issues (Berkes et al., 2006). GEAs, as useful tools, operate at the science-policy interface to provide a basis for interaction amongst various actors (Pregernig, 2007). Gerrad and Kowarsch (2017) support the perspectives of both Berkes et al. (2006) and Pregernig (2007) on GEAs, highlighting the role of the science-policy interface in creating collaborative platforms for effective environmental governance at various levels of government. The arguments of Berkes et al. (2006), Pregernig (2007) and Gerrad and Kowarsch (2017) are underpinned by a discursive policy approach that supports strong stakeholder engagement, especially when integrating GEA-generated scientific knowledge into policies during the policymaking processes. Therefore, to balance the use of this discursive policy approach and scientific reasoning whilst exchanging policy actors' ideas in policymaking processes, policymakers can leverage relevant GEAs associated with global environment-related initiatives and green growth. Thus, GEAs can help enrich the national policy discourse.

In environmental policymaking, discursive policy approaches can be a means of diffusing, translating and communicating global environmental issues. Consequently, this approach enhances the knowledge capacity of policy actors who construct the meaning of environmental change during policymaking (Riousset et al., 2017). While the use of a discursive policy approach can be beneficial from a social learning point of view, other policy approaches that use rational choices based on scientific evidence can potentially assist in balancing the preferential values and subjectivity of policy actors. For example, the rational choices of policy actors that underpin scientific and quantitative information can contribute to the policy discourse, especially when diffusing and communicating the global environmental issues at the individual country level (Mitchell et al., 2006). If we consider the trends of increasing global resource use and GHG emissions over the last few decades, which are usually accurately assessed in GEAs, the integration of rational choice with a discursive approach becomes critical in policymaking. This is because countries around the world have committed to moving beyond policy discourse to act on reducing their GHG emissions and sustainable use of natural resources. Therefore, in addition to the discursive policy approach, the quantitative aspects of policy insights and scientific findings generated by GEAs can better inform decision-making for actions at the country level.

The solution-oriented approach of GEAs has the potential to assist policymakers by enabling deliberative democratic processes[17] and by complementing the subjectivity of policy actors' views on different policy alternatives (Kowarsch et al., 2017). However, the policy alternatives that are influenced by power and pressure groups are weakly positioned to leverage science-policy interface-related outcomes, and this contributes to unpredictability in policymaking and incrementalism in achieving changes in policies (Bammer et al., 2010). In the case of Nepal and Bangladesh, the influence of national and international non-government organisations, global environmental-related initiatives (e.g. international climate agreements and SDGs) and an unstable political situation are critical drivers of change in climate policy paradigms (Vij et al., 2018). Global environmental pressure groups and national and international non-government organisations may not be politically powerful but their role as peripheral and external drivers could be contributing to subjectivism in policymaking by influencing the policy discourse. Voluntary responses to global-environment related initiatives (e.g. NDCs and National Communication Reports), and GEAs that emphasise scientific knowledge could be coupled together in policymaking to strengthen deliberative democratic processes, especially if a country is lacking technical and institutional capacity. This research explores the role of global environment-related initiatives as an influencing factor in two low-income countries with relatively weak technical

[17] Deliberative democratic process in policymaking refers to critical examination of policy issues and the importance of deliberation in decision-making.

and institutional capacities. Further, the research investigates the way scientific reasoning is coupled together with a discursive policy approach in policymaking.

2.2. Global environment-related initiatives – international climate agreements and Sustainable Development Goals 7, 12 and 13

In order to achieve global targets on GHG emissions reduction and to address the issues of free-riding[18], intergovernmental committees and panels, and global and regional partnerships have been fostering cross-country collaboration at the global level. Multilateral Environmental Agreements (MEAs)[19] act as an overarching international contract for participating countries (signatories) to do their part in dealing with global environmental issues, such as GHG emissions and the unsustainable use of resources (UNEP, 2016b). Hong (2015) defines an MEA as a coalition mechanism that aims to resolve transboundary environmental issues. These international collaborative and coalition mechanisms became popular after the Rio Earth Summit in 1992, mainly because they emphasise holistic and multi-disciplinary approaches instead of sectoral approaches to introducing solutions for global environmental issues (Freestone, 1994).

The role of an individual country's policies and actions in efforts to tackle global environmental problems was studied by Hoel (1992) before MEAs were the preferred mechanism, particularly for addressing climate change issues. Hoel's study showed that unilateral policies and actions did not help to solve global environmental issues, as the interventions had to deliver outputs in a non-cooperative environment that required cross-border collaboration. After 1990, the relevant literature on global environmental issues focussed on coalitions between signatories, incentives, political economy, effectiveness and the implementation mechanisms of MEAs at the global and local levels (Carraro and Siniscalco, 1998; Gleves and McGinty, 2016; Gunther and Hellmann, 2017; Ansink et al., 2018). At

[18] The term 'free-riding' is used to explain the condition when an entity continues to garner the benefits from the use of common resources but fails to properly compensate for the use of resources.
[19] MEAs are alternatively referred to as international environmental agreements (IEAs). This thesis uses both acronyms while the meaning of these are understood as international agreements between participating countries to address global environmental issues.

the country level, MEAs may have specific implications for the national environmental policy landscape of a signatory and subsequently for climate-specific policy paradigms. Therefore, the scale of change (incremental or transformational) that policies have to go through, and the changes in policymaking processes that occur as a result of incorporating the objectives of the adopted MEAs, are key to understanding the influence of global environment-related initiatives on policies. On the one hand, incorporating the objectives of MEAs is a voluntary requirement and, on the other hand, MEAs are also an internationally binding contract for signatories. In these circumstances, I aim to explore how the two case countries approach the incorporation of the objectives of the MEAs while examining the changes to various aspects of policies such as policy goals, the scale of change, institutional arrangements and the policy instruments used.

2.2.1. Coalition and participation of countries for addressing global environmental issues

The MEAs enable countries to form coalitions to create cross-country collaboration and common agendas. While developed countries have formed coalitions among themselves, developing countries have also formed coalitions with each other or with developed countries. However, the formation of transnational coalitions could face obstacles, such as the passing of agendas and decisions from powerful coalitions to weak coalitions, which may result in agenda deadlocks or even weak coalitions giving up their agendas (Forman and Segaar, 2006). While the informal nature of arrangements between coalition members can exacerbate the problem of agenda deadlocks, common agenda setting and policy coordination can fulfil the purpose of creating coalitions (Forman and Segaar, 2006). Establishing a common agenda by creating coalitions at the global level can be a source of information and topics for an in-country policy discourse for many countries, including Nepal and Bangladesh. Both of these countries are part of the least developed countries (LDC) expert group that negotiates on behalf of all LDCs at international climate conventions.

Supranational institutions—like United Nations (UN) agencies that usually set rules for negotiations amongst coalition members—are supposed to influence negotiation efforts and monitor the progress made against the agreements (Ecchia and Mamriotti, 1998). However, Batabyal (1997) noticed that in the past MEAs' governing bodies faced issues in creating perfect coalitions, mainly because the governing bodies, such as UN agencies, have to respect the national sovereignty of developing countries and therefore cannot directly monitor the actions of the governments of developing countries, including LDCs. While the weakness of inter-governmental governing bodies could potentially undermine the effectiveness of MEAs, recent MEAs are increasingly factoring in the monitoring and evaluation of progress (e.g. in GHG emissions reductions). Carraro and Siniscalco (1993) formed a different view on coalitions. They stated that, if a significant number of countries participated in forming a coalition, the overall effectiveness of MEAs in improving global welfare through environmental interventions is maximised. There are already more than 190 states participating in global environment-related initiatives like the Paris Climate Agreement and the SDGs (UNFCCC, 2018; SDKP, 2018). As signatories to the abovementioned global environment-related initiatives, Nepal and Bangladesh have been participating in the coalitions via the LDC expert group that has been operative since 2001. Therefore, given the interests of these countries as members of the LDC coalition, this research investigates their policy responses to global environment-related initiatives and examines whether these responses are in line with the objectives of global environment-related initiatives.

For developing countries in the 1970s, there was a need to design effective MEAs that considered poverty and environmental degradation (Batabyal, 1997). Walter (1978) had long before identified poverty, permissive environmental policies and a lack of technology as factors contributing to environmental problems in developing countries. However, from the mid-1980s, developing countries started to incorporate environmental issues in development planning (Munasinghe, 1993). Subsequently, economic policy instruments, market-based approaches and regulations were slowly introduced in developing countries to strengthen the environmental control measures that were highly permissive before the 1980s (Munasinghe, 1993; Xie and Saltzman, 2000). While following the path of developed countries, developing countries have been partnering with them to deal with both global and national environmental issues. Partnerships between developed and developing countries, especially via international development mechanisms, highlight the potential benefits of coalitions for addressing global environmental issues. However, how the international development mechanism/organisation works, particularly in low-income countries such as Nepal and Bangladesh, to ensure that the partnership is fruitful in terms of strengthening the climate mitigation-related policy discourse is not studied in great detail. Therefore, further study is needed to understand how low-income countries have responded with both policy and non-policy actions for delivering climate mitigation for which international development organisations provide technical and financial support.

The coalition established for addressing global environmental issues requires the active engagement of in-country government agencies, private sector organisations, international development organisations and civil society groups in developing countries. In the absence of direct control of the governing bodies, in-country policy actors play an instrumental role through extensive engagements in policy discourse and implementation on the ground (Batabyal, 1997). According to Kim (2013), about 747 MEAs were created between 1857 and 2012. Two of the recent and prevalent global environment-related initiatives are the Paris Climate Agreement and Agenda 2030 (UNFCCC, 2018; SDKP, 2018). The Paris Climate Agreement introduced nationally-determined contributions (NDCs), which are mechanisms for participating countries to communicate their efforts towards reducing GHG emissions to the international community. Agenda 2030 has 17 SDGs that participating countries are strongly encouraged to achieve. While low-income countries intend to integrate the objectives of both the Paris Climate Agreement and the SDGs into their policies, an understanding of how different policy actors have collaborated to operationalise the integration process across economic sectors and governance levels is insufficiently studied. Policy actors in low-income countries have rarely collaborated to integrate climate mitigation actions into government policies because they have considered climate mitigation as an issue for developed countries (Shrestha and Dhakal, 2019; Ayers and Huq, 2009). This PhD thesis addresses this research gap.

2.2.2. Nationally determined contributions (NDC) of low-income countries

The burgeoning literature on NDCs primarily focuses either on large economies, such as countries within the Group of Twenty (G20)[20], or on the aggregated effects of all submitted NDCs (UNFCCC, 2015; UNEP, 2017). The emissions gap analysis of aggregated pledged emission reductions, and the required emissions reductions to be achieved through a least-cost pathway, were reported by UN Environment's eighth Emission Gap Report (UNEP, 2017). The gap analysis focuses on significant emitter countries and sectoral emissions. There is no explicit mention of an aggregated emission gap arising from the NDCs of LDCs or how LDCs can achieve socio-economic development goals while reducing their GHG emissions. The share of LDCs in the total GHG emissions is around 3%, which is likely to grow significantly in the future (Climate Analytics, 2017).

Academic and white papers have insufficiently addressed the relationship between NDCs and socio-economic development (Altieri, 2016; Christoph et al., 2016). Altieri (2016) used an economy-wide CGE model linked to the energy system to explore potential improvements to the general development metrics within a capped carbon constraint in 2050 for the energy sector in South Africa. Christoph et al. (2016) argue that, while choosing socially acceptable 2^0 C pathways, it is imperative to consider sustainable development, as it boosts the prospects of meeting Sustainable Development Goals, especially those related to energy. While these studies aim to initiate a discourse on the development-NDCs nexus, there remains a general lack of different approaches and methods for assessing the potential contribution of NDCs to socio-economic development, especially for low-income countries. There is also a need to identify the nexus between NDC and sectoral policies, as NDCs are cross-cutting in nature.

Additionally, delivering on NDCs by reducing the use of non-renewable resources, and reducing GHG emissions while maintaining economic growth, has not been studied in detail for LDCs like Nepal and Bangladesh. Research on NDCs could therefore be interesting for many other similar countries where

[20] G20 is the group of governments and central bank governors of 19 countries and one region (EU) that share majority of global economy.

there is a challenge to deliver NDCs and at the same time improve the development indicators. Linking NDCs with the sector policies will potentially require policy coherence between NDCs and sectoral policies in low-income countries, and this issue has not yet been explored in detail. Therefore, I use the concept of policy coherence to study how climate policies such as NDCs aligns with sectoral policies, and particularly with the economic growth aspects of development in low-income countries.

2.3. Green growth and competing growth models

2.3.1. Definitions, goals and choice of growth model

For sustainability-related issues, the tension between economic imperatives and environmental imperatives has gained significant traction, with social wellbeing—also an essential part of sustainability—initially less discussed in the economy-ecology relationship (Lehtonen, 2004). The limited recognition given to the social dimension has been challenging for the socio-political feasibility of environmental policies, where the focus has been primarily on either economic or environmental imperatives (Spash, 2011; van den Bergh 2011). While socio-political feasibility remains a contemporary issue associated with the environmental imperative narratives, the debate about the importance of economic growth, ecological constraints and social wellbeing started as early as the 1960s and 1970s (Daly 1973; Sen 1976). In the last decade, an international policy issue involving the tension between economic growth and ecological constraints introduced the concept of green growth (Jacobs, 2012). Subsequently, in the 2012 Group of 20 (G20) summit in Mexico, the wealthiest economies pledged to support 'inclusive green growth' as a pathway to achieving sustainable development (World Bank, 2012). Since then, international organisations such as the OECD, the UNEP, the World Bank and the Asian Development Bank have often emphasised green growth across their international programs and policies.

There has been significant progress in the theory underlying the concept of green growth, and its practical application around the world. This, and the predisposition of international development organisations towards green growth as a favoured growth model, led this research to focus on the green growth model. Green growth supports the notion of economic growth with an emphasis on valuing natural assets and the quality of ecosystem services (Jacobs, 2012). In contrast, the ‘agrowth’ model recommends the exclusion of economic growth as a policy goal, while ‘degrowth’ refers to reduction in the size of an economy (e.g. GDP) and the material/energy throughput (Robra and Heikkurinen, 2019). Figure 2.1 shows the differences between these three emerging growth models in terms of their policy goals, where green growth has been presented as a pro-growth strategy, degrowth as an anti-growth strategy, and agrowth as a neutral growth strategy. While green growth seems to have adopted environmental economics theory, agrowth and degrowth concepts align with ecological economics (Martinez-Alier et al., 2010). Section 2.3.2 provides further details on the relationship between emerging growth models and growth theories.

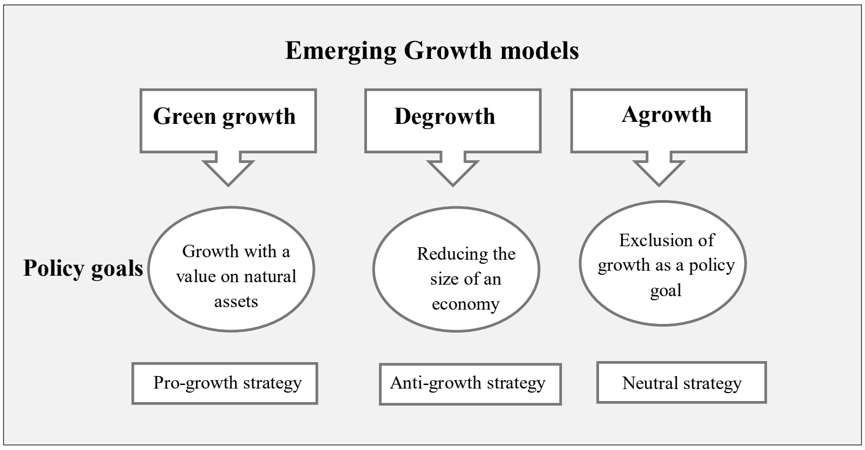

Figure 2.1. Emerging growth models and their goals.

One of green growth’s limitations is that it does not address issues such as ecological limits and the goals of the Paris Climate Agreement (Hickel and Kallis, 2019). Hence, slowing economic growth or achieving degrowth could be a way to see some qualitative changes in the economic production system that would minimise environmental concerns (Juknys et al., 2018). Degrowth has been proposed as a topic for further research, especially after 2010, to build on the work of Latouche (2010). However, there are some concerns as to how the steady-state economy, or even achieving degrowth, could impact production factors such as capital, labour and technology (Martinez-Alier et al., 2010; Drews and van den Bergh, 2016; Juknys et al., 2018). Any negative impact on the production factors could slow economic growth rates below zero, thus weakening social wellbeing that is still measured by progress in economic growth in many countries (Spangenberg, 2010). Spash (2017) and Brand (2013) argue that continuous economic growth, especially in the Global South, will promote inequality within countries, create competition between countries for access to resources, and generate more environmental pollution.

A study by Drews and van den Bergh (2016) about public views on economic growth found that the majority of subjects in the study (more than 1000) chose green growth as a favourable means to reconcile the tension between the economic and environmental imperatives. However, there were also a few cases where the subjects chose agrowth and degrowth, which highlighted the diverse opinions of the public on different emerging growth models (Drews and van den Bergh, 2016). While balanced views on economic growth and valuing natural assets could be a reason for the higher popularity of green growth, Hellegate et al. (2011) state that green growth often disregards ecological limits. Green growth tends to aim for incrementally better efficiency of resource use and an expansion of production and consumption, thus raising a question about limits to growth (Stoknes and Rockström, 2018; Hayden, 2014).

The feasibility of green growth has been questioned, particularly in the context of achieving the GHG emission reductions required under the Paris Climate Agreement (Hickel and Kallis, 2019). Nonetheless, policymakers in low-income countries may prefer a pro-growth strategy (e.g. green growth) as the majority of sectoral policies may identify economic growth as an end goal for two main reasons. First, low-income countries are insignificant contributors to global GHG emissions with low mitigative capacity. Therefore any reductions in their non-renewable resource use and GHG emissions will have an insignificant impact on a global scale. Second, low-income countries strive for higher economic growth as some of them (e.g. Nepal and Bangladesh) are in the process of graduating from the UN's LDC category, which requires attaining a threshold value for gross national income (GNI) per capita (US$ 1,230). While Bangladesh's GNI per capita is marginally above the threshold value, Nepal's GNI per capita is still below the threshold value. A win-win situation could be to adopt a green growth model as a means of delivering both economic and climate mitigation goals, at least in the short term, until they achieve LDC graduation by 2026 (UNCDP, 2021). This approach is in line with the contraction and convergence narrative. There is a research gap in terms of understanding how the potential pursuit of attaining higher economic output (e.g. GNI per capita) by low-income countries could impact their commitments made towards global environment-related initiatives such as the Paris Climate Agreement and the SDGs.

2.3.2. Relevant growth theories for emerging growth models

In neo-classical economic theory, a core metric for measuring overall wellbeing is the economic growth rate. Thus, the neo-classical economic theory emphasises the role of capital and labour based on the understanding that macroeconomic production will rise with investment (capital) and the participation of the population in the total labour force. Therefore, while exploring the environment-economy nexus, neoclassical macroeconomic theory can be considered orthodox. However, there exist heterodox theories that emphasise the inclusion of ecological and social parameters in the economic production system (Gendron, 2014). For example, Hellegatte et al. (2011) developed a framework that proposes an analytical foundation for transitioning from traditional economic growth to green growth. In addition to green growth, which was initially labelled as ‘ecological modernisation’ (Hayden, 2014), degrowth and agrowth have seemingly adopted heterodox theories. The three growth models move beyond focusing on traditional production factors when discussing global environmental issues such as resource use and GHG emissions and the way these interact with the economy.

Initially, the neoclassical growth theory used a production function depending primarily on capital, labour and technology (Solow, 1956). Later on, developments in the field of environmental economics during the 1970s helped neo-classical economic theory evolve into becoming more heterodox (Hellegette et al., 2011; Gendron 2014). As such, the theory evolved further to consider resource constraints and the quality of ecosystem services, and the production function factored in the environmental commodity (Dasgupta and Heal, 1974; Solow, 1974; Smulders 1999). Birkin (2001) presented three criteria that distinguish modern environmental economics from classical economic theories: "Firstly, the economic system should be designed more for people's collective needs. Second, a sustainable economy should be able to replicate itself indefinitely, and lastly, growth in economic activity needs to be decoupled from the negative impacts of the economic activities." These criteria satisfy the conditions for achieving sustainable development, and the 'Natural Capitalism' framework upon which it builds is somewhat in line with the theory of environmental economics. However, Birkin (2001) argues that economists and other policy stakeholders have used environmental economics to correct market failures arising from externalities. Ecological economics, on the other hand, is concerned more with human/business interactions with nature and ecosystem services (Hawken et al., 1999).

In low-income countries like Nepal and Bangladesh, communities have easy access to local resources (e.g. forest, water, and non-metallic construction materials), with weak regulatory frameworks supporting livelihoods. As a result, policy discourse on finite natural resources (e.g. forest biomass and non-metallic construction materials) within a country is often muted, mainly because politicians and policymakers are averse to imposing robust regulatory and governance frameworks. Also, as pointed out by Birkin (2001), environmental economics theory supports the development of the economic system for satisfying the collective needs of the people. A focus on the needs of the people prevails in countries like Nepal and Bangladesh, as the majority of the rural population in both countries depends on traditional forms of energy resources such as forest biomass, and GHG emissions are mainly associated with livelihood-oriented agricultural practices. Therefore, instead of using a prescriptive regulatory framework, an environmental economics-based approach that connects growth with in-country natural resources can be appropriate for developing policy actions to meet the objectives of global environment-related initiatives. The natural resource category of the productive capacity index[21] in most of the low-income countries is performing better than in the majority of developing and developed countries. The low-income country (also referred to as least developed countries) average in the natural resource category is 46, while it is 40 for developing countries and 37 for developed

[21] Productive capacity index measures the productivity capacity of any country's economic system across human and natural capital, energy, transport, information and communication technologies, institutions, private sector, and structural change in an economy. The United Nations Conference on Trade and Development is the creator of the productive capacity index and is currently being operationalised across many countries (193).

countries (UNCTAD, 2020). Owing to their natural asset base, low-income countries will continue to use local resources for both livelihood and productive purposes. Dercon (2012) suggested that some environmental benefits can be waived in low-income countries in favour of keeping the growth-poverty elasticity high. These technical nuances of environmental economics in low-income countries are rarely discussed by academic papers. Therefore, this research discusses the case for green growth in low-income countries.

2.4. Policy paradigms

The seminal work of Hall (1993) on policy paradigms discusses them as interpretative frameworks through which policymakers communicate their ideas. These paradigms specify goals and policy instruments, and the problems policymakers are meant to resolve. Although Kuhn (1962) used the paradigm concept initially to describe the dynamics of knowledge production in natural sciences, studies relating to the comparative political economy have been using the concept of a policy paradigm widely (Skogstad, 2011). The concept is now central to policy studies that aim to understand the role of knowledge and ideas in the policy change processes (Zittoun, 2015). For climate policy study, Vij et al.'s (2018) operationalisation of the concept of policy paradigms explains the change in the climate policy paradigms in Nepal and Bangladesh. However, the central theme of Vij et al.'s (2018) study is climate change adaptation, literature on which has progressed considerably for developing and low-income countries. For the climate mitigation policy domain, and particularly for low-income countries, we lack understanding of how policy paradigms change over time, mainly as a result of the influence of international climate agreements, the environment-related SDGs, green growth and the related international development mechanism (Rahman and Giessen, 2017). The green growth narrative permeated through the government policy landscape of many low-income countries in the mid-2010s, and the Paris Climate Agreement and the SDGs came into effect in the mid-2010s. Unlike the developed countries, low-income countries' policymakers and their climate-specific and sectoral policies started to emphasise climate mitigation only recently, indicating a change in climate policy paradigms that formerly focused on climate adaptation and community resilience (Shrestha and Dhakal, 2019).

Subsequently, policymaking processes may change as policy paradigms are underlying forces that influence the way policymakers address policy issues (Beland and Cox, 2013). This research focuses on addressing this research gap by taking Nepal and Bangladesh as case countries and by focusing on climate mitigation actions in government policies via creating and applying an analytical framework based on this research's conceptualisation of policy paradigm. A detailed description of this research's conceptualisation of policy paradigm is in Chapter 4.

2.4.1. The ideational element of policymaking and institutions in policy paradigm studies

While the concept of the policy paradigm emphasises the ideational element of policymaking as much as the policies per se, it is easy to conflate ideas and policies when using the concept in its current form (Daigneault, 2014). However, a discussion on substance and the discourses around ideas related to policymaking, and the ways these can break the cognitive locks, may help towards an understanding of the meaning of ideas in policy studies (Skogstad, 2011). Ideas are historically constructed 'causal-beliefs'; in other words, the values and perceptions of individual and collective actors (Béland, 2016). While using the concept of policy paradigms, Diagneault (2014) suggests distinguishing between two constructs (ideas and policies) as much as possible in order to better circumscribe the concept of the policy paradigm. The policy paradigm concept is also abstract in the sense that it incorporates the values and worldviews of the policy actors (Huo, 2009), thus making it difficult to understand the actual meanings of ideas and the way ideas affect policy change. Nonetheless, the concept of the policy paradigm introduced ideas into mainstream policy studies (Carstensen, 2015). This research explores the sharing of ideas among policy actors in Nepal as they make decisions about the integration of the objectives of global environment-related initiatives and green growth into government policies. I distinguish between ideas and policies by focusing on two aspects of the integration. First, I focus on the explanatory role (influence) of global environment-related initiatives and green growth-related policy discourse on the ideas of the policy actors. Second, I investigate the causal mechanisms associated with the impacts of change in the ideas of policy actors on policymaking processes that lead to policy changes across sectors.

The conceptualisation of ideas as static and monolithic, and the failure to sufficiently internalise the role of policy actors' institutions in the ideational change process, are also downsides to the use of the policy paradigm concept, in addition to an overemphasis on punctuated equilibrium-style change (Carstensen, 2015). The interaction between the ideas and institutions that policy actors represent, and the analytical distinction between these, are crucial to understanding social policy change (Béland, 2016). Kern et al. (2014) use the notion of an 'interpretative framework of ideas' to connect the ideational element of policymaking with the institutionalist perspective on policy change because the policy actors' institutions embed the interpretative framework of ideas. The way formal institutions such as governmental organisations work on their mandates, and the way institutions interact and operate, present interpretative frameworks as an important aspect of policy paradigms that influences policy objectives and instruments (Kuzemko 2013, p. 48). The interaction between policy actors' ideas and institutions is profound enough to discuss these collectively as the 'discursive institutionalism' that takes ideas and institutions seriously, sets ideas and discourse into institutional contexts, and identifies these as having dynamic characteristics (Schmidt, 2008).

While institutional explanations were popular in policy and governance-related studies before 2010, the new discursive institutionalism has revived the focus on the individual-level behaviour of policy actors (Peters, 2019) which corresponds to the ideas of policy actors. After the advent of discursive institutionalism, the links between ideas and institutions appeared to be more prominent in policy studies and the positive aspects of the linkage are widely discussed. However, Carstensen and Schmidt (2016) think that ideational power[22] and the capacity of actors to influence the cognitive beliefs of others may result in institutions imposing their agendas. This may be true in a multi-level governance setting where central-level government institutions have more power over local-level government institutions, especially while deliberating on international agendas related to international climate agreements and green growth. I use the institutionalist perspective to focus on the interactions between policy actors across sectors and multi-level governance, and their institutions, to understand how the policy actors

[22] Ideational power refers to the influence of one actor over others to adopt their views through the use of ideational elements.

share ideas about the objectives of global environment-related initiatives and green growth via their institutions. The institutional perspective provides an understanding of the nature and extent of policy changes (e.g. incremental, evolutionary, and radical) driven by policy actors' ideas and institutions in multi-level governance settings (Carstensen and Schmidt, 2016). I also refer to the concept of ideational power to observe the influence of one policy actor's ideas and institutions over another.

2.4.2. Changes in policy paradigm

Studies focusing on the ideational element of policy paradigms linked ideas to policy actors' reasoning for problem-solving and for changing the content of policies (Carson, 2004; Baumgartner, 2014; Daigneault, 2014). While the ideational element of policymaking is predominantly discussed as an intrinsic part of policy paradigms driving change, the understanding of change in policy paradigms remains vague, mainly because of the limited literature about when to conclude that a paradigm change has taken place. The multifaceted processes of policy change make it more complex to study. It is therefore, an ambiguous field of study (Capano, 2009). Hogan and Howlett (2015) state that when we are speaking about policy paradigms, we are talking about policy dynamics as ideational constructs that influence policy content. Ironically, the concept of the policy paradigm was supposed to enable us to better comprehend policy change (Hogan and Howlette, 2015), which is by its nature dynamic. The literature on changes in policy paradigms appears to be ambiguous, mainly for the following reasons. First, the policy paradigm shift is an analytical metaphor for radical policy change (Wood, 2015), which may not be the only form of policy change. Second, there is no clarity about which ideas qualify as paradigmatic, and which subsequent changes should be labelled as paradigmatic changes (Wilder, 2015). Third, the non-ideational elements (e.g. knowledge of policy actors) of policymaking can also cause paradigmatic change. Therefore, the multi-dimensional and discursive processes resulting from the ideational constructs of policy actors, and other non-ideational causes and the way these change the content of the policies, are underscored in order to better circumscribe the concept of changes in policy paradigms.

A change in a policy paradigm implies a change in a set of coherent and well-established policy ideas (Daigneault, 2014, p. 482). When ideas that are widely shared and accepted by the policy actors change (Baumgartner, 2013, p. 252), the policy paradigm can also be said to have changed. These changes are related solely to the ideational elements of policymaking. In addition to the ideational element, policy paradigms conceptualise policy goals, policy instruments and government institutions as inter-related elements of policy paradigms (Kern et al., 2014). Based on this conceptualisation, Kern et al. (2014) state that a paradigm shift can occur if significant changes appear in the existing practice in each element. Vij et al. (2018) identify framing, policy goals, meso-level areas (i.e., economic sectors) and policy instruments as key areas to investigate in relation to changes in policy paradigms. This can be done by using the theory of institutional change that has a well-developed literature regarding its linkage with the ideational element of policymaking. The ideational power of an institution, also called the institutional power of any particular actors' group or institution, can cause institutional change across other actors, thus changing the policy paradigm (Carstensen and Schmidt, 2016). The ideational and non-ideational elements mentioned in this paragraph relate to in-country policy discourse. However, transnational actors—for example, international development organisations, intergovernmental networks of actors, and advocacy coalitions—may also play a role in the ideational and policy diffusion processes (Skogstad, 2011). Subsequently, some transnational ideas get unlocked in the national context—for example, ideas related to the objectives of global environment-related initiatives and green growth. Internationally generated policy ideas that diffuse in the national context create a relationship between the national policy paradigm and transnationalism, a means by which the policy diffusion of ideas and norms generated at an international arena occurs (Skogstad, 2011, p. 8).

In policy paradigm studies, changes in policy paradigms have been discussed from many angles, including the scale of change, knowing about the exact point when a policy paradigm changes, and the change across at least one of the elements that define paradigmatic change. Hall (1993) defined the scale of changes as episodic ruptures. He specified three orders of change: first-order change, second-order change, and third-order change. First-order change is characterised by incrementalism, second-order change by including additional policy goals and policy instruments, and third-order change is mentioned as radical in all aspects and leads to a paradigm shift and is, therefore, similar to punctuated-equilibrium-style change. As an alternative to episodic change, an investigation of changes in policy paradigms considered evolutionary change which encompasses small increments of change over time (Howlett and Cashore, 2009). The evolutionary model of paradigmatic change draws on the theory of historical institutionalism that identifies four types of change: layering, conversion, reactive sequences and drift (Skogstad, 2011, p. 12). Change via layering occurs when the existing institutions add new roles. Conversion happens when policies that alter the role of the institution add new goals. The reactive sequence occurs when causally related events occur in response to antecedent events and are a cause of subsequent events. Finally, drift is understood to happen when policymakers and their institutions fail to account social and economic changes (Mahony and Thelen, 2010). For this research, I use the paradigmatic changes discussed in this paragraph to examine the changes in policy paradigms pertaining to climate mitigation actions in the government policies in Nepal and Bangladesh.

2.4.3. Environmental governance and collaborative practice in policymaking

The World Resource Institute's (WRI's) definition of environmental governance mentions the authoritative role human beings play in the management of natural resources and ecosystem services (WRI, 2002). While human beings will continue to interact with natural assets, environmental governance, its key elements, and decision-making will also keep evolving (Armitage et al., 2012; Bouwma et al., 2012; Vatn, 2018). Armitage et al. (2012) explain that environmental governance is a subset of the broader governance literature and that the concept of 'good governance' is relevant in a situation where environmental decision-making emphasises environmental protection.

During the late 1990s, a need for better collaboration, integration, adaptation, learning and participation by different policy actors introduced a New Environmental Governance (NEG) model (Holley et al., 2015). This model was so broad in its scope that there was no fixed understanding of it. However, the features of policymaking such as the level of interaction amongst state and non-state actors, and the roles they have in policy implementation, indicated the presence of the NEG model (de Burca and Scott, 2006; Ostrom, 2010). Other policymaking features, such as collaborative and adaptive learnings, were thought to help solve problems that prescriptive regulatory standards and market-based approaches cannot address (de Burca and Scott, 2006). For this reason, the NEG model that emphasises the role of non-state actors, local knowledge, stakeholder ownership, and stakeholders' buy-in became popular in environmental policy and governance literature (Sabel et al., 1999; Holley et al., 2015). NEG is also compatible with other prevalent models such as 'good governance' decision-making. Both of these models recognise collective environmental decision-making. But the NEG model includes additional roles for non-state and market actors (private sector organisations) in collaborations that contribute to the exchange of ideas and the creation of local knowledge (Vatn, 2018). Good governance is a part of human behaviour that values the role and existence of natural assets for providing ecosystem services (Armitage et al., 2012). In contrast to 'good governance' that is mostly regulated by public sector entities, hybrid environmental governance and the NEG are open to the collaborative participation of other entities active in the market and in society and are non-regulatory in all aspects (Bouwma et al., 2012; Holley et al., 2012).

The apparent shift of environmental governance from being a hierarchical process controlled by government entities to collective governance (e.g. hybrid and NEG) creates a situation where the market and its non-state stakeholders might prevail in achieving their goals (Sacchetti and Sugden, 2009). This also means that the responsibility for protecting common environmental commodities and sustaining ecosystem services extends beyond government space (Bouwma et al., 2012). The interactions between various stakeholders who form partnerships for collaborative decision-making, and the implementation of environmental policies open up a critical research area, which is the collaborative practice in the context of policy discourse on global environment-related initiatives and green growth. In low-income countries, this particular policy discourse has barely a decade long history. Therefore, how this policy discourse fits into the governance of policies related to climate and the environment, and of sectoral policies, is weakly understood in the context of low-income countries. Therefore, this research explores collaborative practices in environmental decision-making that relates to the policymaking process such as the integration of the objectives of global environment-related initiatives and green growth, and the institutional and strategic interactions between different policy actors.

2.4.4. Discourse in the interaction of policy actors' ideas and institutions – theoretical and methodological groundings

The advent of discursive institutionalism created insights into the role of both ideas and discourse in politics and policymaking whilst emphasising the institutional change and explicitly portraying ideas as the content of discourse (Schmidt, 2008). Later, discursive institutionalism was presented as an overarching concept to explain the interactions between policy actors' ideas (and discourse) in an institutional context, particularly in the discursive policymaking approach (Schmidt, 2015). The important relationship between policy actors' ideas and institutions were further elaborated by using a terminology called 'ideational power', which refers to imposing powerful policy actors' ideas and their institutional interest over the least powerful ones (Carstensen and Schmidt, 2015). A collective discussion of policy actors' ideas and institutional interests became popular in later studies focusing on the ideational element of politics and policymaking (Seabrooke and Wigan, 2016; Mügge, 2016; Beland and Cox, 2016). In discursive institutionalism, the role of discourse is rarely used separately from ideas as they are often bundled together and that the policy actors' ideas, power, interest, preferential values, and institutions interact through discourse (Schmidt, 2008; Beland and Cox, 2016). Further, Beland and cox (2016) state that policy actors use their ideas and power to influence discourse. Carstensen and Schmidt (2016) state that ideational elements bring discourse, narratives, and practice. Thus, it is reasonable to infer that policy actors' ideas and power influence the discourse, and the discourse assists in sharing ideas and interests. While the meaning of 'discourse' pertains to having a conversation and 'holding forth' on a subject, research scholars had investigated its philosophical and theoretical meaning as early as in the 1960s across a variety of disciplines, such as cultural theory, critical theory, literary theory, linguistics, and social psychology (Mills, 1971). Of all, Foucault (1979) definition of discourse is the most relevant to this research for its discussion of power and knowledge.

Foucault (1979) presented discourse as something that produces a stretch of text or an utterance and a concept and an effect. Later, the knowledge-power relation, which Foucault (1980) conceptualised, formed a key to explaining discourse. In addition to Foucault (1980) work on power-knowledge relation, the critical discourse analysis (CDA) became a favoured theoretical tool to explain the role of discourse in the interactive and social context of policymaking. The CDA sees language (written texts) as social practice (Fairclough and Wodak, 1997; Wodak, 2001) and context-sensitive (Huckin, 1997). The emphasis on social practice that shapes discursive events, such as policymaking, is justified in the sense that policy per se is socially constructed (Bacchi, 1999). In CDA, certain concepts are emphasised for further foregrounding, and the less significant ones are de-emphasised based on the research problem that needs to be defined in CDA (Keller, 2013, p. 27-28). The discursive differences, policy actors' ideas and institutional interests are negotiated, and differences in power are encoded in texts, meaning the government policy documents can show traces of differing ideologies and discourses (Wodok and Meyer, 2001). Thus, the textual data corpus generated from the government policy documents is the product of discursive practice in policymaking, which can be interpreted in a broader social context beyond public policy to explain the social processes and knowledge structures that generate government policies (Huckin, 1997).

Another constructivist approach to analysing discourse is the post-structural discourse analysis (PDA). While discursive institutionalism can help understand the relationship between policy actors' ideas, the entailing discourse, and institutions, PDA is particularly helpful in understanding the power dimension of the ideas and discourse (Torfing, 1999, p.153; Panizza and Miorelli, 2013), and particularly the intersubjective aspect of ideas (Larsson, 2015). Finally, thematic analysis (TA) can also analyse the manifestation of discourses in the government policy documents and via semi-structured interviews. While the use of TA has been questioned because it focuses on the explicit description (Smith et al. 2011; Vaismoradi et al. 2013), a content-sensitive analytical approach to systematically assessing the manifest and latent contents of the textual data and contextual information enhances validity and rigour (Selvi, 2020, p. 81). Dunn (2001) used various written texts and semi-structured interviews as data sources for discourse analysis (Waitt, 2005). This research builds on above mentioned theoretical and methodological groundings to study ideas, the entailing discourse, and institutions in environmental policymaking. While the discourse analyses are rarely connected to empiricist and positivist approaches (e.g. quantitative research methods) because of the ontological and epistemological tensions (Lepoid et al., 2019), this thesis builds on the idea that constructivist, and empiricist and positivist epistemological paradigms can go together. The ontological approach and epistemological paradigms are discussed in the Research Design chapter (Chapter 3).

2.5. Integrative policy approach across policy formulation and implementation

The policy discourse on global environment-related initiatives and green growth is abstract in the sense that the policy actors involved discuss the merits of different policy ideas and seek a way forward for translating those policy ideas into practice. The abstract logical reasoning that the majority of involved policy actors agree on translates into practice by integrating them into the policies and subsequently delivering on them. The integrative policy approach to leveraging the global environment-related initiatives and green growth-related policy discourse via delivering policies relates to the concept of Environmental Policy Integration (EPI), which refers to the integration of environmental concerns into other non-environmental policy areas (Lafferty and Hovden, 2010). Therefore, I use the concept of policy integration and other similar concepts such as 'policy coherence' and 'mainstreaming' to investigate the integration of the objectives of global environment-related initiatives and green growth into government policies in Nepal and Bangladesh. The concept of policy coherence relates to reducing conflicts and promoting synergies between and within different policy areas for achieving jointly agreed policy objectives (Nilsson et al., 2012). Mainstreaming refers to the integration of environmental and climate-specific objectives, policies and strategies into sectoral planning and decision-making processes (Saito, 2013; Rauken et al., 2015). Although 'policy coherence' and 'mainstreaming' are increasingly discussed separately in the literature, the origins of both concepts are associated closely with the EPI-related literature (Nilsson and Eckerberg, 2007, p. 31; Rauken et al., 2015). However, the term policy coherence is used widely in the context of SDGs, and mainstreaming is often used in the context of development cooperation, climate change adaptation and biodiversity issues (OECD, 2017a; Runhaar, 2018).

2.5.1. Environmental policy integration – integrating environmental objectives into sectoral policies

EPI is useful for facilitating rational policymaking and for prioritising environmental issues in non-environmental policy areas (e.g. Agriculture, Transport, and Industry) despite a potential conflict between economic objectives and environmental objectives. EPI as a tool has the potential to reduce policy contradictions and create a pool of knowledge as policy actors converge for policymaking. EPI employs a democratic process by allowing policy actors to participate via workshops and consultation forums in a transparent and informed way (Persson, 2004, p.11). Thus, EPI provides opportunities to formulate a coordinated approach to considering complex cross-cutting issues in policymaking (Adelle and Russel, 2013). Although initially conceptualised as the integration of environmental considerations into economic and development decision-making, particularly in the context of sustainable development, EPI has become a part of sectoral policies (Nilsson and Eckerberg, 2007, p. 30). EPI is also relevant to global environmental governance because the protection of the global climate by reducing GHG emissions can be integrated as an environmental policy objective within economic development policies, such as the sectoral policies (Biermann et al., 2009). In climate policy studies that present climate change as a specific policy issue, climate policy integration (CPI) is often a separate field of inquiry (Persson et al., 2018). Although CPI and EPI share a similar conceptual basis, the situational and sector-specific characteristics of CPI make it a narrow field of study, and it therefore engages a limited set of policy actors to work in a particular way to meet climate change-specific goals (Adelle and Russel, 2013). Initially, CPI focused more on the developing world to integrate climate change mitigation and adaptation issues in all areas of policymaking (Ahmad, 2009). Recent literature on CPI discusses mainstreaming climate change via integrating climate change mitigation into sectoral policies (Di Gregorio et al., 2017). Thus, EPI and CPI are similar concepts because they apply an integrative policy approach to integrating climate change issues into government policies. Therefore, in this study, I leverage the conceptual underpinnings of both CPI and EPI to build the climate mitigation mainstreaming conceptual framework, which I elaborate on in detail in Chapter 5.

Niedertscheider et al. (2018) investigated the role of CPI in sectoral policies to find that the policy integration-related problem is 'wicked', as there are numerous actors involved across various administrative and governance levels. Policy integration across sectors is called horizontal policy integration, and policy integration across governance levels is called vertical policy integration. Horizontal policy integration implements environmental objectives as a cross-sectoral strategy, whereas vertical policy integration specifies environmental objectives as central policy elements across government bodies in multi-level governance settings (Lafferty and Hovden, 2010). The participation of policy actors from different policy domains (and governance levels) and their coalitions, including their institutions, results in the pursuit of their shared interests (Trein, 2017), which could be the source for potential conflicts and trade-offs. Similarly, sectoral interdependencies and a need for shared decision-making could pose challenges for lead organisations[23] in their efforts to advance the formulation of policies. Nonetheless, government-centric coordination efforts to create policy integration are less demanding for the policy actors involved, given that the integrative measures are mainly strategic considerations (Tosun and Lang, 2017). For global environmental governance, and for climate change issues, policy integration is necessary as these are cross-cutting policy issues (Biermann et al., 2009; Koide and Akenji, 2017; Tosun and Lang, 2017).

The history of EPI dates back to the early 1970s, but it was not until 1992, during the United Nations (UN) Conference on Environment and Development, that EPI gained popularity (Lafferty and Hovden, 2010). Hence, the role of global environmental governance has been instrumental in stimulating EPI. In fact, international and inter-governmental organisations have paved the way for the practical application of EPI since the early 1990s. For example, the World Bank promoted the integration of environmental policy with other sectoral policies (Tosun and Lang, 2017) and UN organisations are advocating policy integration for implementing the SDGs (Nilsson and Persson, 2017). Therefore, to investigate the integration of the objectives of global environment-related initiatives and green growth into policies, this research identifies policy integration as a relevant concept.

[23] Lead organisation is used to refer to the government organisation that leads the policymaking process.

2.5.2. Policy coherence – creating a synergetic effect between multiple policies

Policy coherence is used to reduce conflicts and promote synergies between and within different sectoral policies for achieving jointly agreed policy goals (Nilsson et al., 2012). Although it is easy to understand the meaning of policy coherence, the concept is elusive in the sense that it is difficult to measure the level of coherence (May et al., 2006). This is because the scope of the policies involved can be broad and because of the multifaceted and qualitative nature of coherence. Policy coherence is applicable across multiple governance levels (vertical coherence) and across different policy areas (horizontal coherence). Nilsson et al. (2012) investigated and proposed an analytical framework to assess policy coherence that built on the initial work of Dunn (2003) and Nilsson et al. (2009). The analytical framework focuses on policy outputs such as the objectives and instruments used for achieving outputs, and on policy implementation. Hence, the framework distinguishes policy coherence from policy integration based on the policy stage (implementation) and impacts (outcomes), as these two concepts are frequently bundled together in the same research domain of environmental policy integration. Howlett and Rayner (2013) clarify the distinction between the two concepts by stating that coherence is the ability of multiple policy goals to co-exist logically, whereas integration is to incorporate environmental objectives into different sectoral policies. This research uses policy coherence as a separate concept to policy integration to investigate the synergetic effect that different sectoral policies and climate policy can create for reducing the use of non-renewable resources and GHG emissions in Nepal. Therefore, this research uses the concept of policy coherence for studying the policy implementation aspect of global environment-related initiatives and green growth. For studying the policy formulation, this research uses policy integration.

International organisations such as UN agencies, the World Bank and the OECD have used the concept of policy coherence for developing strategies and indicator frameworks, and even for developing organisational and procedural reforms (Lenschow et al., 2018). The OECD has done substantial work on the theoretical and practical aspects of policy coherence. The OECD’s work in this area uses the two concepts (policy integration and policy coherence) interchangeably and focuses on policymaking processes, coordination and collaboration, knowledge management, and leadership (OECD, 2017a).

While the interchangeable use of policy integration and policy coherence is common amongst policy scholars, recent literature gives more emphasis to the distinction. Policy scholars advocating the use of policy integration and policy coherence for different purposes view policy integration as a means to achieve policy coherence (Nilsson et al., 2012). This research builds on the policy literature that emphasises the distinction between the two concepts mentioned above. Based on this position, this thesis argues that policy integration focuses more on policy formulation and policy coherence focuses more on policy implementation. The argument builds on the policy-analytical framework developed by Dunn (2003) and Nilsson et al. (2009). The way policy coherence focuses on policy implementation will be discussed in Chapter 6 that focuses on promoting synergies between several co-existing sectoral policies of Nepal with a common aim to reducing resource use and GHG emissions. Further, chapter 6 focuses on the implementation of sectoral policies, together with the NDCs of Nepal. Therefore, as argued in this paragraph regarding the suitability of policy coherence for studies focusing on policy implementation, chapter 6 uses the policy coherence concept.

The different aspects of policymaking—such as coordination, collaboration and cooperation—are identified as the means to achieve better coherence by international organisations such as the OECD (OECD, 2015). Therefore, the research assumes that collaborative practice is valuable when one is creating policy coherence. These collaborations focus on three key areas: problem definition, policy objectives and policy instruments (Nilsson et al., 2012). Building on the policy-analytical framework initially developed by Dunn, 2003 and Nilsson et al. (2009), Lenschow et al. (2018) introduces another level in the policy-analytical framework: policy definition. This level emphasises the ideational element of collaborative practice between policy actors and draws on rationalist and institutionalist insights. Fjellborg et al. (2020) present the institutional aspect as a critical element in policy coherence studies which emphasise both horizontal and vertical policy coherence and the way institutions interact to define policy problems and look to resolve them via policies. The institutional dimension of resource efficiency in a multi-level governance setting was investigated by Bahn-Walkowiak and Wilts (2017) to highlight the implementation of specific instruments and policymaking processes, including planning, coordination, and communication networks. The use of specific instruments contributes to credibility, consistency and congruence while facilitating the policymaking processes for improving both horizontal and vertical coherence. Building on these analytical and theoretical contributions to policy coherence, this research investigates the collaborative, ideational, institutional, and instrumentalist approaches to improving policy coherence for delivering on the objectives of global environment-related initiatives and green growth in Nepal and Bangladesh. The collaborative approach pertains to the collaborative practice between policy actors. The ideational approach refers to the role of policy actors' ideas in improving policy coherence. The institutional approach relates to using the policy actors' institutions as part of the institutional interactions. The instrumentalist approach refers to the use of different policy instruments by the policy actors.

2.5.3. Mainstreaming – linking the policy formulation and policy implementation aspects of the policies

Mainstreaming embraces the idea of integrating environmental and climate change objectives into non-environmental sector policies and into sectoral decision-making (Benson et al., 2014). However, unlike policy integration, which relates to policymaking and the entailing policy formulation process, mainstreaming focuses on policy stages beyond agenda setting and policy formulation, and encompasses policy implementation and policy outputs (De Roeck et al., 2018). Mainstreaming is also about using resources efficiently and sustainably for effectively designing and managing policies (Ayers et al., 2014). Therefore, mainstreaming shares a conceptual similarity with policy coherence in the sense that it is policy implementation-oriented and leverages coherent approaches to managing policies by efficiently using specific instruments (e.g. financial instruments) for multiple policies. However, one notable and distinctive feature of mainstreaming is the concept's origin, which relates to development cooperation and climate change adaptation in developing countries (Huq et al., 2004; Klein et al., 2005). Unlike policy integration and policy coherence, which focus almost exclusively on environment and climate policy research areas, the literature on mainstreaming is limited to biodiversity, climate adaptation and development cooperation for climate adaptation (Klein et al., 2007; De Roeck et al., 2018). However, there exists the possibility of extending the use of 'mainstreaming' to another strand of environmental and climate policy research, for example climate mitigation. Therefore, this research uses the concept of mainstreaming, which is in addition to policy integration, to study the integration of the objectives of global environment-related initiatives and green growth into non-environmental sector policies. The concept of mainstreaming is important for this research for two main reasons. First, it explains various levels of policy integration and also intends to explain the conceptual difference between policy integration and mainstreaming. Second, this concept focuses on almost all policy stages and is both policy formulation and policy implementation-oriented. Therefore, the conceptual framework for mainstreaming that the findings chapter (Chapter 5) discusses in detail explains the following processes: the influence of global environment-related initiatives and green growth-related policy discourse; the integration of these into non-environment sector policies; and the level of integration across different sectoral policies.

2.6. Energy and material consumption models for Bangladesh and Nepal

The relationship between energy consumption, GHG emissions, and economic output (e.g. GDP) has been thoroughly explored by econometric studies focusing on Bangladesh, Nepal and other countries (Lee and Chang, 2007; Pokharel, 2007; Begum et al., 2015; Vidyarthi, 2015; Bastola and Sapkota, 2015). Previous studies (Yang et al., 2020; Akçay and Demirtaş, 2015; Rahman et al., 2021; Das and McFarlane, 2020; Sharma et al., 2019) have focused on remittances as an exogenous factor to energy consumption for high remittance-receiving countries, such as Nepal and Bangladesh. Bastola and Sapkota (2015) use the autoregressive distributed lag (ARDL) model to study the relationship between energy consumption, carbon dioxide emission, and economic growth in Nepal to find the causal relationship between the three variables. Similarly, the use of multivariate time series analysis of energy consumption, economic output and carbon emissions found a causal relationship running from (i) the economic output to energy consumption and (ii) the carbon emissions to the economic output (Nepal and Paija, 2019). For Bangladesh, Sarkal et al. (2019) used the generalized least squares (GLS) model to find that energy consumption and economic growth are correlated. The ARDL co-integration model and Granger causality analysis of carbon emissions, energy consumption, and industrial growth in Bangladesh found that energy consumption and industrial growth drive carbon emissions (Rahman and

Kashem, 2017). Building on previous econometric models, this thesis focus on the methodological contribution by using regularised regression method—ridge regression—that employs a machine-learning approach to create models with the least error and use cross-validation algorithms to test the validity of the models.

Most of the research exploring the relationship between material consumption and economic output uses the concept of resource decoupling, which is the decoupling of material use from GDP (Haberl et al., 2020). While we lack LDC-specific domestic material consumption (DMC) models, there is a well-developed literature on material flow accounts and their projections across global, regional, national (non-LDCs) and urban scales. Krausmann et al. (2009) had discussed the growth in global material use resulting from the GDP and population in the 20th century. Schandl and Eisenmenger (2006) investigated a regional resource extraction pattern related to resource extraction of different country groups based on income levels and geographical location with the GDP. Weisz et al. (2006) investigated the economy-wide material use in the EU-15 member state by considering population density as a driver to material consumption. Later research on material consumption, such as a study by Dong et al. (2017), focuses on China, South Korea, and Japan to discuss DMC resulting from changes in GDP, population, and technology (resource productivity). Similarly, Schandl et al. (2017) analyses forty years of evidence on global material use and resource productivity to discuss growing wealth and consumption as drivers to material consumption. The latter studies used the IPAT (Impact, Population, Affluence, and Technology) accounting model devised by Ehrlich and Holden (1971) to discuss the role of technology alongside population and affluence. Alfredsson et al. (2018) emphasise the important role of technology (for material productivity improvements) in transforming the current unsustainable level of consumption and production into more sustainable. Thus, drawing on the research by Weisz et al. (2006), Krausmann et al. (2009), Schandl and Eisenmenger (2006), Dong et al. (2017) and Schandl et al. (2017), it is inferred that initially, the focus was mainly on GDP and population as exogenous factors to material consumption. Later they added technology alongside GDP and population. However, other factors, such as latitude and climate data (Steinberger et al., 2010; Baynes and Musango, 2018), renewable energy utilisation (Aola et al., 2020), and sectoral value-added in GDP (Wu et al., 2019) are also used. This research presents a first-order attempt to create a material consumption model for LDCs (Nepal and Bangladesh) by using GDP and population as exogenous factors. More literature-based and methodological contribution on the material consumption models is provided in Chapter 7 that also discuss the role of technologies.

2.7. Summary of literature review

This literature review investigated knowledge pertaining to the integration of the objectives of global environment-related initiatives and green growth into government policies by focusing on integrative policy approaches and the processes by which changes to policy paradigms occur. Previous research scholars have used integrative policy approaches for climate and environmental policy studies. However, inadequate explanations about the conceptual basis for the three integrative concepts mentioned in Section 2.5 have often resulted in the concepts being used interchangeably. Therefore, the literature review highlighted the need for further clarification of the conceptual differences—which this research explores via conducting country-specific studies.

The policy paradigm field is a rapidly evolving field of study and the majority of recent progress in this particular research domain focuses on the ideational element that is highly theoretical. The understanding of non-ideational elements of policymaking, such as the knowledge of policy actors and institutional interactions, is far for being adequate for identifying these elements as core aspects of policy paradigms, despite the institutionalist perspective explaining the policy paradigm change mechanism. The policy actors' knowledge and their institutions are non-ideational elements in the sense that policy actors' knowledge and their institutional interests and preferences exchanged during discursive policymaking were excluded from the original conceptualisation of policy paradigm by Hall (1993). While the knowledge and institutional interests and preferences can be endogenous factors to generating ideas by policy actors, they are often discussed separately as ideas and institutions (Walt, 1994; Shearer et al., 2016; Béland, 2016). On the other hand, knowledge is primarily discussed as a critical element of science-policy interactions (Rayner and Howlett, 2017). Further, although the policy paradigm concept has seen significant progress in the theoretical sense, the literature on the scale of changes, the ways in which policy paradigms change and the conditions for change, represents a research gap. The limited explanation of change mechanisms draws on information from the institutional change literature. The policy instruments used and the policy goals are two key considerations that explain the scale of changes, and there is a lack of a framework that explains the conditions for change. Drawing on the previous work and the gaps identified from the review of literature, this research applies the policy paradigm concept in the context of Nepal and Bangladesh, as the lack of sufficient country-specific studies is another notable research gap.

The influence of the discourse on global environment-related initiatives and green growth-related policy on policymaking, particularly in low-income countries that aim to achieve both economic and environmental goals, has not yet been covered in the academic literature. As countries with insignificant contributions to global GHG emissions and global non-renewable resource extraction embrace the idea of climate mitigation actions, the way these concepts integrate into these nations' sectoral policies—and the causal mechanism related to the integration process—go unexplained. While climate adaptation-related studies have sufficiently applied integrative approaches such as policy integration and mainstreaming in case countries, climate mitigation-related studies have rarely used concepts such as policy coherence and mainstreaming, particularly in the context of low-income countries.

Finally, looking at the delivery of the objectives of global environment-related initiatives and green growth, countries which are insignificant contributors to global environmental issues, particularly those in the LDC group of the United Nations, are confronted with the challenge of simultaneously achieving economic and climate mitigation goals. This is an unfamiliar situation for them, and the majority of studies concerning the objectives of global environment-related initiatives and green growth are policy-oriented. There has not been sufficient research into how low-income countries that make an insignificant contribution to global environmental issues go about achieving higher economic output for graduation from LDC status while at the same time reducing their GHG emissions and sustainably using resources. The research on the contraction and convergence approach has generated insights into understanding the economic growth in developing countries in the context of international convergence of per capita resource use and per capita GHG emissions. However, we know little about how the contraction and convergence approach applies to low-income countries like Nepal and Bangladesh. These countries are considerably different to populated developing countries like India and China, whose per capita GHG emissions and per capita resource use may not be huge in comparison to that of developed countries but are significant contributors in an absolute sense. For example, China ranks first and India ranks third in the list of countries with highest GHG emissions in an absolute sense.

Chapter 3: Research Design

This chapter describes the mixed-method research approach used to conduct this research, the rationale and purpose of the chosen methods, and the epistemological paradigms associated with the methods. The research gaps identified by the literature review, the research questions, and the research objectives informed the choice of appropriate research methods, noting the related epistemological paradigms. The research gaps identified are: (i) insufficient knowledge base and a lack of analytical basis to explain changes in climate policy paradigms resulting from the framing of climate mitigation actions in the government policies in Nepal and Bangladesh; (ii) conceptual basis for differentiating between policy integration and mainstreaming is lacking, meaning they are used interchangeably without a clear justification, which is problematic for researchers studying the framing of climate mitigation actions into the government policies ; (iii) insufficient country-specific studies on green growth, meaning we do not know the prospects for greening economic growth in low-income countries, such as Nepal and Bangladesh while delivering the commitments regarding global environment-related initiatives with LDC graduation. A mixed-methods research approach that utilises both quantitative and qualitative research methods intends to address the research gaps.

While the specific research methods pertaining to each of the research questions are elaborated in Chapter 4 to Chapter 7, Section 3.1 in this chapter provides an overview of the overarching research approach, Section 3.2 explains the qualitative research methods, and Section 3.3 explains the quantitative research methods used for this research.

3.1. Overview of the mixed-method research approach

This research produced four results chapters (Chapter 4 through to Chapter 7) that answer the two research questions by focusing on the following:

- The changes in policy paradigms pertinent to climate mitigation actions in Nepal and Bangladesh for two periods 1992–2004 and 2005–2018.
- The mainstreaming of climate mitigation-oriented actions in policies, and the role of influencing factors such as global environment-related initiatives and the green growth in Nepal.
- Linking climate policies across economic sectors in Nepal by assessing the role of green growth.
- Historical evidence and future avenues for the greening of growth in Nepal and Bangladesh.

Both quantitative and qualitative research methods were used to examine: the influence of the global environment-related initiatives and green growth on government policies; the subsequent changes to policy paradigms; and future GHG emissions, resource use, and growth pathways for Nepal and Bangladesh. Figure 3.1 shows the use of the mixed-method research approach via using the four different methods. Section 3.2 and Section 3.3 elaborate on the four methods in detail. While the use of the mixed methods approach can be challenging because of the multiple data collection phases and different data procedures employed, it helps to test the consistency of findings and build on the results of one method with another (Rogers et al., 2003; Wheeldon, 2010). Semi-structured interviews and qualitative content analysis were the preferred qualitative research methods, and quantitative empirical analysis and predictive modelling were the favoured quantitative research methods.

The decision to use semi-structured interviews and qualitative content analysis was primarily for descriptive purposes, while also making it possible to draw interpretation from analysis of the textual data corpus. Hence, the qualitative research methods examine the phenomenon of the introduction of climate mitigation actions into government policies, the role of external drivers (influencing factors), and changes to policy paradigms. In contrast, the use of quantitative empirical analysis and predictive modelling is mainly for gauging the relevance of green growth for low-income countries that are aiming to deliver both climate mitigation goals and LDC graduation. Thus, a research approach that uses both empirical evidence and theoretical models (quantitative) for this study builds on the principle of pragmatism by adopting multiple perspectives to address the research gaps mentioned above. Pragmatism is a common alternative to using either positivism or constructivism (Creswell and Plano Clark, 2007), and it pertains to the mixed-method research adopted in this thesis. The positivist epistemological paradigm is characterised by the use of quantitative methods and statistical analysis (e.g. quantitative empirical analysis and predictive modelling), whereas the constructivist epistemological paradigm corresponds to the use of qualitative methods such as interviews with research participants (e.g. semi-structured interviews) and theme identification as in qualitative content analysis. Thus, at an overarching thesis level, the epistemological paradigm is pragmatism, whereas, for the findings chapters, the epistemological paradigm is constructivism for chapter 4 and chapter 5, and positivism for chapter 6 and chapter 7.

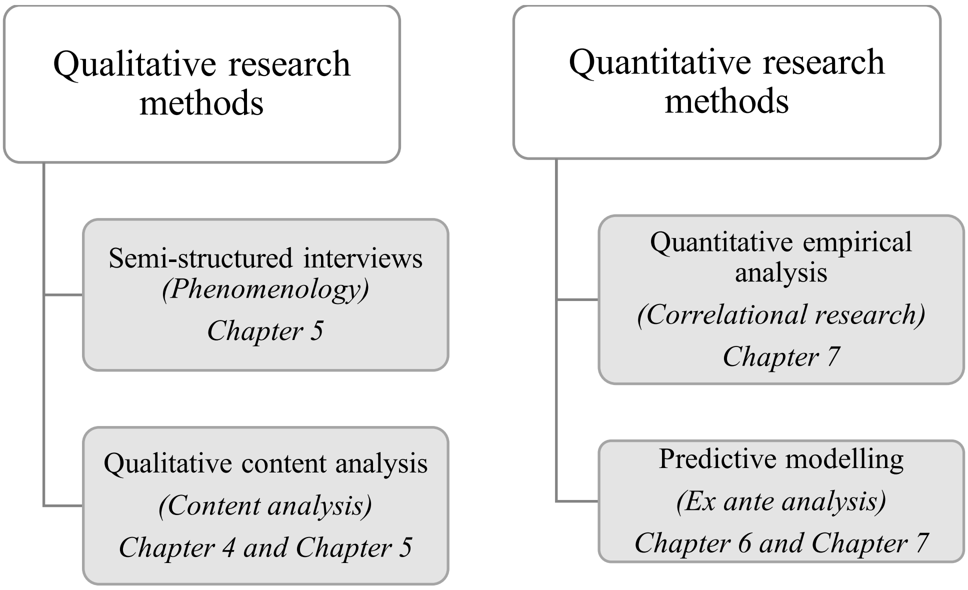

Figure 3.1. Qualitative and quantitative research methods

As an overarching strategy for conducting the research, I use multiple strands of related literature while limiting discussions to main themes for each chapter. The findings from the literature review provide a basis for creating theoretical foundations, analytical framework, and conceptual frameworks, for Chapters 4 and 5. These chapters present and discuss qualitative findings. Table 3.1 maps the methods used against each of the research findings chapters.

Table 3.1 Methods used in each of the research findings chapters.

	Semi-structured interviews	Qualitative content analysis	Quantitative empirical analysis	Predictive modelling
Changing policy paradigms: How are the climate change mitigation-oriented policies evolving in Nepal and Bangladesh? *(Chapter 4)*		✓		
Mainstreaming climate change mitigation actions in Nepal: influencing factors and processes *(Chapter 5)*	✓	✓		
Linking climate policy across economic sectors: green growth potential in Nepal *(Chapter 6)*				✓
Green growth in Nepal and Bangladesh: empirical analysis and future prospects *(Chapter 7)*			✓	✓

3.2. Qualitative research methods

The research questions investigate the perceptions and experiences of policy actors and their institutional and strategic interactions regarding the integration of the objectives of global environment-related initiatives and green growth into government policies in Nepal and Bangladesh. Qualitative research methods are best suited to collecting this information. Creswell (2003) describes qualitative research as a useful approach to use in a natural setting that allows the researcher to develop a level of detail from involvement in actual experiences. Qualitative research is both interpretative and naturalistic. Therefore, the observations and interpretations of people's perceptions help in exploring different perspectives through the use of a holistic approach (Guba and Lincoln, 1994; Holloway and Wheeler, 2002). For this study, I use two suitable forms of qualitative research—phenomenology and content analysis—as these methods are relevant to properly answering the research questions. The phenomenological approach uses semi-structured interviews with policy actors in Nepal, and the content analysis uses directed qualitative content analysis and deductive qualitative content analysis of government policies for both Nepal and Bangladesh.

The phenomenological approach intends to engage policy actors in the research to understand how the objectives of global environment-related initiatives and green growth, and the associated policy discourse, influence the knowledge and ideas of policy actors. The phenomenon is largely to do with the perceptions, awareness and experiences of the policy actors as they engage in policymaking processes in order to integrate the objectives of global environment-related initiatives and green growth into overarching national and sectoral climate policies. In the phenomenological approach, researchers try to get beneath the subjective experience of people to reveal the genuine nature of things (Schwandt, 2002, p. 192). Therefore, the phenomenological approach used in this research focuses mainly on the narratives of the research participants, which is also a reasonable means of capturing the meaningful contributions made by the research participants via recounting their experiences. Chapter 5 uses a phenomenological approach to emphasise the preferential values of the research participants regarding global environment-related initiatives and green growth.

The content analysis research approach uses verbal, visual and written data to describe a specific phenomenon and is concerned with the meanings, intentions, consequences and contexts that produced the data (Downe-Wamboldt, 1992). In the mixed-method research approach, content analysis can be used in conjunction with quantitative methods and is suitable for all types of written texts (Bengtsson et al., 2016), including government policies and semi-structured interviews. Therefore, I use content analysis for two chapters (Chapter 4 and Chapter 5) to present and discuss the findings by categorising the keywords, sentences and phrases relevant to the theme of the research. For Chapter 4, content analysis is the sole analytical research method used to examine and discuss empirical evidence generated from the policy documents in the form of textual data. The textual data provides useful insights across four key aspects of changing policy paradigms in Nepal and Bangladesh: (1) the integration of climate mitigation oriented-actions into the policies as policy goals; (2) the contents of the policies (e.g. policy instruments and financial mechanism); (3) institutional and strategic interactions between policy actors and their institutions; and (4) the consideration of issues raised by global environment-related initiatives. Chapter 5 uses content analysis in conjunction with the phenomenological approach (semi-structured interviews) to develop and apply the conceptual framework on climate mitigation mainstreaming. The conceptual framework is applied to understand the process by which climate mitigation mainstreaming occurs and the level of mainstreaming of climate mitigation actions into government policies in Nepal. As part of using content analysis for Chapter 4 and Chapter 5, the focus is on the inferential values of the findings arising from the review of the environment- and climate-specific and sectoral policy documents from Nepal and Bangladesh.

3.2.1. Semi-structured interviews

As part of using a phenomenological approach, semi-structured interviews were the preferred tool for engaging with policy actors for collecting and recording their policymaking-related experiences. Semi-structured interviews can be useful where there are open research questions and a pre-existing theory to guide the research (Wethington and McDarby, 2015). The climate mitigation mainstreaming conceptual framework that I developed based on the existing literature (Chapter 5) needed to be tested via open-ended questions and follow-up discussion with policy actors in Nepal. Therefore, semi-structured interviewing is suitable for this research. Policy actors (research participants) provided realistic and useful insights regarding the influence of policy discourse related to global environment-related initiatives and green growth on policymaking processes in Nepal. The subsequent climate mitigation mainstreaming process is also of importance for this research. Therefore, 12 semi-structured interviews with policy actors (n=12) from government organisations (central and local) and non-government organisations (international organisations and private sector industry associations) provided a basis for understanding the perceptions of the research participants regarding the climate mitigation mainstreaming processes that unfold in the public policy realm in Nepal.

Table 3.2 explains the role of policy actors in the policymaking process in Nepal. The policy actors selected as research participants were diverse in terms of their knowledge and awareness regarding the objectives of global environment-related initiatives and green growth, and their experiences in the policymaking process. The predetermined order of questions used in structured interviews rarely contributes to the gathering of different ideas and opinions from a diverse group of research participants. On the other hand, semi-structured interviewing is flexible because it can include situation-specific open-ended questions that are able to generate additional insights into the topic at hand. The perceptions reported by the research participants about the phenomena under study are the foundation of knowledge (Donalek, 2004). For this research, the findings from the semi-structured interviews and the inferential discussion allowed for the creation of the emerging knowledge, particularly relating to the influence of global environment-related initiatives and green growth on government policies and the climate mitigation mainstreaming process in Nepal.

The selection of the research participants via an appropriate sampling technique is key to collecting meaningful information. For this research, I used purposive sampling. Research that is not concerned with the statistical generalisability often uses non-probabilistic sampling such as purposive sampling to select participants according to predetermined criteria relevant to a specific research objective (Patton, 2002). The two main inclusion criteria for the research participants were i) that they had experience in policymaking, and ii) were affiliates of an active government or non-government organisation in Nepal. This research refers to the theory of collaborative governance to understand the interactions between different actors within the realm of public policymaking while they seek to incorporate the objectives of global environment-related initiatives and green growth into government policies. Emerson et al. (2011) define collaborative governance as engaging people constructively across public agencies and private and civil spheres for public policy decision-making. Therefore, the research participants represented the government, the private sector and international development organisations active in Nepal.

Regarding the number of research participants for interviews, Guest et al. (2006) argues that data saturation often occurs after around 12 interviews. For phenomenological studies, Guest et al. (2006) found the following: "Morse (1994, p. 225) recommends at least six participants; Creswell (1998) recommends between five and twenty-five interviews; whereas Kuzel (1992, p. 41) emphasises heterogeneous sample and research objectives to recommend six to eight interviews." For in-depth interviews in a naturalistic setting, having a small sample size (less than 20) can be a practical way to engage with the research participants while exchanging information openly (Crouch and Mckenzie, 2006). I chose 12 participants for the semi-structured interviews as this number is assumed to be reasonable for generating meaningful insights from in-depth discussion with the research participants. As argued by Guest et al. (2006), this number fits the data saturation criteria and is sufficient for heterogeneous sampling, as Creswell (1998) suggested.

Table 3.2. Type and number of research participants (Policy actors)

Research participants' organisations	**Role in policymaking**
Central government organisations (n=4)	Formal institutions responsible for leading the policymaking processes and are in the frontline of the global environment-related initiatives-policy interface.
Local government organisations (n=3)	Represent the local government in policymaking process as part of practising multi-level governance.
Industry associations (n=3)	Represent the associations of the different private sector bodies such as service-oriented businesses and manufacturing.
International development organisations (n=2)	Provide funding for government and local non-government organisations led programs and projects via official development aid.

While the semi-structured interviews intend to provide an understanding of the influence of global environment-related initiatives and green growth on the *knowledge* and *ideas* of the policy actors, the interview questions did not explicitly ask about the changes in the *knowledge* and *ideas* of the policy actors. The interview questions focused more on the global environment-related initiatives and green growth-related policy discourse and the subsequent steps that allowed for the integration of climate mitigation issues into government policies, which is explained by using the concept of mainstreaming. The influence of global environment-related initiatives and green growth on the *knowledge* and *ideas* of the policy actors was an assumption for this research. Therefore, the interview questions and the open-ended queries focus on allowing the research participants to structure the discussion and present their insights on changes in their *knowledge* and *ideas* as they practised collaborative governance. A set of 12 semi-structured interview questions is presented in the supplementary materials to Chapter 5. In general, the questions sought to collect the following information:

- Policy actors' understandings about climate mitigation-oriented actions in government policies.
- The influence of global environment-related initiatives and green growth-related policy discourse on policymaking processes, and how critical these are for national and sectoral policies.
- Policymaking approaches and analyses used to introduce the objectives of global environment-related initiatives and green growth (climate mitigation actions) into government policies.
- Different steps of policymaking processes that lead to a framing of climate mitigation actions into government policies.
- Impacts of policy discourse related to global environment-related initiatives and green growth on policy paradigms.
- Impacts of the changes in policy paradigms on cross-sector collaboration and multi-level governance.

The semi-structured interviews were conducted in Nepal during October and November 2019. Therefore the COVID-19 did not impact the data collection process. After completing the data collection process, and as part of the condition of the approved research ethics application (ETH18-3168), the local researcher (and the Chapter 5 co-author based in Nepal) was responsible for the triangulation of data and analysis with all respondents.

3.2.2. Qualitative content analysis

As an unobtrusive method, qualitative content analysis is the preferred analytical technique used to examine the corpus of textual data generated from government policies in Nepal and Bangladesh. Qualitative content analysis allows for the subjective interpretation of textual data by using a systematic classification process of coding and identifying themes and patterns (Shannon, 2005). The empirical analysis of the environment and climate-specific policies and sectoral policies of Nepal and Bangladesh explored the ways in which policies incorporate climate mitigation actions. A condensed description of the process that explores the contextualisation of climate mitigation actions in policy discourse by examining the textual data makes it practical and less labour intensive to review the policies in ways that intend to generate new insights and knowledge. The analysis of both the manifest and latent content[24] of chosen policies, coupled with new insights and knowledge pertinent to the phenomenon under study, provide a basis for drawing inferences regarding the framing of climate mitigation actions in government policies.

Qualitative content analysis has received criticism in the past for being a simple technique that does not depend on statistical tests (Elo and Kyngas, 2008). However, a content-sensitive analytical approach to systematically assessing the manifest and latent content, contextual information and core ideas and themes enhances validity and rigour (Selvi, 2020, p. 81). Further, computer-supported research makes it easier to use qualitative content analysis despite the huge number of policies and myriad textual data under investigation. For this study, I used NVivo computer software, mainly because of its code application, its code searching and retrieval, its matrices for exploring the relationships between codes and data and sources, and its interactive data display. These abilities of NVivo software were key considerations for choosing it (Guest et al., 2014, p. 12). This software simplified the coding, analysis, and interpretation of a textual data corpus generated from 35 government policies of Nepal (n=17) and Bangladesh (n=18).

[24] Manifest content refers to the readable texts in the policy documents, whereas latent content refers to the interpretation of readable texts.

I started the qualitative content analysis by selecting the relevant policies of Nepal and Bangladesh. The environment and climate change policies together with the nationally determined contributions (NDCs) of Nepal and Bangladesh are climate mitigation-oriented policies. I provide detailed information about climate mitigation-oriented policies in Chapter 4. In addition to these overarching policies, this research identified sectoral policies of the energy, agriculture, forest, industry and transport sectors for analysis. These sectoral policies contextualise the reduction of GHG emissions and sustainable use of resources as part of linking environment and climate change-specific policies and NDCs across economic sectors. Therefore, the qualitative content analysis included environment and climate change-specific policies, NDCs and sectoral policies. I used NVivo software to analyse the textual data corpus from the chosen policy documents to examine the following:

- the framing of climate mitigation actions in the chosen government policies
- changes in the government institutions that formulate policies and deliver climate mitigation actions
- policy instruments and financial resources to support the delivery of the chosen government policies
- cross-sector and multi-level governance for policymaking
- the level of framing of climate mitigation actions across chosen policies, which is explained by using the concept of mainstreaming

For this study, the phenomenological approach to the analysis of the corpus of textual data involved directed content analysis and deductive content analysis. Both of these types of content analysis are preferred if there exists a theory, prior research, mind maps, or literature review that could generate a further description of a phenomenon and the objects under study (Shannon, 2005; Elo and Kyngas, 2008). Directed content analysis uses a deductive approach to analysing text data, particularly for validating or extending the theoretical and conceptual framework (Humble, 2009; Shannon, 2005). I use a literature review of global environment-related initiatives, green growth and policy paradigms, and the theories of policy integration and mainstreaming to develop a theoretical basis and conceptual framework to examine the textual data corpus extracted from the policies. For an epistemological study that uses previous literature, Graneheim et al. (2017) recommend analysing the manifest content. The manifest content analysis is needed to obtain a concrete phenomenological description. In addition to manifest content analysis, the analysis of the latent content provides a basis for interpretation of manifest content and the implicit meaning of the texts (Graneheim et al., 2017). Therefore, building on the theoretical basis and conceptual frameworks, and using these for creating initial coding categories, the manifest and latent content of chosen policies begins to expand the coding categories as new insights emerge. A review of the manifest and latent content enables the identification of units of analysis, such as a piece of text or a group of sentences that makes sense and is meaningful enough to generate hidden insights. The expanded coding categories and the predetermined sub-category codes were organised in a way that was designed to achieve the research goals.

3.3. Quantitative research methods

As part of framing climate mitigation actions into government policies, the NDCs, climate policies, and sectoral policies include specific actions pertinent to the reduction of non-renewable resource use and GHG emissions, either as a subjective policy statement or as a numerical target. Quantitative research methods were used for empirical analysis and for forecasting the numerical values of resource use and GHG emissions for various policy and economic growth scenarios. This research used an ex-ante analysis of NDCs of Nepal, a non-experimental empirical analysis, and an analysis of the prospects for greening growth in Nepal and Bangladesh. Therefore, quantitative empirical analysis and predictive modelling seek to provide insights into how policy and technology-oriented actions pertaining to global environment-related initiatives and green growth can contribute to reductions in non-renewable resource use and GHG emissions. While the qualitative empirical analysis uses historical data on resource use and GHG emissions for Nepal and Bangladesh, predictive modelling based on statistical techniques was used to create energy and material consumption models.

3.3.1. Quantitative empirical analysis

This study uses a correlational analysis of six green growth indicators to examine the empirical evidence regarding green growth in Nepal and Bangladesh. The six chosen green growth indicators are (i) energy productivity; (ii) carbon productivity; (iii) material productivity; (iv) percentage GDP from services; (v) share of renewable energy in the energy mix; and (vi) proportion of land area covered by forest. The selection of these most commonly used green growth indicators (OECD, 2017b) is discussed in detail in Chapter 7. The multivariate correlational analysis of these six indicators explains the relationships amongst the indicators between 1985 and 2016 and the factors potentially causing changes in their values. Quantifying degrees of correlation is a statistical analysis technique used to establish patterns in the relationships between two variables (Creswell, 2002). Therefore, the correlational research used as part of the quantitative empirical analysis is descriptive in the sense that it describes a particular phenomenon based on the empirical evidence related to the six green growth indicators. While green growth-related policy discourse has a short history of about a decade, the empirical analysis of green growth in Nepal and Bangladesh intends to explain how these countries fared in the past in terms of green growth, and whether this model of growth necessitates a paradigm shift.

The standard argument for green growth is that economic growth can occur even while environmental impacts are significantly reduced (Jacobs, 2012). The concept of green growth has revived the global debate on developing an economic growth model that could promote sustainable development. Green growth strategies aim to ensure a mutual synergy of economic growth and environmental protection (Kasztelan, 2017). Therefore, green growth can be an attractive economic growth model for low-income countries that are aiming for LDC graduation while looking to address the objectives of global environment-related initiatives. In this study, correlational research uses historical data pertinent to six green growth indicators. The correlational research is largely to do with the exploratory analysis of the rational utilisation of energy and material resources while ensuring progress against the objectives of global environment-related initiatives. For example, the levels of the following indicators are expected to increase: the share of renewable energy in the energy mix; material, energy and carbon productivity; and the land area covered by forest. The aim is to increase the levels of these indicators while the economy transitions from GHG emissions-intensive agriculture to a service-based economy that is less resource and less GHG emissions-intensive. The empirical analysis of historical data supports an ex-ante analysis method such as predictive modelling that makes predictions about the prospects and value propositions of policy actions oriented towards the greening of growth in Nepal and Bangladesh.

The correlational analysis uses data to objectively measure the degree of dependency of one indicator on another. Correlational analysis therefore examines the relationships between the indicators that are independent and separate variables. A numeral called 'Pearson's correlation coefficient'—which is denoted by 'r'—reports the degree of dependence, i.e. correlation (Cooper and Schindler, 2001). The strength of 'r' varies between -1 and +1. Positive values imply a positive correlation between the indicators, and the negative value implies a negative correlation between the indicators.

3.3.2. Predictive modelling

In addition to the quantitative empirical research, predictive modelling was used for the ex-ante analysis of NDCs for Nepal, and for understanding the prospects for green growth in Nepal and Bangladesh. For this research, the predictive modelling technique was based on the statistical treatment of numerical data to create mathematical models that predicted the values of energy and material consumption and GHG emissions in the future for two primary purposes:

- To study the potential role of the green growth approach in delivering the climate mitigation actions identified in the NDC of Nepal.
- To analyse the greening of economic growth in Nepal and Bangladesh up to 2030, and to discuss their efforts to deliver on both climate mitigation actions and LDC graduation.

A fundamental assumption of predictive modelling is that the historical relationship between the variables under study is likely to persist. However, this assumption may not be valid (Brooks and Thompson, 2010, p. 64). Therefore, predictive modelling is supported by creating various scenarios that provide a range of estimates instead of single values for each energy and material consumption and GHG emission statistic, given any notable changes in the value of variables. Instead of a single value for each energy and material consumption and GHG emissions statistic, a range of estimates contributes to the validity of the models. For studying the potential role of the green growth approach in delivering climate mitigation actions identified in the NDC of Nepal, I used the Long-Range Alternative Energy Planning (LEAP) software.[25] The use of a multivariate regression analysis via the Python programming tool was applied to the greening of economic growth in Nepal and Bangladesh up to 2030 for four different economic growth scenarios.

The Stockholm Environment Institute developed the LEAP software for energy policy analysis, and for assessing GHG emissions reduction policies and low emissions development strategies in developing countries (SEI, 2020). The primary reason for selecting the LEAP software for this research was that at least 32 countries have used LEAP to create energy and emissions scenarios to support their NDCs under the Paris Climate Agreement (Heaps, 2016). Further, LEAP supports different modelling techniques ranging from demand-side bottom-up modelling to top-down macroeconomic modelling (Connolly et al., 2010). While these features make LEAP software widely used all around the world for comprehensive energy planning, specific assumptions related to how the data and variables under study will change in the future may cast doubt on the validity of the models and the forecast results. To manage this limitation, I create scenarios that take into account the potential change in the values of variables in the future. For example, the scenarios that I use consider changes in the population growth rate, GDP growth rate, and share of population with access to energy and electricity. Further, I also compare the outputs of the models with results from previous studies that are published in academic journals.

A multivariate regression analysis via the machine learning technique in the Python programming software enabled the creation of energy and material consumption models for Nepal and Bangladesh.

[25] LEAP is developed by the Stockholm Environment Institute and this software has been used by many countries to evaluate NDC scenarios for reporting to the UNFCCC.

The numerical data about energy and material consumption, and gross domestic product (GDP) and population projections were statistically tested using log-linear regression and ridge regression to create predictive models. In addition to predicting the values of energy and material consumption for different economic growth scenarios, the predictive models explained the relationship between the predictor variables (GDP and population) and response variables (total energy and material consumption). Subsequently, the use of statistical techniques, such as training and testing of the data, was carried out to evaluate the models and ensure their accuracy was within acceptable limits. The model is denoted as acceptable in this circumstance if the value of R^2 (goodness-of-fit measure for linear regression models) is kept greater than 0.6.

3.4. Limitation of this thesis' methodological approach

This thesis uses mixed-method research, which is challenging in managing time, data, and analysis as multiple qualitative and quantitative methods are used together at an overarching thesis level. Wheeldon (2010) identifies the use of mixed-methods as time-consuming for its multiple data collection process and the discrete analysis procedure employed for each method. I found it challenging to identify the number and choice of appropriate methods in the mixed-method research. Therefore, I base the selection of numbers and appropriate methods on the need to answer research questions, the quality of data they are likely to generate, the complexity of the data analysis process, and the anticipated number of findings chapters. For findings chapters, the selection of methods was largely dependent on (i) the research objectives of each findings chapter, (ii) the ontological and epistemological paradigms, and (iii) diversity across the methods (e.g. different qualitative and quantitative methods).

Another limitation of the mixed-method research at an overarching thesis level I identified was the extra work needed to connect qualitative and quantitative research findings. While the ontological paradigms did not pose many challenges during the collective discussion of findings chapters, their epistemological paradigms made it difficult to discuss the findings collectively as they generated ideas and discourse-based qualitative insights and numerical modelling-based quantitative insights. To counter issues with the collective discussion of qualitative and quantitative findings, I identified a common thread connecting results from each findings chapter and discussed them together. For example, the climate mitigation issues as policy goals and the corresponding on-ground actions of the past, present, and future. Further, the thesis by publication means that the findings are presented as published chapters that limit a smooth transition between findings chapters. This situation is further complicated by the use of different methods in each chapter. Therefore, I inserted transition paragraphs between the findings chapters to allow for a smooth transition for readers.

I did not encounter any issues with the data collection, as I got the quantitative data from credible data sources (e.g. World Bank's development indicator database, Asian Development Bank database, and government reports). I got the qualitative data from Nepal's and Bangladesh's governments' policies and semi-structured interviews in Nepal. However, the ridge regression introduced by Hoerl and Kennard (1970), which is used for the development of energy and material consumption models, presented a challenge. For example, it works by shrinking explanatory variables' coefficients' estimates in order to reduce the impact of the least significant variables. In doing so, it may cause absolute shrinkage to some explanatory variables' coefficients that are relatively less significant in predicting the response variables' data. The remaining non-zeroed coefficient estimates are only the significant ones with a strong bearing on response variable values. Therefore, the machine learning algorithm in Python software was used to create and use models with no non-zeroed coefficient estimate. Similarly, different variables with different units and scales mean the possibility of a heteroscedastic effect. This research considered the minimisation of the impact of heteroscedasticity on the models, and therefore, I use a logarithmic scale for each variable.

Finally, I faced difficulties getting the human research ethics approval from the university (UTS) mainly because of the choice of case countries and the organisational respondents to semi-structured interviews. I resolved the research ethics application-related difficulties by frequently discussing with the research ethics officer to resolve areas of concern to succeed in the course of five months.

Chapter 4: Changing policy paradigms: How are the climate change mitigation-oriented policies evolving in Nepal and Bangladesh?

Paper preface

This chapter includes a co-authored peer-reviewed paper. The full bibliographic details of the paper, including all authors are:

> Baniya, B., Giurco, D., & Kelly, S. (2021). Changing policy paradigms: How are the climate change mitigation-oriented policies evolving in Nepal and Bangladesh? *Environmental Science and Policy*, 124, https://doi.org/10.1016/j.envsci.2021.06.025.

Bishal Baniya led the research project, collected and analysed the data, and wrote the full paper. Damien Giurco (Principal supervisor) and Scott Kelly (Co-supervisor) provided supervisory guidance and reviewed the paper.

Research highlights

- Climate mitigation-oriented actions are getting attention in the national policy discourse in both Nepal and Bangladesh.
- Qualitative content analysis of Nepal and Bangladesh's previous and existing government policies shows changes in policy paradigms from adaptation-based to mitigation-based.
- Delivery of climate mitigation-oriented actions remains weak despite a paradigmatic change in government policies.

Abstract

The inclusion of climate mitigation actions in the Nationally Determined Contributions and climate policies of low-income countries such as Nepal and Bangladesh mean that policymakers are seeking to address both types of responses to climate change. This study assesses changes in policy paradigms pertinent to climate mitigation, in Nepal and Bangladesh for the period from 1992 to 2018. Policy paradigm refers to the framework of policymakers' ideas and strategies that influence the formulation of policies across different aspects. This research develops and uses an analytical framework which considers the following aspects of public policy: (i) problems and focus; (ii) content (policy instruments and financial resources); (iii) institutions and strategic interactions; and (iv) global environment-related initiatives. Relevant policies (18 for Bangladesh and 17 for Nepal) were analysed and thematically coded using NVivo software. While most aspects showed notable change over time, the institutions and strategic interactions aspect showed incremental change. Although primarily focussed on adaptation, policy paradigm that seems to have emerged post-2005 for Nepal and Bangladesh focuses on low carbon development, access to energy, sustainable transport, and sustainable agricultural practices. To operationalize the new policy paradigms in both countries, economic and market-based policy instruments that utilize the government's internal funding will need to support policies to minimise the impacts of changes in official development assistance.

Keywords: Policy paradigms; climate change mitigation; policy analysis; climate finance; official development assistance

4.1. Introduction

In the mid-1990s, the focus of climate-related policies in Nepal and Bangladesh was largely on disaster response and relief. The policies have now evolved to focus mainly on climate change adaptation mainstreaming in Bangladesh, and localised action for climate change adaptation in Nepal (Vij et al., 2018). Mitigation, however, has received less attention. The lack of a focus on mitigation in both countries can be attributed to a tendency to focus on adaptation on the part of most developing countries, especially least developed countries (LDCs). Nepal and Bangladesh, both LDCs, are listed as countries highly vulnerable to climate change, and most climate-related stressors, such as extreme weather events and natural disasters, will have an impact on the livelihoods and wellbeing of the people (Werner and van der Geest, 2013). However, recent policies, including non-environment sector policies[26], dedicated climate policies, and Nationally Determined Contributions (NDCs) under the Paris Agreement—collectively referred to as climate change mitigation-oriented policies throughout this paper—have started to emphasise mitigation.

The focus on climate mitigation appears to be timely as both Nepal and Bangladesh are aiming to become middle-income countries by 2025 (Bhattacharya and Khan, 2018; Rai, 2017; UNDESA, 2019). Nepal and Bangladesh were deemed eligible for LDC graduation in 2018 based on the progress made against each of three LDC graduation criteria: Gross National Income (GNI) per capita, Human Asset Index (HAI) and Economic Vulnerability Index (EVI) (CDP, 2018). However, the UN Committee for Development Policy and the Nepal and Bangladesh governments are expected to review the progress and LDC graduation in the next triennial review in 2021 (UNDESA, 2019). Whilst aiming to achieve LDC graduation via increasing economic growth, the income elasticity of resource use[27] could undermine the effectiveness of climate change mitigation-oriented policies.

[26] Non-environment sector policies refer to policies across different policy areas such as energy, forest, agriculture, transport, and industry.
[27] In this paper, the term 'resource use' refers to the use of different energy sources, including forest and agricultural biomass resources.

Most of the research on climate change policy discourse in LDCs (Ayers et al., 2014; Vij et al., 2018) has been limited to adaptation, meaning policymakers know little about effective framing and operationalisation of climate mitigation actions across relevant policies. The Global South has historically considered mitigation as an issue of developed countries and often prioritised climate adaptation (Shrestha and Dhakal, 2019). Therefore, it may be reasonable to assume that policymakers in LDCs have relatively less policy formulation experience regarding climate mitigation-oriented policies than the policymakers in the developed countries. Hussein et al. (2013) identified a lack of systematic evidence on the impact of climate mitigation on the welfare in developing countries. Barbier (2014) pointed out a lack of systematic analysis on the impacts of climate mitigation policies in low- and middle-income countries and suggested that a more comprehensive approach be employed, particularly for analysing changes in trade and economic growth and poverty. A lack of systematic evidence and comprehensive approach for understanding the impact of climate mitigation policies suggests that climate mitigation-oriented policies are at an early stage of policy formulation and implementation. Hence, we know little about how and to what extent framing and operationalisation of climate mitigation-oriented actions have progressed across policies in LDCs, including Nepal and Bangladesh. This research gap, coupled with the intention of Nepal and Bangladesh to deliver their NDCs and other climate policies, together with LDC graduation, motivates this paper to investigate changes in policy paradigms pertinent to climate change mitigation-oriented policies in these countries. A policy paradigm is a framework of ideas and strategies that influences policy formulation by specifying policy goals, instruments for achieving the goals, and the problems that policies are meant to address (Hall, 1993; Menahem, 1998).

This study focuses on the period 1992 (date of the Rio Earth Summit) to 2018. The rest of the paper is structured as follows: Section 2 presents the concept of policy paradigms and an analytical framework. Section 3 explains the methodological approach, Section 4 shows the results, Section 5 presents a discussion of the results, and Section 6 concludes the study.

4.2. Policy paradigm: concept and analytical framework

A seminal work of Hall (1993) on policy paradigm introduces the concept as an ideational framework that policymakers use to exchange their ideas to specify the focus of policies during policy formulation. A policy paradigm can also be referred to as a system of ideas that specifies policy goals, instruments used to achieve those goals, and the problems that the goals are meant to address (Menahem, 1998). Additionally, the policy paradigm is understood as any statutory and regulatory framework or model that governs the generation and delivery of policies (O'Sullivan, 1993). While the term 'paradigm' was initially used in Thomas Kuhn's seminal work on scientific revolution to emphasise the sociological importance of scientific theories (Polsby, 1998; Wade, 1977), the concept of policy paradigm is widely used to highlight the way policymakers' ideas are translated into policies (Skogstad, 2011). The concept has become central to policy studies that emphasise the role of ideas in policy change processes (Zittoun, 2015). It has been lauded for signifying the ideational element of policy in mainstream policy studies (Carstensen, 2015, p. 297). The linkage between the ideational element of policy and the institutions policymakers represent makes the policy paradigm more important as the linkage is crucial to understanding policy change (Béland, 2016). Policymakers' ideas are embedded within the institution they represent (Kern et al., 2014). The policymakers' institutions are driven by a mandate that influences policymakers' ideas and how they shape and change policies (Kuzemko 2013, p. 48). This paper builds on the existing literature on the ideational framework and the institutionalist perspective on policy change to conceptualise policy paradigm as a model of policy formulation that can be influenced by the policymakers' ideas and their institutions. We look at how policymakers' ideas and their institutions are changing policy formulation models across the focus of the policies, contents of the policies, strategic interactions between the responsible institutions, and inclusion of global environment-related initiatives' mandates in Nepal and Bangladesh. In this study, global environment-related initiatives pertain to the international climate agreements and other multilateral agreements such as the sustainable development goals.

A policy paradigm is a foundation upon which policy ideas are framed, articulated, and implemented (Carson et al., 2009). Additionally, problems policies are meant to address, decisions on appropriate policy goals, and policy instruments that could help achieve policy goals are also given importance (Hall, 1993). While the earliest application of the paradigm concept in the public policy domain dates to the late 1980s, recent theories on policy paradigms focus mainly on aspects such as the cognitive perspectives of individuals, institutional structures, and strategic interactions between responsible institutions (Carson et al., 2009). The strategic interaction between responsible institutions refers to the way in which policymakers strategise the delivery of their mandates while ideas are shared between the institutions to reflect those into the policies. The change in the context of policy paradigms has been understood as the change in the structure and content of the policy—for example, values, strategies, and instruments (Capano, 2009). Therefore, aspects such as problems, policy goals, policy instruments, and institutional and strategic interactions are emphasised in this study. Policy instruments are a crucial element of environmental policies and related decision-making (Goulder and Parry, 2008).

Climate change mitigation policies have not by themselves driven increases in energy efficiency and the use of renewable energy, especially in the absence of long-term economic support mechanisms (Halsnæs et al., 2014). One economic support mechanism in low-income countries is official development assistance (ODA), which supports the financial mechanisms by supplementing government's internal funding. A financial mechanism is understood as a way by which governments manage funding for delivering policies and is key because of the importance of ODA and internal funding for effective climate governance in developing countries (Persson, 2008). For climate change and cognate policies in Nepal and Bangladesh, the entities that provide ODA, also called donor agencies, are involved via bilateral or multilateral co-operation (Rahman and Giessen, 2017). Therefore, in addition to formal institutions (i.e. government agencies), donor agencies influence the focus and contents of the policies by forming advocacy coalitions with local non-government organisations, which is essentially considered in any analysis of policy formation (Sabatier, 1998). Global environment-related initiatives such as various Climate Agreements can also be viewed as a causal factor, as the policies embrace new paradigms that frame climate change broadly as social, political, and cultural challenges (Hermwille, 2016). Global environment-related initiatives influence local non-government entities such as civil society organisations via conferences of the United Nations Framework Convention on Climate Change (UNFCCC), which have played a major role in changing climate policy paradigms in Nepal and Bangladesh (Vij et al., 2018). 'Changing policy paradigms' are conceptualised as the changes in the latest climate mitigation-oriented policies relative to the earlier version of the same across four aspects: (i) problems and focus of the policies; (ii) contents of the policies, (iii) institutions and strategic interactions; and (iv) global environment-related initiatives.

The above-mentioned four aspects are similar to Vij et al.'s (2018) framework for assessing climate policy paradigms that used framing of policy issues, policy goals, meso-level areas[28] (sectors), and financial policy instruments. The four key aspects of the analytical framework used by this research emphasise the ever-increasing role of institutions and their strategic interactions and global environment-related initiatives by analysing meso-level area focused policies (non-environment sector policies), in addition to climate policy and NDCs. While the institutions and strategic interactions and global environment-related initiatives are distinct elements to Vij et al.'s (2018) framework, a case for climate mitigation in the context of changing policy paradigms will be discussed. Ideas and institutions need to be considered collectively as the influential policymakers and their institutions can cause institutional change across others, thus changing the policy paradigm (Carstensen and Schmidt, 2016). The interaction between the ideas and institutions is also sufficiently profound to discuss both together (Schmidt, 2008). The global environment-related initiatives and their international bureaucracies have both cognitive and executive influence on policy formulation (Biermann et al., 2009). While cognitive influence refers to the influence on policymakers' ideas, executive influence refers to the changes across responsible institutions. A similar conceptualisation of policy paradigms coupled with an emphasis on climate mitigation will contribute to advancing of Vij et al.'s (2018) framework that has primarily focused on climate adaptation. Figure 4.1 shows the four key aspects of changes in policy paradigm and are briefly introduced in Table 4.1.

[28] Meso-level policy areas refer to different policy sectors such as energy, agriculture, forest, and industry.

Table 4.1. Key aspects of changes in policy paradigm

Problems and key focus of the policies	Policies are formulated to address problems, and the focus of a policy provides an indication of the problems it is intended to address.
Contents of the policy	A policy comprises policy instruments and financial mechanisms that are supposed to effectively deal with the issues which the policies is designed to address.
Institutions and strategic interactions	Strategic interactions between institutions are driven strongly by the framing of policy ideas of formal institutions and advocacy coalitions.
Global environment-related initiatives	Global environment-related initiatives are climate agreements and other global environmental policy frameworks such as sustainable development goals and environmental declarations and protocols.

While the ideational constructs of policymakers drive changes in policy paradigms (Daigneault, 2014), limited literature about when to consider a paradigm has changed makes it challenging to understand a change in policy paradigm. The multifaceted processes of policy change, change in the core topic of ideas, the extent of change in ideas and constructs, qualifiers for paradigmatic change, and the influence of non-ideational aspect (e.g. relevant institutions mandates and global environment-related initiatives) make it more complex to study the change in policy paradigm (Capano, 2009; Hogan and Howlette, 2015; Wilder, 2015). When the policy paradigm concept was evolving in its early days, Hall (1993) defined three different orders of change that policies may go through in terms of magnitude of change. The first-order changes involve incremental shifts in routinised decision making; second-order changes involve new policy instruments and more strategic actions; and third-order change is radical in all aspects. Further, Capano and Howlett (2009) note that policy change occurs by four mechanisms: cyclical, dialectic, linear and teleological. Cyclical changes return to the status quo. Dialectic changes focus on negation and synthesis and are primarily driven by ideational constructs. Linear changes are evolutionary without a clear end-point. Teleological change occurs in the direction of an identifiable goal and focuses on policy output. Vij et al. (2018) use layering, drift, and conversion as the modes of change. Layering is understood as a gradual change, such as new policy goals and instruments that co-exist with the previous paradigm (Mahoney and Thelen, 2010). Drift is achieved via change in the existing institutions to accommodate the shifts in the external environment, and the conversion refers to the redeployment of institutions for additional policy purposes (Hacker and Pierson, 2010; Hacker, 2004). Hall's (1993) order of changes and Capano and Howlette's (2009) change mechanisms are relevant for defining changes in policy paradigms. Therefore, policy paradigms are thought to be changed when at least one of four aspects goes through one of three different order of changes via any one of four mechanisms mentioned above (Figure 4.1).

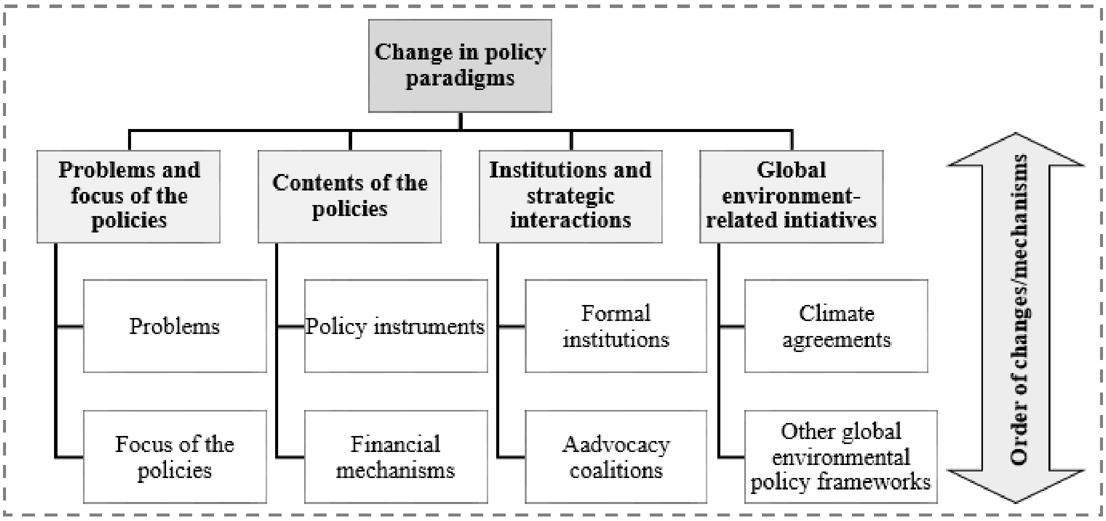

Figure 4.1. Key aspects of changes in policy paradigms

4.3. Methodology

The changing policy paradigms in Nepal and Bangladesh are focused on by using the analytical framework defined above (Figure 4.1). Nepal and Bangladesh are amongst the most climate change vulnerable countries in South Asia (map in supplementary materials, Figure A1) and are prone to climate-related natural disasters such as severe storms, floods, soil erosion, and droughts, thus impacting the livelihood and economy (Bandara and Cai, 2014; Saklini et al., 2020). The climate model projections for the South Asian region show intense and variable precipitation (Shrestha and Aryal, 2011). Therefore, whereas scientific research and climate change negotiations during the 1990s focused on mitigation, LDCs—including Nepal and Bangladesh—prioritised reducing their vulnerability to climate change and, later, adaptation (Huq et al., 2004). The mainstreaming of climate change adaptation in Nepal and Bangladesh progressed significantly largely due to the preparation of country-specific National Adaptation Plans of Action (NAPA) under the UNFCCC (Saito et al., 2013). More recently, both countries have pledged reductions in resource use and greenhouse gas (GHG) emissions despite being insignificant contributors to global GHG emissions (MoPE, 2015, GoB, 2016). Bangladesh was the first LDC to release its climate change policy in 2009, followed by Nepal in 2011, confirming the interest of these countries in addressing both mitigation and adaptation aspects of climate change (Fisher, 2013).

This research focuses on climate mitigation by drawing 'textual data' and by using qualitative content analysis (QCA) of non-environmental sector policies, climate policies and NDCs (Bangladesh (n = 18) and Nepal (n = 17)) to identify changes in policy paradigms as shown in Figure 4.2. The QCA is relatively new to environmental policy research as the method is burrowed from social and health science (Hall and Steiner, 2020). In addition to Vij et al. (2018), Forde et al. (2019) have used textual data from policy documents to investigate evolving policy paradigms about leadership and education. Goldthau (2012) and Kern et al. (2014) have also reviewed energy policy documents to explain changing energy policy paradigms in the UK and globally. Amidst the limited use of qualitative content analysis of policy texts in environmental policy research, Fitzgerald (2012) suggested consideration of the authentic, credible, representative, and meaningful policy documents. This research uses climate mitigation-oriented policies formulated by the governments of Nepal and Bangladesh, which satisfy the criteria set by Fitzgerald (2012).

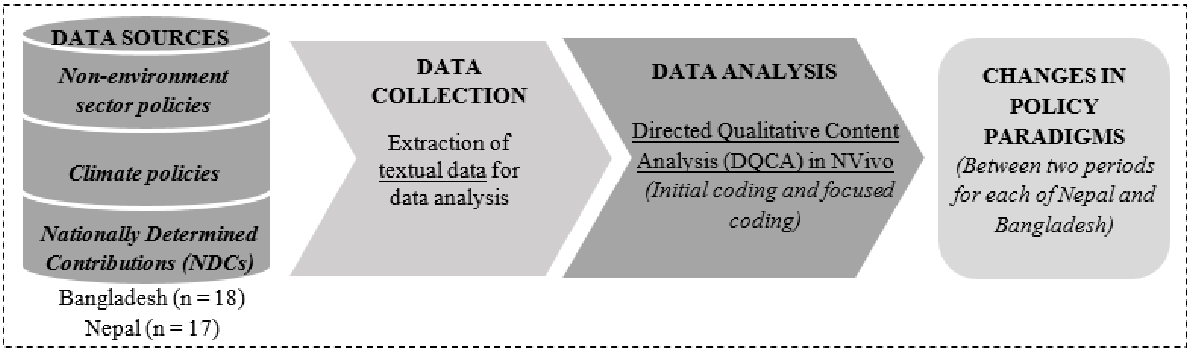

Figure 4.2. Methods used for data collection, extraction, and analysis for observing the changes in policy paradigms in Nepal and Bangladesh.

4.3.1. Data sources and extraction of textual data

Firstly, non-environment sector policies, overarching climate policies, and NDCs in Nepal and Bangladesh were identified using a desktop search. The primary criterion for inclusion was that the policies contained statements with the following keywords: 'resource management', 'resource efficiency', 'energy efficiency', 'renewable energy', 'GHG emission', and 'climate change mitigation'. Further, the policies needed to be in force between 1992 and 2018. Using the inclusion criteria, policies were chosen for a thorough review to identify changes in policy paradigms based on the abovementioned analytical framework. The policies chosen for review are listed in the supplementary materials to this chapter (Tables A1 and A2). The chosen policies were entered in qualitative content analysis software 'Nvivo' where text data pertinent to keywords were extracted and stored for analysis. The text data should have a potential for analytical contribution and should also allow for exploration of themes and patterns that is of interest from a research viewpoint (McLellan, 2003). Whilst the keywords mentioned above are present in the policies designed after 2005, previous versions of the same policies did not always cover these issues. Despite this, previous versions have been reviewed to determine whether climate mitigation issues were ignored because they were considered less important during the early 1990s. For both Nepal and Bangladesh, changes in policy paradigms were reviewed separately for two periods: from 1992 to 2004 and from 2005 to 2018, because both Nepal and Bangladesh showed a significant rise in resource use and GHG emissions after 2005.

4.3.2. Data analysis

The QCA is best suited for analysing textual data that utilises subjective interpretation of the contents through the systematic classification process of coding and identifying themes or patterns (Hsieh and Shannon, 2005). Therefore, we use directed qualitative content analysis, a type of QCA that uses text data and follows a structured process to extend an existing conceptual framework or a theory (Hickey and Kipping, 1996). Directed QCA begins by identifying key concepts as initial coding categories (Potter and Levine-Donnerstein, 1999). We use the four key aspects of the analytical framework as the initial coding categories which were expanded further using focused coding categories to emphasise the elements of each of the four aspects of the analytical framework (Figure 4.1). The focused coding categories segregated textual data pertinent to different elements of each of the four aspects of the analytical framework. A thorough review of the textual data under focused coding categories provided insights into how and to what extent the recent policies evolved across each of the four key aspects and its elements with respect to the earlier policies. Finally, the comparison between the textual data under focused coding categories for two different periods (1992–2004 and 2005–2018) allowed identification of the order of changes and the change mechanisms as defined by Hall (1993) and Capano and Howlette (2009), respectively.

4.4. Results

Table 4.2 shows the changes in policy paradigms, order of changes, and change mechanisms in Nepal and Bangladesh for the periods 1992–2004 and 2005–2018. Apart from the 'institutions and strategic interactions' aspect of the policies that has gone through a first-order change, other aspects have gone through second-order changes. The changes in the four aspects of the policies are explained in the following sections.

Table 4.2. Change in policy paradigms for two periods between 1992 and 2018 for Nepal and Bangladesh.

		Policy paradigm 1992-2004	Policy paradigm 2005-2018	Order of changes/mechanisms
Problems and key focus of the policies	Nepal	• Generic environmental policies with a focus on quality of environment. • Sectoral policies emphasise sustainable economic growth. • Resource management and conservation are covered under dedicated energy policy and agriculture policy.	• Dedicated climate policy with an emphasis on adaptation and resilience actions over mitigation. • Energy policy and low carbon economic development strategy focus on climate change mitigation, electrification, and energy efficiency across economic sectors. • Management of resources such as forest biomass and other energy resources are included as cross-cutting issues in the sectoral policies, mainly by industry policy.	Second-order teleological change
	Bangladesh	• Generic environmental policies focus on quality of environment through sustainable agriculture and forest land management. • Forest, agriculture and energy policies focus on sectoral productivity and resource management, for example managing access to forest biomass and other energy sources.	• Dedicated climate policy with two-fold strategy on both mitigation and adaptation. • Sectoral policies include climate change and renewable energy as secondary issues.	Second-order teleological change
Contents of the policy	Nepal	• Environmental standards as a favourable policy instrument, and capacity building of stakeholders as a means to deliver policy. • Official development assistance (ODA) comprise majority of funding required for the delivery of the policy.	• Economic- and market-based instruments such as tax rebate, subsidy, concessions, and incentives for private sectors. • Generation of internal funding via local financial institutions, and least developed countries development funds (LDCDF) to supplement ODA.	Second-order linear change
	Bangladesh	• Mainly environmental standards and few market-based instruments such as fair prices for sustainably produced agricultural products. • Major source of funding identified as ODA.	• Mainly economic- and market-based instruments such as tax rebate, subsidy, concessions, and incentives for private sectors. • International climate finance mechanisms such as green climate fund and funds from global environmental facility to supplement ODA and internal financial mechanisms.	Second-order linear change
Institutions and strategic interactions	Nepal	• Participatory approach for the delivery of policy and for sectoral development.	• Stakeholders' engagement and participation for coordination, training and capacity building, and for monitoring the progress of policy delivery.	First-order dialectic change
	Bangladesh	• Coordination and partnership for sectoral development and for policy delivery.	• Coordination and partnership research, design and delivery of the policies. • Engaging government institutions at a local level for ground-level coordination, and for capacity building, mostly technical.	First-order dialectic change.
Global environment-related initiatives	Nepal	• None of the global environment-related initiatives are mentioned in the sectoral policies	• UNFCCC's climate agreements and Millennium Development Goals (MDGs) seems to have an influence on the sectoral policies. However, it's only the NDC and climate change policy that provides a reference to these global environment-related initiatives.	Second-order linear change
	Bangladesh	• Agenda 21 of the Rio Earth Summit 1992 seems to have an influence on Forest policy.	• UNFCCC's climate agreements, MDGs and SDGs are strongly mentioned in NDC and in almost all of the key sectoral policies: energy, forest, and agriculture.	Second-order teleological change

4.4.1. Problems and key focuses of the policies

The first climate change policy of Bangladesh, the Bangladesh Climate Change Strategy and Action Plan, was developed in 2009. Nepal's Climate Change Policy was developed in 2011. Prior to these dedicated climate change policies, climate change and resource use issues were rarely mentioned in sectoral policies. After 2005, policies for sectors such as energy, forestry, agriculture, industry, and transport have included policy statements on climate change, reduction of GHG emissions and resource use that align well with statements in overarching climate policies. The main focus of the climate change policies of both countries is still on climate change adaptation, as adaptation is viewed as a bigger problem than mitigation. However, recent sectoral policies, along with the Reducing Emissions from Deforestation and Forest Degradation (REDD+) strategy (2015) of Nepal and the REDD+ readiness roadmap of Bangladesh (2012), focus specifically on reduction of GHG emissions and use of biomass resource. The agriculture and forest sectors contribute about 50% of the total GHG emissions in Nepal and 27% in Bangladesh. The REDD+ documents cite potential to absorb GHG emissions, a high deforestation rate (1.6% per annum for Nepal and 2600 hectare per annum for Bangladesh), and potential carbon credits transactions via international REDD funding as motivation to focus on climate mitigation. Therefore, this aspect of the policies has gone through second-order teleological change because of additional strategic actions and clearly-defined policy goals, such as reducing GHG emissions and resource use.

4.4.2. Contents of the policies

The policy instruments preferred in the earlier period were mostly environmental standards with few market-based instruments, particularly for Bangladesh. In the later period, both countries have favoured incentive-oriented economic and market-based instruments, while environmental standards are still prevalent. The financial mechanism, previously largely reliant on overseas development assistance (ODA), has evolved to include internal government funding as part of financing the delivery of the policies in the later period. The additional incentives-oriented policy instruments and the strategic move to allocating resources from internal funding mean that this aspect shows second-order linear change for both Nepal and Bangladesh.

4.4.3. Policy instruments

4.4.3.1. Environmental standards as regulatory instruments

Environmental standards appear to be an important policy instrument during both the periods under study. This policy instrument was in existence well before 1990 in both countries and is still preferred for controlling environmental pollution and promoting resource conservation. In fact, in addition to previous general environmental policies, such as the Bangladesh National Environmental Policy (1992) and the Nepal Environmental Policy and Action Plan (1993), regulatory frameworks—for example, the Environmental Protection Act (1995) in Bangladesh and the Environment Protection Act (1997) in Nepal—are still in force to protect the environment from activities in sectors such as forestry, agriculture, transport and industry. Nepal's Vehicle and Transport Management Act (1993) and National Transport Policy (2001) were two separate regulatory frameworks for controlling emissions of environmental pollutants from the transport sector. The National Sustainable Transport Strategy (2015) was formulated in the later period, aiming to address issues beyond environmental pollutants by promoting electric and hybrid vehicles, along with affordable standards for fuel quality to reduce GHG emissions and use of fossil fuels in the transport sector. For Bangladesh, the Strategic Transport Plan (2005) and its revised version (2015), along with vehicle emissions standards, aims to reduce GHG emissions and consumption of other fossil fuels by using compressed natural gas and improved fuel technology. Therefore, except for the transport sector, it appears that general environmental policies are still the major legal basis for enforcing environmental standards.

4.4.3.2. Information-based instruments

Policies during the early 1990s prioritised information-based instruments such as training, capacity building and awareness programs for relevant stakeholders. The National Agriculture Policy of Bangladesh (1999) has a section on creating awareness to reduce the use of chemical fertilizers and pesticides to prevent environmental pollution. The Agriculture Perspective Plan (1995-2015) of Nepal encourages improvement in agricultural productivity. The updated version of the agriculture policy of Nepal, the Agriculture Development Strategy (2015-2030) has emphasised training and awareness programs on the use of bio-fertilizers. Most recent policies like the Bangladesh National Agriculture Policy (2010), the Bangladesh National Forest Policy (2016), Bangladesh REDD+ readiness roadmap (2012), the Nepal Industrial Policy (2011), Nepal REDD+ strategy (2015), and the Nepal Forest Sector Strategy (2015-2030) have emphasised the role of broader community participation and the involvement of public sector employees via continuously delivering awareness programs on environmental protection, and climate change mitigation and adaptation. This is in line with Article 11.1 of the Paris Agreement which states the need to enhance the capacity and ability of the developing country party, particularly countries with least capacity, such as the least developed countries, for effective climate actions.

4.4.3.3. Economic and market-based instruments

Economic and market-based policy instruments were rarely used in policies during the 1990s. However, their use has increased in recent years, particularly after 2005. During the 1990s and until 2005, tax incentives and subsidies were provided to private sector organisations to improve sectoral productivity. However, recent policies have emphasised the need to provide tax rebates, duty concessions, and subsidies to encourage production processes and practices that comply with environmental protection acts and regulations. Bangladesh's Industrial Policy (2010) states that the bio/herbal pesticide industry will be provided with financial incentives. Similar statements are included in Nepal's Industrial Policy (2011) and the Nepal Agriculture Sector Development Strategy (2015-2030). The REDD+ strategy of Nepal (2015) used tax incentives to promote private forestry. The Energy Sector Strategy (2010) of Nepal and the Renewable Energy Development Policy (2008) of Bangladesh explicitly state that renewable energy producers will be exempted from value-added tax (VAT) and will also be considered for incentive tariffs. Nepal's Renewable Energy Subsidy Policy (2016) explicitly mentions involving local finance institutions in the distribution of subsidies for renewable energy technologies. The greater move towards these policy instruments in Bangladesh and Nepal reflects their incorporation in international biodiversity and climate change agreements, including payments for ecosystem services. The REDD+ strategy of Nepal (2015) and Bangladesh's REDD+ readiness roadmap encourage the selling of carbon credits arising from REDD+ activities.

4.4.4. Financial mechanisms – internal funding and official development assistance (ODA)

Most of the policies introduced during the early 1990s stated the need to receive financial assistance via foreign aid mechanisms to improve sectoral environmental performance. The National Forest Policy of Bangladesh (1994) proposed establishing a fund that sourced money through ODA to support the implementation of the policy. The updated version of the same policy, the Bangladesh National Forest Policy (2016), recommends bolstering the international funds available under international climate agreements and conventions by establishing an internal conservation fund, an investment fund, and other funds for environmental education and human resource development. Similarly, to deliver its Industrial Policy (2016), the Bangladesh government developed internal-funding-based financial packages and incentives for private sector businesses to invest in environmentally friendly projects. Nepal's Industrial Policy (2011) also mentions the need to provide financial assistance via internal sources for research and development of technologies that could improve the environmental performance of the industrial sector. In contrast, the Industrial Policy (1993) of Nepal created financial provisions such as a concession on income tax and sales tax, but these incentives were targeted more towards increasing the production of goods and services.

Bangladesh's National Renewable Energy Policy (2008) created an innovative financial mechanism using domestic funding for commercial lending and a micro-credit system for the purchase of renewable energy technologies. The National Energy Policy (2005) focused on increasing access to micro-finance, as well as joint ventures and structured loans to improve access to energy for the majority of the population. This policy also stated that it aimed "*to reduce the dependence on external donors gradually by internal financing to the extent possible and new mechanisms of project financing*". The National Energy Policy (1995) had stated that Bangladesh lacked the funds to encourage private sector participation in the development of the energy sector and therefore most of the policy statements were focused on technology development and dissemination. For Nepal, the Rural Energy Policy (2006) created a central rural energy fund. While the government was the major contributor, donor agencies also made some financial contributions. Subsequent energy policies, the National Energy Strategy (2013) and Renewable Energy Subsidy Policy (2016), created a power development fund through internal funding. A separate fund that had a partial contribution from ODA was also created to improve energy access in rural areas.

While the early policies of Bangladesh emphasised ODA more than internal funding for policy implementation, policies designed after 2005 have explicitly mentioned special funds for climate change projects—for example, a Green Climate Fund under UNFCCC, REDD+ project fund, and the Global Environment Facility. The external funding bodies are still sought for climate change mitigation and adaptation projects despite the recent shift to managing funding from internal sources. The previous energy, forest and agricultural policies of Bangladesh mentioned ODA as a source in addition to creating local micro-credit facilities and funding from designated private financial institutions. The climate, energy, forest and agriculture policies of Nepal also emphasised foreign investment as a financial source in the early 1990s. However, after 2005, these policies have emphasised a dedicated internal-funding-based climate change fund and encouraged local financial institutions as internal sources of funds.

4.4.5. Institutions and strategic interactions

Interactions between formal institutions and advocacy coalitions are essential for the conceptualisation and synthesis of the knowledge required for environmental and sustainability decisions (Videira et al., 2017). During the two periods under study, strategic interactions amongst formal institutions and advocacy coalitions have not changed much for Nepal and Bangladesh. Though there have been slight changes in the names of the ministries responsible for developing sectoral policies, there have always been responsible formal institutions looking after the development of sectors like energy, forest, agriculture, transport, and industry. One notable change in the period from 2005 to 2018 is that environmental issues are now pinpointed as an additional consideration by each of the key sectoral ministries in both Nepal and Bangladesh. Another change is that formal institutions have strengthened their engagement with other government organisations at the central and local levels in terms of sharing knowledge and information and improving their technical capacity to deliver the policies. A third notable change in the 2005–2018 period is that formal institutions have evolved to look after climate change mitigation and resource use issues. Examples include the Sustainable Energy Development Authority of Bangladesh, and a high-level Climate Change Council and a dedicated Climate Change Management Division in Nepal.

Across the vertical dimension, local government institutions have also been given responsibilities to head the government-supported local committees for the development of the forest, agriculture and energy sectors. The role of local institutions in policymaking is not explicitly mentioned but the NDC of Bangladesh (2016), REDD+ readiness roadmap (2012) and the Bangladesh Climate Change Strategy and Action Plan (2009) do all talk about consultations with local and international non-governmental organisations, private sector organisations, communities and civil society groups. Similarly, the Industry Policy (2010), the Forest Policy (2016), REDD+ strategy (2015), the Strategic Transport Plan (2015), and the Agriculture Policy (2018) emphasise government, non-government, and private sector partnerships for the research, development and delivery of policies. Nepal's Forest Sector Policy (2000) and the National Agriculture Policy (2004) emphasise participatory research and the development of the agriculture and forest sectors by involving private sector and non-government organisations. The NDC (2015) of Nepal emphasises the strengthening of both central and local government institutions and coordination mechanisms that involve the private sector and NGOs, both local and international. Similarly, the Climate Change Policy (2011), the Energy Sector Strategy (2013), REDD+ strategy (2015), the National Sustainable Transport Strategy (2015), and the Forest Sector Strategy (2016) emphasise broader stakeholder engagement for research and coordination, capacity building, and monitoring of progress with regard to policy. This aspect of the policies has gone through first-order dialectic changes for both countries, reflecting incremental changes across formal institutions and the way negation and synthesis of ideas and knowledge still focus on capacity building of local level organisations.

4.4.6. Global environment-related initiatives – climate agreements and other global environmental policy frameworks

It would seem that global environment-related initiatives did not have much influence on policies until 2004. The exception is Bangladesh's Forest Policy (1994), which referred to the Rio Earth Summit 1992 by stating that the policy has considered chapter 11 of the UN's Agenda 21 (Combating Deforestation). However, during the period between 2005 and 2018, almost all the policies of Bangladesh made a specific reference to climate agreements, Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs). The NDC (2016), the Bangladesh Climate Change Strategy and Action Plan (2009), the Bangladesh Renewable Energy Policy (2008), the REDD+ readiness roadmap, the Forest Policy (2016), the Industry Policy (2010), and the Agriculture Policy (2018) all mention the Paris Agreement (2015), the Bali Action Plan (2007), the 1997 Kyoto Protocol, and both the MDGs and SDGs as being important to address through these policies. Therefore, this aspect shows second-order teleological change because of more strategic actions towards global environment-related initiatives that are clearly identified and explained in the policies.

For Nepal, earlier global environment-related initiatives do not seem to have influenced policies. However, more recent policies, especially the ones developed after 2005, mention global environment-related initiatives such as climate agreements and MDGs. For example, the NDC (2015) of Nepal was introduced in the run-up to the Paris Climate Conference, and the Climate Change Policy (2011) identified the MDGs as a reference strategy to meet the nation's development agenda, as well as being a means of addressing climate change issues. While the MDGs have now been superseded by the SDGs, this is not mentioned in any of the existing sectoral policies. The National Sustainable Transport Strategy (2015) references the Bangkok 2020 Declaration on sustainable transport goals for 2010-2020, the Bali Declaration on sustainable transport and Rio+20. Similarly, the REDD+ strategy (2015) of Nepal seems to have been generated as a response to the Bali Action Plan (2007) as the policy refers to obligations to initiate GHGs emissions and resource use reductions under various meetings of UNFCCC. The change is therefore second-order linear change because of the strategic actions (transport and REDD+ policies) for incorporating the objectives of global environment-related initiatives.

4.5. Discussion

4.5.1. New climate policy paradigm

Changes in the concepts upon which policies are based influence understanding of the problems that policies are designed to address (Hall, 1993; Kuzemko, 2012). Policy and problem are, however, sometimes perceived as separate streams in public policy (Béland and Howlett, 2016). Nevertheless, these streams create a platform for perceiving problems, the actions required to respond to them, and analyses of proposed solutions. The climate policies of both Nepal and Bangladesh identify climate change adaptation as a problem in terms of sustaining the livelihoods of communities and for ensuring economic growth. Further, adaptation and resilience are top priorities for low-income countries in international negotiations on climate change (Ayers et al. 2014). Therefore, the normative position of Nepal on climate change emphasises adaptation actions in policies. However, the second-order teleological change in the 'problem and key focus' aspect of the policies means a paradigmatic change from solely focusing on climate change adaptation towards embracing a new climate policy paradigm that has strategic actions pertinent to climate mitigation. The new climate policy paradigm is characterised by transparency regarding climate change mitigation actions even applicable for developing countries, which is the feature of the present international climate policy paradigm (Hermwille, 2016). The new paradigms in Nepal and Bangladesh are transparent in the sense that climate change mitigation actions are included in the NDCs and their climate policies. Both countries have submitted their NDCs together with the national communication reports to the UNFCCC.

Bangladesh included mitigation for energy access and finance, and Nepal included mitigation for low carbon development in their climate change policies (Fisher, 2013). As both Nepal and Bangladesh move a step further from a traditional focus on climate change adaptation, particularly in the later period, the new climate policy paradigm is therefore characterised by a broader view of problems that was normally understood in terms of the quantity of GHG emissions. There are numerous meso- and micro-level initiatives that are a part of new climate policy paradigms in both countries. For example, sustainable transportation system, reduction of fossil fuels consumption, improved fuels quality, sustainable agriculture practices, conservation of forest area, human resource development, and environmentally sound products. In addition to these initiatives, the new climate mitigation-based policy paradigm in both countries is a positive step towards implementing their NDCs as part of meeting their commitments of the Paris Climate Agreement. However, absolute resource use and GHG emissions are on the rise for both countries since 2005 (World Bank, 2021). The absolute resource use and GHG emissions are projected to increase significantly by 2030 and beyond despite notable improvements in carbon productivity and energy productivity between 1985 and 2016 (Baniya et al., 2021). Therefore, in addition to framing climate mitigation-oriented actions in the policies, the new policy paradigms in both countries could focus on delivering absolute reductions in resource use and GHG emissions. While climate change adaptation remains the main focus, the new policy paradigm that frames climate mitigation broadly co-exists with the adaptation based policy paradigm for both Nepal and Bangladesh (Figure 4.3). The layering mode of changes is present for both countries, as mentioned by Vij et al. (2018). Further, only one occasion of drift and conversion in Bangladesh and none for Nepal in climate adaptation-related policy paradigms (Vij et al., 2018) substantiate the efforts required to strengthen the institutions and their strategic interactions not only for climate mitigation but for climate adaptation too.

4.5.2. Institutional interplay and strategic actions

The 'institutions and strategic interactions' category has gone through first-order dialectic changes for both Nepal and Bangladesh. A lack of broader participation of local formal institutions during policy design is a notable weak link in the strategic interactions. Institutional constraints like this have been identified as impacting policy change (Beland, 2009). However, advocacy coalitions involving international development organisations have driven policy changes in Nepal and Bangladesh (Rahman and Giessen, 2017). The role of these exogenous agents in policy design appears to have been significant for both Nepal and Bangladesh from 2005 to 2018 given the second-order changes in global environment-related initiatives which occurred by linear mechanism for Nepal and by teleological mechanism in Bangladesh. However, the technical capacity of formal institutions at the local level appears to have been undermining the role of exogenous agents, as the majority of policies stated a capacity building requirement for local government organisations. In general, the formal institutions at the local level are subjected to ideational power from central government, a power which is defined by Cartensen and Schmidt (2015) as influencing cognitive and normative beliefs. The first-order change in the 'institution and strategic interactions' aspect for both countries is an incremental approach to policy changes via a dialectic mechanism, meaning a non-crisis driven change that is prevalent within discursive institutionalism (Schmidt, 2011). Despite this, teleological change in the global environment-related initiatives aspect of policies in Bangladesh, and linear change in Nepal, indicate governments' interest in possibly taking more strategic actions pertinent to climate mitigation in the future, in line with international climate commitments.

4.5.3. Potential changes in Official Development Assistance (ODA)

Donor agencies such as the World Bank and United Nations have contributed to the creation of a $1.3 billion LDC fund under the Global Environment Facility to support climate change adaptation in low-income countries (GEF, 2020). The Green Climate Fund (GCF) has apportioned half of the adaptation allocation for LDCs and small island developing states (Antimiani et al., 2017). LDCs can also access the mitigation allocation of the GCF. Additionally, the developed countries pledged to provide US$100 billion per year for developing countries by 2020 (Dion et al., 2014). However, the ODA received as a percentage of GNI has significantly decreased for both countries. Nepal's ODA funding as a percentage of GNI decreased from 9% to 5%, while that of Bangladesh decreased from 4.5% to 1% between 1985 and 2016 (World Bank, 2021). In lieu of ODA, government's internal funding has been supporting climate change mitigation actions. Market-based and economic policy instruments such as tax rebates, subsidies, funding from local financial institutions, and other financial incentives have been designed to close the financial shortfalls in the later period (2005 to 2018). The apparent shift from ODA-based climate finance to internal funding is a significant milestone for both Nepal and Bangladesh, especially in terms of being self-sufficient. However, as both countries are targeting LDC graduation, reliance on ODA has ultimately to change. The ODA and climate finance delivery mechanism is likely to change as part of changes in international support measures post-LDC graduation (UNTCAD, 2017). The changes—such as an increase in the ratio of loan to grant, a loss of access to LDC specific climate change funds, and a reducing amount of ODA received per GNI—means that there is a need to identify funding sources other than ODA for both countries. The contents of the policies have gone through second-order linear changes in both Nepal and Bangladesh. Therefore, the existing policy instruments and financial mechanisms may need to evolve further and probably achieve third-order radical changes to counter the negative impacts of changes in ODA. Figure 4.3 shows the relationship between changing policy paradigms, financial mechanisms and the LDC graduation. After point A, if Nepal and Bangladesh succeed in LDC graduation, climate change mitigation actions are likely to become the key focus of their policies, in addition to climate adaptation, as a result of problems such as significantly increased resource use and GHG emissions.

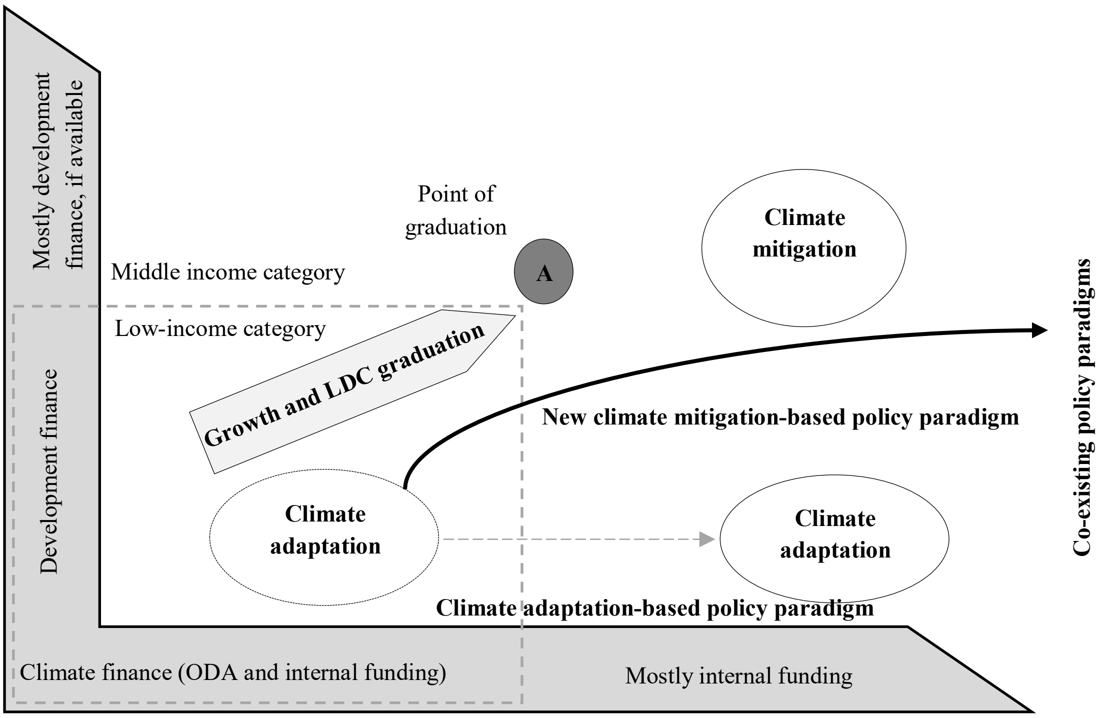

Figure 4.3. Changing policy paradigms, financial mechanisms, and least developed country (LDC) graduation

4.6. Conclusion

Existing policies are still adaptation based. However, the climate change mitigation-oriented policies have evolved significantly in both Nepal and Bangladesh, particularly post-2005, to embrace a new policy paradigm. The new policy paradigm emphasises climate mitigation for reasons other than the reduction of GHG emissions such as low carbon development, energy access, sustainable transportation, and sustainable agriculture and is proactive in the sense that it looks to address broader issues. While the new policy paradigms in both countries have significantly framed climate mitigation-oriented actions, delivering absolute reductions in resource use and GHG emissions remains an area of concern, particularly given the requirements of global environment-related initiatives. A potential reduction in the ODA because of the shift in the financial mechanism may further challenge the prospects for delivering absolute reductions in resource use and GHG emissions. Therefore, the new policy paradigms in both countries will have to move beyond policy formulation to deliver climate mitigation-oriented actions. The contents of the policies will also have to evolve further to minimise the negative impacts of any changes to ODA. This would create more opportunities for collaboration between formal institutions and local financial institutions, thus leveraging the discursive institutionalism to enhancing strategic interactions, which currently appear to be weak. A transition from ODA-based financial mechanisms to internal funding, especially after LDC graduation, will enable both countries to leverage progress made on economic- and market-based policy instruments.

Finally, although the literature on policy changes has progressed rapidly, there is a lack of sufficient country-specific studies focusing on climate mitigation-oriented policy paradigms. This study undertook country-specific research by creating and applying the analytical framework, which could be compared with other similar studies or applied in a different context. Further, the global environment-related initiatives have continued to become demanding even for the LDCs. Therefore, this study recommends that future studies investigate the role of global environment-related initiatives as an external driver to changes in policy paradigms, particularly for developing and low-income countries where the international development and ODA delivery mechanisms are strong.

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Supplementary materials to Chapter 4

Table A1 Overarching and sectoral policy documents of Nepal

Year	Policy	Policy type	Primary focus
1993	Industrial Policy	sectoral	Growth in industrial sector
1993	Vehicles and Transport Management Act-1993	sectoral	Regulatory framework for transport sector management
1993	Environmental Policy and Action Plan	overarching	Environmental protection
1995	Nepal Agriculture Perspective Plan	sectoral	Growth in agriculture sector
2000	Forest Sector Policy	sectoral	Use and management of forest resources
2001	National Transport Policy	sectoral	Improve the reliability of road and air transportation service
2004	National Agriculture Policy	sectoral	Self-reliant agriculture sector
2006	Rural Energy Policy	sectoral	Improving access to energy for rural population
2011	Climate Change Policy	overarching	Climate change mitigation, adaptation and financing.
2011	Industrial Policy	sectoral	Growth in industrial sector
2013	National Energy Strategy	sectoral	Renewable energy development and energy efficiency for resource management
2015	National Sustainable Transport Strategy	sectoral	Productive, resilient and sustainable transport system in Nepal
2015	Nepal Reducing Emissions from Deforestation and Forest Degradation (REDD+) strategy	sectoral	Improve the carbon sink capacity of the forests
2015	Agriculture Development Strategy	sectoral	Growth and job creation in agriculture sector
2015	Nationally Determined Contribution	overarching	Climate change mitigation and adaptation actions
2016	Renewable Energy Subsidy Policy	sectoral	Promote renewable energy technologies
2016	Forest Sector Development Strategy	sectoral	Sustainable use and effective management of forest resources

Table A2 Overarching and sectoral policy documents of Bangladesh

Year	Policy	Policy type	Primary focus
1992	Bangladesh National Environmental Policy	overarching	Environmental protection
1994	National Forest Policy	sectoral	Management of forest resources
1995	National Energy Policy	sectoral	Energy development and access
1997	Environmental Conservation Rules	overarching	Environmental conservation
1999	Industrial Policy	sectoral	Growth in industrial sector
1999	National Agriculture Policy	sectoral	Sustainable agriculture production system
2004	National Land Transport Policy	sectoral	Provide safe and reliable transport service
2005	National Energy Policy	sectoral	Energy generation and access
2005	Strategic Transport Plan	sectoral	Urban transport planning
2008	Renewable Energy Policy	sectoral	Renewable energy development
2009	Bangladesh Climate Change Strategy	overarching	Climate change mitigation and adaptation
2012	Bangladesh REDD+ readiness roadmap	sectoral	Plan the implementation of REDD+ projects
2013	National Integrated Multimodal Transport Policy	sectoral	Ensure equal importance of inland water, rail, air and road transportation
2015	Revised Strategic Transport Plan	sectoral	Effective management of transport demand, particularly in urban areas
2015	Nationally Determined Contribution	overarching	Intended actions for climate change mitigation and adaptation
2016	National Industrial Policy	sectoral	Growth and job creation in industry sector
2016	National Forest Policy	sectoral	Sustainable use and effective management of forest resources
2018	National Agriculture Policy	sectoral	Growth and job creation in agriculture sector

Figure A1. Location of Nepal and Bangladesh in the South Asian region.

Chapter 4 to Chapter 5 transition paragraphs

The previous chapter identified that the environment- and climate-specific policies, both national and sectoral, in Nepal and Bangladesh focused on climate mitigation as well as climate adaptation. The climate mitigation-related issues—such as low-carbon development, access to energy, sustainable transport, and sustainable agriculture practices—appeared as key highlights of the new climate mitigation-based policy paradigm that emerged after 2005 in both Nepal and Bangladesh. Thus, the content analysis of both countries' government policies sheds light on government policymakers' efforts, including those of policy actors from the private sector and non-government organisations, to emphasise climate mitigation actions. This is in addition to the traditional focus on climate adaptation.

The new climate mitigation-based policy paradigms in both countries, and the integrated approach that policymakers have taken to address both climate mitigation and adaptation, can be perceived as a positive step towards identifying climate mitigation actions as one of the multiple objectives of government policies. However, the policy paradigm pertains to policymaking that includes the formulation of new policies and the reform of existing policies. Therefore, while we know that Nepal and Bangladesh have begun to focus on climate mitigation, we do not know how and to what extent government policies have incorporated climate mitigation-oriented actions or how climate mitigation actions in government policies are linked to the prospects for their delivery. The previous chapter also highlighted the global environment-related initiatives, the official development assistance mechanism, and the policy actors' institutional interactions as key factors in the shaping of the new climate mitigation-based policy paradigms in both countries. The next chapter builds on the insights into the climate mitigation-based policy paradigms to explore the following: 1) how the climate mitigation issues are framed into government policies; 2) the extent of framing (which is explained by using the concept of mainstreaming); 3) the global environment-related initiatives together with green growth as influencing factors to the changing policy paradigms; and 4) the process by which climate mitigation mainstreaming occurs—for example, the way by which policy actors and their institutions interact to incorporate climate mitigation actions into government policies.

The next chapter uses Nepal as a single-case country; 12 semi-structured interviews in a single country are deemed sufficient to generate insights into climate mitigation mainstreaming. In addition, a well-established and active green growth program in Nepal is also key to choosing Nepal, as this research extends the breadth of influencing factors by adding green growth to the global environment-related initiatives.

Chapter 5: Mainstreaming climate change mitigation actions in Nepal: influencing factors and processes

Paper preface

This chapter includes a co-authored peer-reviewed paper. The full bibliographic details of the paper, including all authors are:

> Baniya, B., Giurco, D., & Kelly, S. (2021). Mainstreaming climate mitigation actions in Nepal: influencing factors and mainstreaming process, *Environmental Science and Policy*, 124. https://doi.org/10.1016/j.envsci.2021.06.018

Bishal Baniya led the research project, collected and analysed the data, and wrote the full paper. Damien Giurco (Principal supervisor) and Scott Kelly (Co-supervisor) provided supervisory guidance and reviewed the paper. Prem Prakash Aryal (External author) administered the project on the field by facilitating during semi-structured interviews.

Research highlights

- Climate mitigation actions are getting attention in the national and sectoral policy discourse in Nepal.
- Semi-structured interviews and content analysis of policies provided insights into climate mitigation mainstreaming in Nepal.
- The global environmental discourse and the green growth concept are influencing the policy discourse in Nepal.
- The climate mitigation mainstreaming process employs a collaborative approach across sectors and multi-level governance.

Abstract

This study aims to investigate the influencing factors and the processes for incorporating climate change mitigation actions into policies in the non-environment sector in Nepal. We use semi-structured interviews with policy actors such as national and sub-national policymakers, and respondents from the private sector and international development organizations active in Nepal. We also use thematic, narrative, and focused coding to analyse narrative data obtained from 12 respondents, and qualitative analysis of textual data from six non-environment sector policies to generate insights into the mainstreaming of climate change mitigation actions. A major finding from the study is that global environment-related initiatives like the Paris Agreement and the Sustainable Development Goals, and the green growth concept that aims to mitigate greenhouse gas (GHG) emissions, are influencing the policy discourse in Nepal. Consequently, climate change mitigation actions are integrated either as add-ons or as overriding policy objectives in non-environment sector policies. Our conceptualization of mainstreaming moves beyond the mere integration of policy objectives to focus on the collaborative practices of policy actors, the influencing factors, and the processes for incorporating climate change mitigation actions across non-environment sector policies.

Keywords: climate change mitigation, GHG emissions, collaborative governance; policy integration; sectoral policies; mainstreaming

5.1. Introduction

Many low-income countries, including Nepal, tend to focus more on climate change adaptation than on mitigation. However, the global environment-related initiatives such as the Paris Agreement and the Sustainable Development Goals (SDGs), and environmentally focused economic growth frameworks like green growth, encourage policymakers from low-income countries to focus on climate change mitigation too. For developing countries in Asia, climate change mitigation and green growth have appeared on governments' agendas for a range of reasons, including the desire to achieve energy security, pursuing technological advantages, and addressing local environmental problems (Turner, 2014). Green growth is defined as any strategy "that fosters economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies" (OECD, 2011). Green growth has broad coverage and application across all critical economic sectors, and its linkage to development agendas in emerging Asian economies means that climate change mitigation and green growth frequently intersect (Koide, 2017; Turner, 2014). While global environment-related initiatives and green growth (GEIGG) objectives such as reducing resource use and GHG emissions are less prioritized in low-income developing countries than they are in other nations, they have been incorporated into climate policies and nationally determined contributions (NDCs). For example, Nepal's climate change policy (2011 and 2019) and its both NDCs (2016 and 2020) explicitly mention actions to lower the nation's greenhouse gas (GHG) emissions, improve energy efficiency, and reduce the exploitation of forest resources. We investigate GEIGG as influencing factors that encourage policymakers to integrate climate mitigation actions into Nepal's existing non-environment sector polices.

The concept of policy integration in environmental policy studies is usually explained by the term 'environmental policy integration' (EPI). EPI is defined as the process of incorporating environmental objectives into non-environment sector policies (Lafferty and Hovden, 2010). While environmental objectives such as elements of GEIGG (i.e. climate change mitigation actions) are incorporated into climate policies and NDCs, non-environment sector policies may not have them as primary objectives.

The concept of EPI is therefore relevant, as policymakers look to mainstream climate change mitigation actions across economic sectors to deliver global environment-related initiatives effectively whilst trying to green their economic growth. Mainstreaming is generally referred to as integrating an issue into institutions and decisionmaking (Ayers et al., 2014). One prominent definition of environmental mainstreaming is "the informed inclusion of environmental concerns into the decisions of institutions that drive national, local and sectoral development policy, rules, plans, investment and actions" (Dalal-Clayton and Bass, 2009, p. 11). While 'mainstreaming' is often used as an alternative term for policy integration, there exist conceptual differences based on the context of use, the field of study, and whether environmental objectives are incorporated as overriding or add-on objectives (De Roeck et al., 2018; Yamin, 2013). The concept of mainstreaming is thought to have come from a development discourse that emphasizes the mainstreaming of gender issues into development policies (Klein et al., 2005). Mainstreaming in the context of climate change involves the integration of measures to address climate change into ongoing sectoral and development decisionmaking (Klein et al., 2005). In this paper, we distinguish mainstreaming and policy integration as separate concepts by using criteria such as policy objectives and impacts, sector and multi-level governance, financial and human resources, and institutional changes.

The mainstreaming of climate adaptation actions in development policies has substantially progressed in comparison to the mainstreaming of climate change mitigation (Adelle and Russel, 2013). The mainstreaming of climate change mitigation in development policies via policy integration was initially discussed by Klein et al. (2005) and Swart and Raes (2007). However, the limited literature in this research domain, particularly after 2010, has motivated the present study, which leverages the concepts of EPI and collaborative governance to investigate the way climate change mitigation actions are incorporated across non-environment sectors in Nepal. Collaborative governance is defined as the processes and structures of public policy decisionmaking that engage people across public agencies, levels of government, private, and civic spheres (Emerson and Nabatchi, 2015). Mainstreaming implies involving policy actors such as governments, civil society, industry, and local communities in the decisionmaking process (Gupta, 2009). This means that mainstreaming takes place within the realm of collaborative governance. While collaboration across sectors is not a panacea, it does encourage policy actors to respond collaboratively to problems that are common to all stakeholders (Bryson et al., 2006).

In addition to NDCs, low-income countries, including Nepal, are also required to develop Nationally Appropriate Mitigation Actions (NAMA). Little to no information about NAMAs from low-income countries means that climate change mitigation is yet to be fully framed across the policies. However, the NDCs produced as part of the Paris Climate Agreement may have encouraged policymakers in low-income countries to consider climate change mitigation. Despite well-developed literature on the mainstreaming of climate change adaptation, we know little about what has been done so far regarding the mainstreaming of climate change mitigation in low-income countries and if GEIGG-related policy discourse has any influence. We build on the climate adaptation mainstreaming literature to discuss the case for the mainstreaming of climate change mitigation in Nepal by emphasizing the influencing factors and the mainstreaming process[29]. We choose Nepal to study mainstreaming of climate mitigation actions for the following reasons. First, Nepal is a low-income country with an active green growth program. Second, Nepal receives relatively higher official development assistance (ODA) per capita compared to other low-income countries, meaning the agenda of GEIGG is potentially considered in public policy decisionmaking. Third, Nepal has made an effort to focus on climate mitigation via formulating climate change policy (2011 and 2019) and by submitting the two NDCs (2016 and 2020) to the United Nations Framework Convention on Climate Change (UNFCCC).

The main purpose of this study is to investigate the influence of GEIGG on climate policy discourse, climate mitigation mainstreaming process, and the extent of mainstreaming in non-environment sector policies in Nepal. The rest of the paper is structured as follows: Section 2 presents the theoretical foundations and conceptual framework for conducting the research, Section 3 explains the methodology, Section 4 presents the findings, Section 5 discusses the findings, and Section 6 presents the conclusion.

[29] Mainstreaming process (es) refers to the way by which climate mitigation actions are made mainstream policy issue and a prioritised goal in policies across sectors such as energy, forest, agriculture, and industry.

5.2. Theoretical foundations and conceptual framework

We consider that the in-country policy discourse linked to GEIGG influences the knowledge and ideas of policy actors. The change in the knowledge and ideas of policy actors and their broader participation in the policymaking process can help decide collectively to integrate climate change mitigation actions into non-environment sector policies. Although the knowledge, ideas, and interests of policy actors may result in diluted and ineffective policies (Koontz et al., 2004), being responsive to feedback can strengthen the technical aspects of these policies (Anderson et al., 2013; Steele et al., 2010). Most well-informed decisions are characterized by the knowledge and informational resources different people bring to the production of group decisions on any issue (Gigone and Hastie, 1993). In spheres such as environmental regulation and energy policy, policymaking involves highly technical issues and specialized knowledge. It also involves social learning and the exchange of ideas of the policy actors (Hall, 1993). The ideational element of policymaking does not only help decision-makers to interpret potential changes in policy (Capano et al., 2009), but also forms the core of the policy paradigm that determines how policymakers choose one course of action rather than another (Hall, 1993). Policy paradigms include policy goals, objectives, and policy actors' preferences (Howlett, 2009). Vij et al. (2018) conceptualization of policy paradigm includes framing of policy issues, policy goals, meso-level areas (non-environment sectors), and financial policy instruments. These abstractions of policy paradigm pertain to the concept of mainstreaming that contributes to redefining the policy goals across non-environment sector policies.

Knowledge systems, practices, and institutions for the production, transfer, and synthesis of knowledge are also important in science-policy interactions, especially in the context of global change (Tengö et al. 2014; Cornell et al., 2013). Knowledge and learning are critical drivers for change in knowledge systems within the realm of public policy (Rayner and Howlette, 2017). We consider GEIGG-related policy discourse to influence the knowledge and ideas of policy actors. Therefore, GEIGG is an influencing factor for climate change mitigation mainstreaming in Nepal. National, sectoral, project and local-level governance are considered as "entry-points" for this mainstreaming (Drutschinin et al., 2015). These entry-points are understood as avenues for mainstreaming, as intervening at any of these entry-points by using legal and regulatory instruments, economic policy instruments, and capacity building is a key step towards mainstreaming (Drutschinin et al., 2015; Hugé et al., 2020). Starting with existing policies and practices instead of developing new ones that may require separate institutions and policymaking processes optimizes the use of scarce financial resources (Label et al., 2012). This is relevant for a low-income country like Nepal where policy actors vie for limited financial resources in a collaborative environment during policy formulation. An appropriate choice of policy instruments such as the finance-based instrument can avoid the negative interplay between policy actors across sectors and multi-level governance (Henstra, 2016). Therefore, we discuss policy instruments that may foster coordination and collaboration between policy actors.

We also explore collaborative governance practices in Nepal by examining the interplay between policy actors when they make decisions about the integration of climate change mitigation actions. Empirical evidence shows that collaborative governance is effective in resolving environmental problems, knowledge gaps, and social learnings. However, the nature of the problem, and the risk that policy actors will free ride on the efforts of others, also need to be considered (Bodin, 2018). Policy actors are the institutions (and individuals) that introduce climate change mitigation mainstreaming. They do so by intervening across entry-points and by changing the policymaking process[30], including the mainstreaming of climate mitigation actions. Collaborative governance introduces the notion of sectoral failure, which is an initial condition for collaboration (Bryson et al., 2006). If sectoral failure is to be considered as a precondition for effective collaborative governance, it can be inferred that the non-environmental sectors may always want to practice collaborative governance when incorporating environmental objectives. This is because, unlike dedicated environment sector organizations, organizations in non-environment sectors are not always adequately equipped in terms of knowledge, experience, and human resources to deliver environmental objectives. The way knowledge, experience,

[30] Policymaking process refers to the way by which policy actors participate in policymaking to finally formulate policies.

and human and financial resources are optimized across entry-points is a part of the policymaking process for mainstreaming climate change mitigation.

Collaborative governance is integrative in the sense that external drivers (e.g. policy discourse on GEIGG) are taken into consideration (Emerson et al., 2012). Therefore, we consider collaborative governance by identifying four criteria (Table 5.1) that provide a conceptual basis for discussing the mainstreaming of climate change mitigation actions. The level of mainstreaming is another key consideration as it helps us to understand the extent of integration of climate change mitigation across policies. De Roeck et al. (2018) uses four levels of policy integration – non-integration, coordination, harmonization, and prioritization – to highlight that mainstreaming involves the incorporation of issues as overriding objectives, whereas policy integration is reactive and incorporates issues as add-ons. Coordination involves avoiding contradictions between policies. Harmonization implies the realization of synergies between policies, and prioritization involves overriding objectives (De Roeck et al., 2018). Mainstreaming can therefore be regarded as an extreme form of policy integration. Figure 5.1 shows the key aspects of mainstreaming, such as the entry-points, drivers/influencing factor, policy actors, and the policymaking process by which mainstreaming occurs. We consider these aspects in order to conceptualize mainstreaming as integrating climate change mitigation actions across policies. This mainstreaming results in changes to areas such as policy objectives and impacts, sectoral and multi-level governance, the efficient use of human and financial resources, and institutional changes. The abovementioned mainstreaming levels are used to discuss the extent of mainstreaming resulting from interventions across entry-points.

Table 5.1. Conceptual criteria for discussing the mainstreaming of climate change mitigation action

	Conceptual criteria
Policy objectives and impacts	• Mainstreaming goes beyond the one-dimensional conceptualization of environmental policy integration (EPI) that seeks to integrate issues as policy objectives and not the impacts (Adelle and Russel, 2013).
Sector and multi-level governance	• Mainstreaming involves distinguishing between the vertical (e.g. sectors) and horizontal (e.g. multi-level governance) dimensions of decision-making (Rauken et al., 2015). However, mainstreaming can also be achieved if only the horizontal dimension of decision-making is materialized (Dovers and Hezri, 2012).
Human and financial resources	• Mainstreaming is also seen as making efficient and effective use of financial and human resources rather than just designing and implementing policies (Klein et al., 2005).
Institutional changes	• Theoretically, mainstreaming can be achieved when individuals move beyond their sectoral foci to embrace new ideas, approaches, and modes of operation, for example, when introducing changes to institutional arrangements (Sowman and Brown, 2006). • The effectiveness of environmental mainstreaming is measured by the changes implemented in institutions and decisions in order to improve the range of possible outcomes (Dalal-Clayton and Bass, 2009).

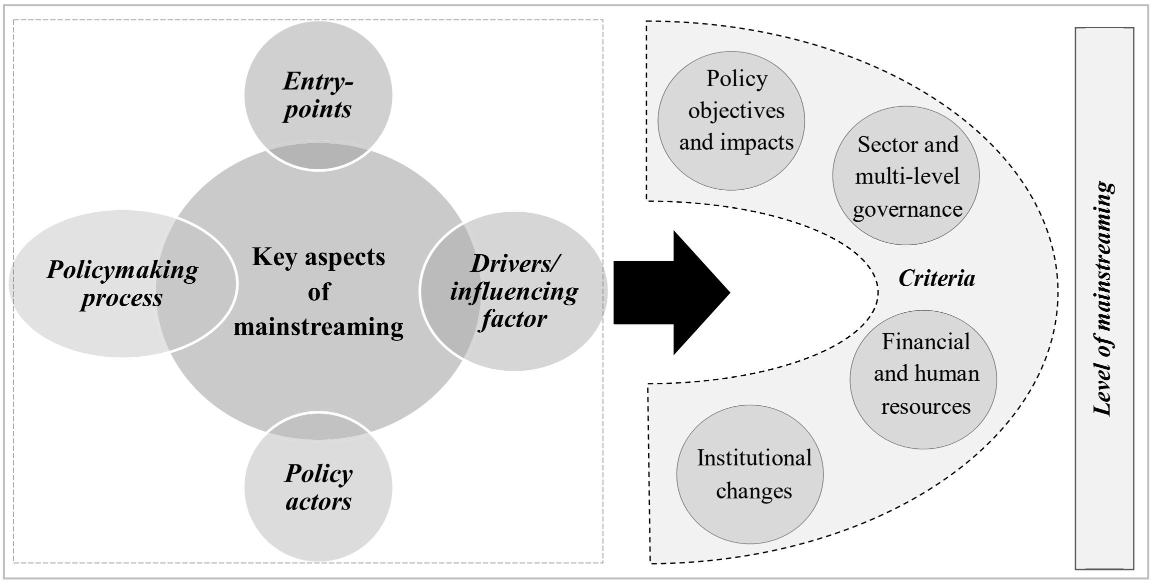

Figure 5.1 Conceptualisation of the climate change mitigation mainstreaming based on key aspects, criteria and level of mainstreaming

5.3. Methodology

The theoretical foundations and the conceptual framework mentioned above provide a basis to discuss mainstreaming of climate change mitigation in Nepal. Semi-structured interviewing (n = 12) was the qualitative research method chosen to document policy actors' perceptions, knowledge, and experience pertinent to GEIGG concepts. Nepal was chosen as the case country because the climate change policy (2011 and 2019) and NDCs (2016 and 2020) of Nepal include commitments regarding climate change mitigation actions. Although Article 4.6 of the Paris Agreement does not mandate low-income countries to include climate change mitigation actions in their NDCs, Nepal has explicitly mentioned the climate mitigation commitments. The interest of policymakers in climate change mitigation, coupled with an active green growth program in Nepal, makes it a preferred case country for studying the influence of GEIGG on policies and for examining the mainstreaming of climate change mitigation actions into existing policies. While Nepal's share is only 0.027% of the global GHG emissions, the consequences of climate change are adverse for the mountain ecosystem in Nepal (Macchi, 2011). Thus, hydrological hazards such as storms, floods, landslides, and mudflows have become more frequent and intense in recent years in Nepal (Mainali and Pricope, 2017). Therefore, climate adaptation has been the priority of the government's climate change and cognate policies. However, a three-fold increase in Nepal's GHG emissions per capita in the last two decades means additional policy actions pertaining to climate mitigation (Ritchie and Roser, 2020). Consequently, post-2012 climate agreements, international development partners[31] have been encouraging developing countries, including Nepal, to use clean energy technologies and achieve greater resource efficiency to lower their GHG emissions (Howard-Grenville et al., 2014). More information about climate change adaptation and mitigation in Nepal is provided in the supplementary material to Chapter 5.

We also use deductive content analysis to review non-environment sector policies (n = 6). This method makes it possible to use a small number of content-related categories to test the use of concepts and hypotheses (Elo and Kyngäs, 2008). Figure 5.2 shows the approach to data collection and analysis. The semi-structured interviews provided information on the key aspects of mainstreaming, such as entry-points, drivers/influencing factors, policy actors, and policymaking process. Textual data provided information on four conceptual criteria and the level of mainstreaming. The coding of narrative data in NVivo software and the deductive content analysis of textual data provided insights on climate change mitigation mainstreaming in Nepal.

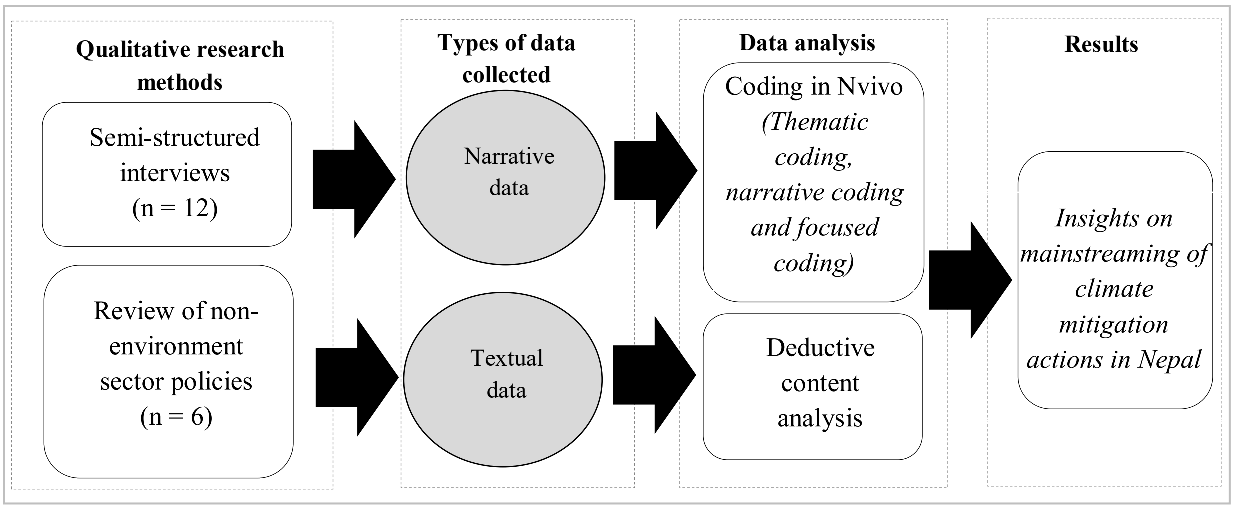

Figure 5.2. Methodological approach for data collection and analysis.

[31] International development organisations, including bilateral and multilateral agencies that often partner with government and provide technical and financial assistance to deliver development projects.

5.3.1. Sampling and data collection

A purposive sampling method was used to recruit 12 respondents across four distinct groups: (i) central government organizations; (ii) local government organizations; (iii) private sector organizations; and (iv) non-government international development organizations. The inclusion criteria were that the participants were mid-level staff and had experience in policymaking. The first group consisted of four national policymakers from central government organizations and the second group comprised three respondents from local government organizations. Respondents from both central and local government organizations were included to examine collaboration across multiple levels of governance. The third group consisted of three respondents from industry associations that are responsible for leading private sector organization participation in environmental policymaking. The fourth group had two respondents from non-government international development organizations that provide technical and financial support to both central and local government organizations of Nepal via official development aid (ODA).

Interview questions were carefully written to ensure consistent phrasing and to highlight three themes: (i) global environment-related initiatives; (ii) green growth; and (iii) policy paradigms. The interview questions were used to collect information on the following topics: respondents' understandings about climate change mitigation-oriented policies; uncertainties associated with the scale of commitments regarding climate change mitigation actions; policymaking approaches[32] used; cross-sector collaboration and across multi-level governance; and climate change mitigation objectives in non-environment sector policies. In addition to the prepared 12 questions, further queries were also raised to emphasize any emerging insights. The face-to-face interviews lasted between 60 and 120 minutes, and the responses were mainly recorded as narrative data. Policy documents such as the National Energy Strategy of Nepal (WECS, 2013); Forest Sector Strategy (2016-2025) (MFSC, 2015); Agriculture Development Strategy (2015-2035) (MAD, 2015); Industrial Policy (2011) (MICS, 2011); National

[32] Policymaking approaches refer to the way by which policy actors choose to formulate policies. For example, by using collaborative approaches involving broader stakeholders (discursive) or by preferring the advice of few subject matter experts (technocratic).

Environmentally Sustainable Transport Strategy (MPIT, 2015); and the Reducing Emissions from Deforestation and Forest Degradation (REDD+) strategy (MFE, 2015) were also reviewed as part of deductive content analysis to extract textual data.

5.3.2. Data analysis

The data and information from the 12 respondents were analyzed using two coding cycles to understand the phenomena and explain the proposition that GEIGG-related policy discourse influences the knowledge and ideas of policy actors. The first cycle of coding involved two steps: thematic coding and narrative coding. Thematic coding was followed by further coding which increased the breadth of analysis. A qualitative data analysis tool, NVivo, was used for thematic coding to store information related to the three main themes (global environment-related initiatives, green growth, and policy paradigms). Narrative coding was then used to identify the narrative data pertinent to the three themes. This provided further insights to expand the breadth of analysis. These insights included other GEIGG alternatives that respondents had experienced, and the process of climate mitigation mainstreaming via non-environment sector polices. Narrative research and data are usually interpretive, and they are meant to contribute to an understanding of human experience (Kim, 2020). The narrative data articulated respondents' interpretations of their experiences shared as answers to the 12 main questions. The second cycle of coding synthesized key data and information collected, mainly by follow up questions as more specific information emerged during the discussions. This focused coding method allowed the capture of more analytical items which were then coded under both thematic and narrative codes. Deductive content analysis used data from policy documents to discuss the conceptual criteria and the level of mainstreaming of climate change mitigation actions in non-environment sector policies.

5.4. Results

5.4.1. Are global initiatives and green growth influencing the policy discourse in Nepal?

5.4.1.1. Global environment-related initiatives and green growth as drivers

Most respondents identified the objectives of GEIGG (e.g. reduction of resource use and reducing GHG emissions) as important national, sectoral, and local policy issues. The most prominent global environment-related initiatives, as identified by the respondents, were the Paris Agreement and the SDGs. Green growth and other environment-focused growth agendas such as ‘the green economy’ and ‘sustainable growth’ were also seen as influencing the national and sectoral policy issues. A dedicated ‘green economy strategy’ has been in place in Nepal since 2014. However, this policy has not been fully implemented. Almost half of the respondents saw green growth as a way to create a green economy and address the SDGs. However, unlike the Paris Agreement and the SDGs, the respondents believed green growth had not been sufficiently prioritized in policy discourse. The SDGs were seen as addressing broader socio-economic objectives that aligned well with government priorities. Nevertheless, almost all respondents admitted that green growth is also a broad concept in the sense that it can be applied to all major economic sectors in Nepal: energy, agriculture forestry and other land use (AFOLU), water, transport, tourism, services, manufacturing, and mining. Unlike green growth, global environment-related initiatives are viewed as an indispensable strategic issue that needs to be incorporated across sectoral policies. The respondents highlighted the commitments made by Nepal’s government at various international conventions by signing multilateral agreements, for example, at the UNFCCC conference of parties’ meetings.

All the respondents mentioned that incorporating GEIGG into national and sectoral polices will help policy actors to collaborate with international development organizations and local non-government organizations. Respondents who were government policymakers or representatives of international development organizations talked about the merits of fostering collaboration, not only for an economic growth and development, but also for climate change mitigation and adaptation. Some notable advantages of engaging with international development organizations, as highlighted by the respondents, are: an increased ability to apply financial policy instruments; increased stakeholder engagement across sectors and multiple levels of government; and contribution to knowledge systems via the fostering of learning processes. Most respondents mentioned that some sectoral policies have gone through policy reform recently to incorporate the objectives of global environment-related initiatives into non-environment sector polices. ODA from international development organizations was mentioned as being a factor that encouraged policy actors to incorporate objectives of GEIGG, not only at policy level, but also into projects active on the ground. Projects in areas ranging from renewable energy and energy efficiency to REDD are taking advantage of ODA, and these projects may have been difficult for the government to implement without ODA. These active projects support the notion of generating realistic outcomes rather than merely adding on the climate change mitigation actions as policy objectives.

5.4.1.2. Influence on the knowledge system and ideas of policy actors

The respondents mentioned that they are always willing to adopt the theoretical knowledge, technological advances, and financial incentives associated with GEIGG that come via international development. The policy actors leverage the knowledge gained through GEIGG-related international workshops, capacity building, and training events. Attendees at these international gatherings often discuss different types of policy instruments, policymaking approaches, strategic actions, technological interventions, and successful policy cases. Respondents from central government organizations mentioned that when operating at the external drivers–policy interface, one objective is to understand the visions and policy statements related to GEIGG. A proper interpretation and understanding of the theories, principles, and objectives of GEIGG can help policymakers to explore potential applications; socio-economic benefits; the potential to address resource use and GHG emissions issues at the local level; and opportunities for cooperation with international development organizations.

Whilst the learning process associated with international development contributed to the knowledge system by enhancing the knowledge of individual policy actors, respondents from local government organizations mentioned that their ideas (and technical judgements) are somewhat influenced by central government organizations. Further, the ways in which non-environment sector policymakers interpret GEIGG are influenced by the knowledge and ideas of environmental sector policymakers (e.g. the environment ministry). Central environment sector organizations are the formal institutions that lead responses and coordination for almost all the relevant GEIGG. The knowledge system and learning process are therefore more relevant for environment sector organizations, and they determine the influence that GEIGG will have on non-environment sector policies. Figure 5.3 shows the influence of GEIGG on the knowledge and ideas of policy actors that result in changes such as policymaking approaches and sectoral and multi-level governance. The causal relationships between the influencing factors, knowledge, and ideas of policy actors, learning process, policymaking approaches, and collaborative governance are elucidated in following sections.

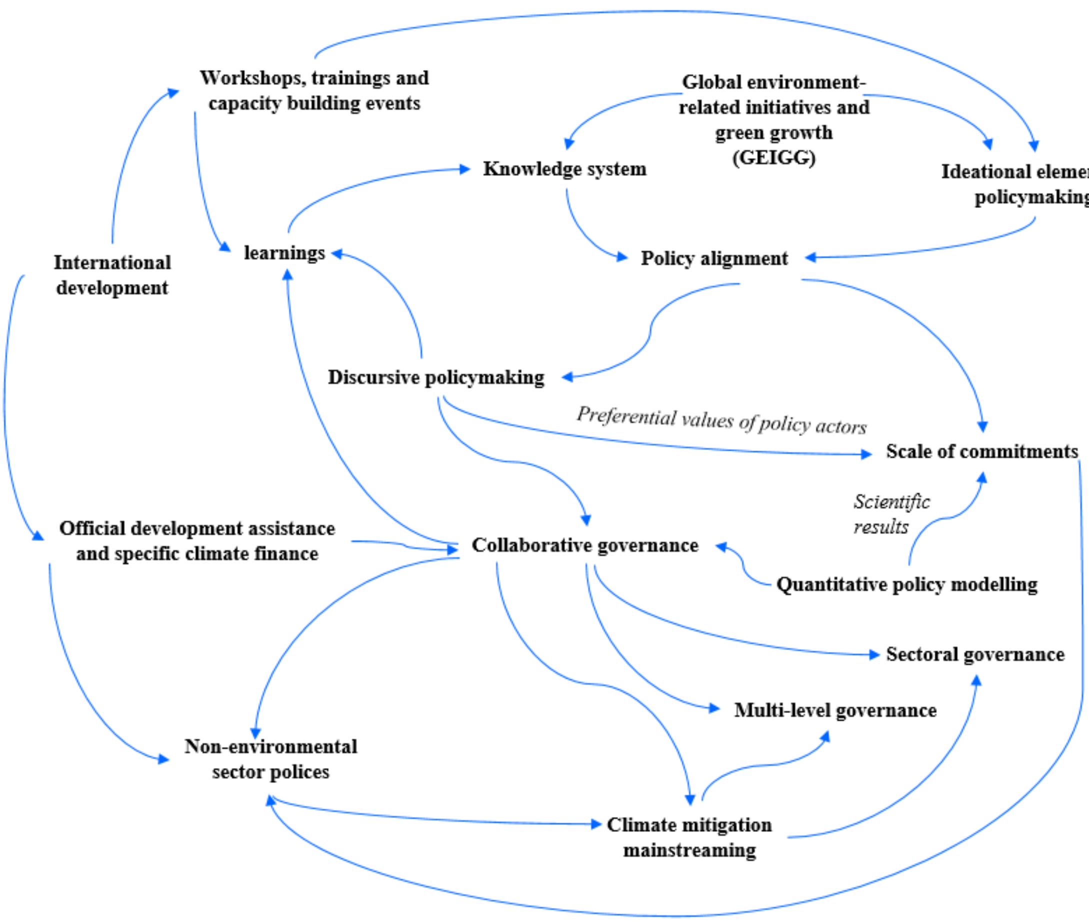

Figure 5.3 Causal relationship between influencing factors, knowledge and ideas of policy actors, policymaking approaches, and collaborative governance.

5.4.2. Climate mitigation mainstreaming process

5.4.2.1. Policy alignment as a first step

All respondents who emphasized the importance of incorporating climate change mitigation actions into non-environment sector policies mentioned that policy alignment is the very first step. Policy alignment is the process of aligning non-environment sector policy goals with the objectives of GEIGG. This alignment is likely to happen after the national policymakers commit to incorporating elements of GEIGG (e.g. reduction of resource use and GHG emissions). Policy alignment is linked to setting the policy direction which indicates how proposed changes to policy will be introduced. The respondents related policy alignment to the knowledge system and learning processes associated with discursive policymaking that uses consultations and collaboration across policy actors. However, the discursive policymaking was blamed for creating uncertainties about issues such as the types of resources the policies should focus on, the magnitude of reductions to resource use and GHG emissions, and the prioritization of sectors. These uncertainties were highlighted as the downsides of using discursive policymaking by most of the respondents. These respondents viewed quantitative policy modelling as a solution. Quantitative policy modelling uses technical methods with less stakeholder consultation. Notwithstanding the uncertainties, policy alignment was deemed sufficient to maintain consistency across non-environment sector polices in terms of incorporating climate change mitigation actions. A few respondents also said that GEIGG self-align with non-environment sector polices, and that the impacts of the uncertainties mentioned above are insignificant. Respondents from central government organizations mentioned that two decades of national experience in dealing with the global environment-related initiatives and concepts like green growth have given them the confidence needed to manage any uncertainties. Further, respondents felt that the ability of environment sector organizations to analyze the potential impacts of incorporating GEIGG on the economy, and the realistic level of climate change mitigation actions the country can commit to, can help manage uncertainties.

5.4.2.2. Scale of commitments as a metric of mainstreaming

The extent of the commitment to an objective policy goal is usually expressed in terms of a numerical target for a reduction in resource use or a reduction in GHG emissions. The respondents viewed setting these targets as the next step to incorporating elements of GEIGG. Most respondents mentioned that including these targets in the policies involves uncertainties. For example, policy actors from international development organizations and local non-government organizations are usually in favour of radical change in the shortest possible period, whereas private sector stakeholders prefer incremental change over longer periods. The difference in the preferences of different policy actors was identified as one of the main sources of conflict when using a discursive policymaking approach. Therefore, to decide on achievable commitments, respondents from government organizations mentioned that they favoured the use of quantitative policy modelling because the ability to achieve desired reductions in resource use and GHG emissions should be considered more important than the preferences of non-government policy actors. A team of technical experts from key GHG emissions sectors such as energy and AFLOU lead the technical analysis and the ensuing human and financial resource capability assessment. The respondents from non-government international development and private sector organizations emphasized the need for government policymakers to leverage the knowledge system to reflect the objectives and requirements of GEIGG while deciding on the scale of commitments. A few respondents mentioned that having higher commitments in polices implies strong integration of the elements of GEIGG, meaning that the numerical scale of commitments can be viewed as a metric for measuring the level of mainstreaming.

5.4.2.3. Financial policy instruments fostering the collaborative governance

Information-based, market-based, and finance-based instruments were identified as the preferred policy instruments by the respondents. These policy instruments, particularly the finance-based support communities and private sector organizations by creating dedicated financial resources to deploy climate change mitigation actions on the ground. Central government and international development organizations have facilitated the creation of dedicated financial resources such as climate change budget codes, REDD financing, and a climate change fund. These financial resources have brought non-environment sector organizations and local government organizations on board, and have also encouraged them to practice collaborative governance. In the past collaborative governance has been largely ignored, especially in climate change mitigation projects. The respondents mentioned that government policymakers in Nepal have successfully leveraged GEIGG-linked market and financial instruments such as carbon trading under the clean development mechanism (CDM), thereby benefitting the private sector and communities. Other financial incentives such as subsidies for renewable energy and energy-efficient technologies are still covered by a share of ODA received from international development organizations. Quantity-based policy instruments were also mentioned by the respondents as the preferred ones after finance- and market-based instruments. However, quantity-based instruments are connected more with legal and regulatory frameworks, and they therefore provide relatively weak incentives for the private sector and communities. However, quantity-based instruments provide guidelines for private sector organizations and communities for devising their resource use and GHG emissions reduction strategies. This measure is non-regulatory at this stage but is highly encouraged by the government.

5.4.2.4. Policymaking approaches and collaborative governance for envisioning realistic goals

Most respondents mentioned that the discursive policymaking and quantitative policy modelling approaches complement each other. The quantitative policy modelling is mainly used to support decision-making associated with discursive policymaking. For example, for technical analysis to support the case for incorporating climate change mitigation actions as policy objectives; and to resolve contentious issues regarding the scale of commitments and priority sectors. The respondents from government organizations viewed quantitative policy modelling as an independent part of policy formulation that was usually favoured by the lead government agencies responsible for developing non-environment sector policies. Lead agencies use quantitative policy modelling to present scientific results that are rarely influenced by the preferential values of non-government policy actors. The private sector respondents mentioned the need to have objective policy statements which refer to reductions in resource use and GHG emissions in quantitative terms. Quantitative policy modelling provides a clear understanding of the financial incentives available and the extent of resource use and GHG emission reduction they can deliver, as explained by the respondents from the private sector and local government organizations.

Aligning the policy objectives and setting the scale of commitments entails agreement between local and central government policymakers. This is usually done in a collaborative environment that involves sectoral and multi-level governance. The respondents from government organizations stated that collaborative governance is part of the policy formulation process per se. However, the private sector and international development organizations thought otherwise, as they said lead agencies can overlook feedback from non-government policy actors. Nonetheless, in non-environment sector policies there could be statements about incorporating the objectives of GEIGG. However, respondents did not view this as a significant policy milestone. Maintaining consistency in clearly stating the realistic goals and targets across policies are viewed as a key step. Collaboration for setting realistic targets based on individual sector capabilities is an impactful step towards mainstreaming climate change mitigation actions. A few respondents emphasized the need for a collective effort that extended beyond policy design to include delivery. Sectoral growth, job creation, and addressing social issues remain the primary goals of non-environment sector policies. However, the cross-cutting nature of climate change mitigation actions and the availability of international climate finance have encouraged government policymakers to foreground climate change mitigation actions in sectoral and multi-level governance, thereby fostering collaborative governance.

5.4.3. Levels of mainstreaming climate change mitigation actions across sector policies in Nepal

Table 5.2 shows the findings from the review of non-environment sector polices in Nepal and the way climate mitigation actions are incorporated in Nepal's key sector policies across four conceptual criteria. The National Energy Strategy of Nepal (WECS, 2013); Forest Sector Strategy (2016-2025) (MFSC, 2015), and the Reducing Emissions from Deforestation and Forest Degradation (REDD+) strategy (MFE, 2015) have included climate change mitigation actions as overriding objectives, and hence mainstreaming is prioritized. The National Environmentally Sustainable Transport Strategy (MPIT, 2015) seems to have realized the advantages of synergies between policies, and this strategy has therefore included climate mitigation actions such as the use of electric vehicles and lowering the GHG emissions from the transport sector. These add-on objectives mean that the level of mainstreaming is harmonization. The Agriculture Development Strategy (2015-2035) (MAD, 2015) and the Industrial

Policy (2011) (MICS, 2011) minimize the contradictions between policies by stating that climate change mitigation actions such as reductions in energy use and GHG emissions are key considerations. However, these policies have not addressed climate change mitigation-related policy statements against the sector and multi-level governance, financial and human resources and the institutional changes criteria. Therefore, the level of mainstreaming is limited to coordination.

Table 5.2. Findings from the review of non-environment sector policies of Nepal

Climate change mitigation actions across four conceptual criteria			
Policy objectives and impacts	**Sector and multi-level governance**	**Human and financial resources**	**Institutional changes**
• Promotion of energy efficiency, renewable energy and GHG emissions reduction across residential and industry sectors.	• Allocation of responsibilities such as energy management to non-environment sector organizations (forest, industry and transport) and local government bodies.	• Strengthening of the organizational, technical, and leadership capacities of forest, agriculture, transport, and energy sector bodies (both central and local).	• Creation of energy coordination committee at federal level.
• Enhance forest carbon stock by at least 5% between 2015 and 2025.	• Coordination across non-environment sectors and local bodies regarding forest, agriculture and energy policy issues.	• Enhancement of institutions' capacity to undertake policy reform and the capacity to regulate policies.	• Allocation of responsibilities (climate change mitigation-related) to the water and energy commission.
• Increase the productivity of forest resources (biomass) and intensify sustainable forest management.	• Enhancement of partnerships and coordination amongst different government agencies for establishing a climate-resilient society.	• Making use of opportunities for carbon trading under Clean Development Mechanism (CDM) and REDD.	• Creation of separate Renewable Energy Development agency or upgrade of existing Alternative Energy Promotion Centre.
• Promotion of community-based climate change mitigation measures in Agriculture, Forest and Other Land Use (AFOLU) sector.	• The approach of the forest sector strategy is consistent with Reducing Emissions from Deforestation and Forest Degradation (REDD) approaches.	• Institutional capacity building and development of human resources to capture carbon credit benefits.	• Creation of forest groups at local level with clearly established roles and authority to respond to climate change including mitigation.
• Promotion of electric vehicles and minimization of CO_2 emissions from transport.	• Improve access of local communities (Forest and agriculture groups) to carbon benefits generated from REDD.	• Participation in financing mechanisms for carbon markets.	• Envisioning the creation of forest carbon trust fund via institutional change.
• Reduction of energy use in production processes across industry sector.		• Access to REDD financing and disbursement to local beneficiaries.	• Changes in institutional arrangements and policy reform to attract native and foreign investments in hydropower projects.

5.5. Discussion

This study generated three key insights. First, about the way GEIGG-related policy discourse are influencing climate change mitigation mainstreaming in Nepal. Second, the process by which mainstreaming of climate mitigation actions unfold within the government policy landscape in Nepal. Third, the level of mainstreaming across six non-environment sector policies in Nepal by using De Roeck et al. (2018) indicators for measuring the scale of integration of environmental objectives into non-environment sector policies. These insights explain the causal mechanism between influencing factors (i.e. GEIGG), knowledge and ideas of policy actors, policymaking approaches, and collaborative practice across sectors and multi-level governance to answer how and to what extent the objectives of GEIGG has become a mainstream policy issue in Nepal.

We found that the GEIGG-related policy discourse and the ensuing meetings, workshops, and capacity building events involving policy actors contribute positively to the knowledge system via learnings, and the exchange of ideas between policymakers is strengthened. The influencing factors contributing to the knowledge system and the ideational element of policymaking are a positive step forward for policy actors as the climate change policies (2011 and 2019) and the NDCs (2016 and 2020) mention enhancing the individual and institutional capacity regarding climate mitigation in Nepal. The enhanced capacity of the policy actors could support initial progress on climate mitigation mainstreaming, particularly in transport, agriculture, and industry sectors that are yet to incorporate climate mitigation actions as overriding policy objectives in their sectoral policies.

We observed that climate mitigation mainstreaming starts by aligning the objectives of GEIGG with the non-environment sector policy goals, and the alignment employs discursive policymaking. While discursive policymaking has been criticized for its dependence on unstructured and rhetorical argumentation (Wood, 2015), respondents talked about relying on quantitative policy modelling in a collaborative environment to decide the scale of commitments once alignment has been achieved. Thus, utilizing the evidence-based rhetorical argumentation appeared as a way to seek a balance between interest-based preferential values of policy actors and the scientific approach, which is a part of an enhanced knowledge system. We found that the scale of commitments expressed as numerical policy targets in non-environment sector policies was understood as an indicator of climate mitigation mainstreaming by respondents. Based on this finding, we suggest that this indicator can complement De Roeck et al. (2018) indicators for measuring the scale of integration as the latter is highly subjective. However, further research on this can shed more light on the suitability of using numerical policy targets as an indicator for understanding the level of climate mitigation mainstreaming.

While the GEIGG-related policy discourse has influenced policy in multiple non-environment sectors in Nepal, the respondents were more interested in climate mitigation being incorporated into projects. Thus, the influence of GEIGG on sectoral policies does seem to have ultimately affected projects active on the ground, as these projects are linked to delivering the objectives of GEIGG across non-environment sectors. The respondents' interest in translating climate mitigation actions in policies into on-ground actions via climate change mitigation projects implies a focus towards delivering the objectives of GEIGG in addition to merely mainstreaming via sectoral policies. The respondents reported, there are several active projects related to the energy and forest sectors, and these sectors contribute more than 40% of GHG emissions in Nepal (MoPE, 2015). The level of mainstreaming of climate change mitigation actions in these sectors policies (energy and forest) is prioritization, meaning a delivery-focused mainstreaming of climate mitigation in these two sectors The level of mainstreaming in the agriculture sector is coordination despite this sector contributing about 48% of GHG emissions in Nepal and several on-ground actions as reported by the respondents (MoPE, 2015; MAD, 2015). This implies that a sectoral policy can be delivery-focused even with a relatively weak mainstreaming. The transport and industry sectors were reported to have relatively less active projects by the respondents and have a harmonization and coordination level of mainstreaming, respectively. These are insignificant sectors in terms of GHG emissions in Nepal.

A relatively weak level of climate mitigation mainstreaming in non-environment sectors (Transport and Industry) that do not contribute significantly towards the nation's GHG emissions means that policymakers focus more on sectors with higher potential for GHG emissions reduction. The respondents reported that an assessment of each sector's potential to achieve reductions of resource use and GHG emissions was followed by analyses on which to base predictions of sectoral growth and job creation, and to address other environmental issues. The analyses showed other non-climate benefits such as sustainable agriculture, the introduction of electric and low emissions vehicles, and improved indoor air quality in buildings and industries. We found that policy actors consider the advantage of non-climate benefits of climate mitigation actions and cross-sectoral collaboration. Respondents pointed to both of these as encouraging factors to incorporate climate mitigation actions as add-on policy objectives in policies of sectors with relatively least potential to reduce GHG emissions. Therefore, we argue that addressing non-climate benefits of climate mitigation actions via sectoral policies can be accounted as part of mainstreaming. This argument is supported by respondents' information and by the study (Zen et al., 2019), which found that mainstreaming in climate policy encompasses non-climate policy gains such as conservation strategies, environmental management plans, and sustainable developments strategies for different economic sectors.

The respondents linked the GEIGG as an influencing factor for incorporating climate mitigation actions to the country being a signatory to the Paris Agreement and the SDGs. This finding is also evident from the study by Laudari et al. (2021), which identified international obligation and international fund as factors to framing climate actions into Nepal's NDCs instead of framing based on a nationally determined plan of climate actions. In contrast to Laudari et al. (2021) point about not focusing on nationally determined climate actions plan, our findings suggest that climate mitigation mainstreaming process in Nepal have employed both technocratic and discursive policymaking approaches. The respondents talked about using evidence-based rhetorical argumentation while framing climate mitigation actions into sectoral policies. However, we found that the process by which mainstreaming occurs is hindered by lack of financial resource, limited capacity of policy actors, particularly the local government stakeholders, and multi-level governance related to climate change primarily controlled by the central government organization. Benson et al. (2014) identify nation's limited technical capacity to analyze potential mitigation strategies as a barrier to mainstreaming. Similarly, Gomez-Echeverri

(2018) emphasize the role of policymakers' capacity to develop and implement programs of action using integrative approaches across sectors and geographies. Multi-level governance can also pose challenges, as policymakers at the sub-national level (i.e. local government organizations) depend on higher-level decision-makers (Gouldson et al., 2016). This seems to be the case in Nepal.

On one hand, effective multi-level governance and collaboration across sectors are challenged by the lack of finance and the limited knowledge capacity of the institutions involved (Busby and Shidore, 2017). On the other hand, proliferation and fragmentation of climate finance have also challenged policymakers to develop effective and coherent climate change policies that could integrate the measures adopted to combat climate change (Gomez-Echeverri, 2018; Van Asselt and Zelli, 2014). In the case of Nepal, the respondents reported that international climate finance has strengthened collaborative governance through the creation of climate change budget codes, REDD financing, and the climate change fund. However, the capacity of the political and administrative systems, and to some extent, income levels have been found to weaken the prospects for incorporating environmental objectives into sectoral policies (Tosun and Leininger, 2017). This implies that low-income countries like Nepal with limited institutional capacity in terms of financial and human resource might likely struggle to fully implement the objectives of GEIGG even if they are incorporated into sectoral policies. Our findings from the review of chosen policies in this study show significant progress pertinent to human and financial resources, and there are appropriate institutional and administrative changes that can strengthen the climate mitigation mainstreaming.

The institutional and administrative changes, particularly after transitioning into a federal system post-2015, necessitated an increased collaboration between federal, provincial, and local level organizations in formulating policies, plans, and projects related to climate change, including mitigation. Our analysis of the sectoral policies identified several measures towards fostering collaborating governance for climate mitigation across multiple levels of governments, particularly in sectors such as energy, forest and agriculture. The respondents provided further evidence on collaborative governance by pointing at the role of local-level organizations in delivering climate mitigation actions via projects active on the ground while the central level organization lead to access to the international financial resource pertaining to climate change. The recently updated climate change policy (MFE, 2021) of Nepal has explicitly mentioned collaboration amongst three levels of government, private sector and non-government organizations, including international development agencies.

Climate change mitigation was hardly a policy issue until the country produced climate change policy in 2011 and the NDC in 2016. Therefore, we suggest that the country can build on its climate adaptation-related progress to prioritize the objectives of GEIGG, especially in the transport, agriculture, and industry sector policies, and subsequently deliver the objectives of GEIGG across all sectors. In this way, climate mitigation mainstreaming in sectoral policies can be operationalized via more on-ground actions.

5.6. Conclusion

Our conceptualization of climate mitigation mainstreaming has provided insights into what causes climate mitigation mainstreaming, how the mainstreaming process unfolded, and the extent of mainstreaming. The GEIGG-related policy discourses are influencing the knowledge and ideas of policy actors, thereby affecting the climate mitigation mainstreaming process that involves cross-sectoral approach and multiple levels of government. Our analysis of the chosen policies shows that the level of climate mitigation mainstreaming varies across policies. We identified the levels of climate mitigation mainstreaming as: prioritization for the energy and forest sectors, harmonization for the transport sector, and coordination for the agriculture and industry sectors.

We found that the policy actors utilize both technocratic and discursive policymaking approaches as they deliberate on climate mitigation mainstreaming and its extent across sector policies. The causal relationship between the influencing factors and the collaborative practice between policy actors is such that the collaboration for mainstreaming is led by the central environment sector organization (e.g. the environment ministry). Nevertheless, this is a good starting point for strengthening collaborative governance, especially for aligning policy goals and for setting the scale of commitments that present and future projects on the ground can deliver. The local-level policy actors whose role appeared weak in the mainstreaming process have taken advantage of international development and international finance that have supported on-ground projects that are aimed at delivering climate mitigation actions incorporated in polices.

Finally, we conclude that climate mitigation mainstreaming via sectoral policies and the prospects for the delivery of the objectives of GEIGG via on-ground projects needs to be studied together to understand how mainstream agenda in policies are translated into practice. Our study generated preliminary findings about the notion of on-ground projects linked to climate mitigation mainstreaming. Therefore, we recommend that future studies focus on this to generate additional perspectives, which will benefit the climate mitigation mainstreaming-related literature and the global literature on mainstreaming in a climate policy context.

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Supplementary material to Chapter 5

Brief overview of the climate change policy landscape in Nepal

Nepal is a landlocked country situated between India and China. The Himalayas cover the significant proportion of the landmass in the Northern side to share a border with China. On the other three sides, Nepal shares a border with India. Figure A1 (5) below shows the map of Nepal. Nepal is one of the most climate vulnerable countries in the world, which is mainly due to its fragile economic and environmental base (Gentle and Maraseni, 2012). The complex topography and unstable geology makes Nepal susceptible to climate change-induced natural disasters (Panthi et al., 2012). Consequently, climate change is likely to impact all economic sectors of Nepal, including water, biodiversity, and agriculture for their sensitivity to climate change.

High vulnerability to climate change coupled with previous experiences pertinent to natural disasters means Nepal's policy response to climate change has emphasized localized action for climate change and disaster risk reductions (Vij et al., 2018). Further, following the United Nations Conventions on Climate Change (UNFCCC) negotiations, Nepal has been active in producing policies such as the National Adaptation Program of Actions (NAPA) and climate change policy (Ojha et al., 2016). The NAPA was produced in 2010, and the climate change policy was developed in 2011. To materialise the LAPA at the local level, Nepal developed a National Framework on Local Adaptation Program of Actions (LAPA) in 2011. These policy responses from the Government of Nepal (GoN) show that the core strategy to dealing with the climate change impacts in Nepal is via improving the adaptive capacity. A focus on climate change adaptation is understandable as the country's GHG emissions is not an immediate area of concern for policymakers. However, the Nationally Determined Contributions (NDCs) submitted to the UNFCCC as part of delivering the Paris Climate Agreement and the inclusion of climate change mitigation in climate change policies (2011 and 2019) means mitigation is considered in a climate change policy discourse in Nepal.

Nepal's NDCs include the production of a low carbon economic development strategy (LCEDS) that will aim to achieve low carbon emission across economic sectors while promoting economic development. Similarly, the climate change policies (2011 and 2019) aim to deliver low carbon development. In addition to NDC, Nepal is also expected to prepare Nationally Appropriate Mitigation Actions (NAMAs) and submit to UNFCCC. However, the NAMA database does not show any active projects from Nepal as the NAMA is yet to be formally produced by GoN. Nepal is at the early stage in terms of framing climate change mitigation as an overarching policy agenda and in sectoral policies. And, the current progress on climate change mitigation relates to capacity building, financing GHG emission reduction projects, and linking mitigation to adaptation. Although adaptation focused, the UNFCCC's negotiations and the bi-lateral and multi-lateral donor organisations have encouraged policymakers to formulate climate policies in Nepal (Ojha et al., 2016).

Figure A1 (5). Location of Nepal in the South Asian region

Semi-structured interview questions

(i) General questions

1) What is your understanding of climate mitigation-oriented policies and non-environment sector policies? What is your understanding about mainstreaming climate mitigation into these policies?

2) Does the following dot point influence your works, especially with regard to climate mitigation-oriented policies and non-environment sector policies design and delivery: -

   - International Climate Agreements, the Sustainable Development Goals, green growth, and other global environmental commitments that you know about.

   A. As a government policymaker

   B. As a non-government organisation/international development and donor agency

   C. As a private sector stakeholder

   If yes, to what extent?

(ii) Global environment-related initiatives and Green Growth

3) Given the growth aspirations and development context of your country, to what extent climate mitigation related to International Climate Agreements, the Sustainable Development Goals, green growth, and other global environmental commitments are viewed as important national and sectoral policy drivers?

   A. As a government policymaker

   B. As a non-government organisation/international development and donor agency

   C. As a private sector stakeholder

4) How are the vision and objectives of International Climate Agreements, the Sustainable Development Goals, green growth, and other global environmental commitments are interpreted?

   A. As a government policymaker

   B. As a non-government organisation/international development and donor agency

   C. As a private sector stakeholder

5) How the commitments in relation to International Climate Agreements, the Sustainable Development Goals, other global environmental commitments, and adopting (or not adopting) green growth are discussed and finalised – for example through discursive policy approach or through quantitative policy modelling? To what extent these approaches are used (e.g. low, medium and high)?

   A. As a government policymaker

   B. As a non-government organisation/international development and donor agency

   C. As a private sector stakeholder

6) How can the prioritized International Climate Agreements, the Sustainable Development Goals, other global environmental commitments, and adopting the principles of green growth create uncertainty such as establishing policy direction and the scale of the commitments (incremental or radical) for transitioning to a low-carbon economy?

   A. As a government policymaker

   B. As a non-government organisation/international development and donor agency

   C. As a private sector stakeholder

7) Are national commitments arising from International Climate Agreements, the Sustainable Development Goals, green growth, and other global environmental commitments decided based on broad consultation across relevant government ministries and with local government representatives? How are the sectoral policy goals determined and whether or not they are looked for consistency in line with the commitments under climate agreements, the SDGs and green growth?

8) To what extent the relevance of green growth are considered whilst identifying the potential sectors and the likely benefits from adopting green growth?

   A. As a government policymaker

   B. As a non-government organisation/international development and donor agency

   C. As a private sector stakeholder

(iii) Policy paradigms

9) For implementing the climate mitigation and green growth programs, which policymaking approach seems to be better – discursive policy approach or quantitative policy modelling? How does these approaches influence knowledge and ideas, framing, policy goals, instruments, institutions, and collaboration pertaining to climate mitigation? What do you think: -
   A. As a government policymaker
   B. As an international development and donor agency
   C. As a private sector stakeholder
10) How has the climate agreements, the SDGs, and growth paradigms impacted the policy paradigms? What policy instruments and institutionalist approaches are favoured for effectively implementing commitments under climate agreements, and green growth across sectors?
   A. As a government policymaker
   B. As a non-government organisation/international development and donor agency
   C. As a private sector stakeholder
11) What policy analysis methods are used at sectoral level to determine goals and targets related to climate mitigation? How are the cross-sectoral and multi-level governance stakeholders involved?
12) How does the change in policy paradigms impact cross-sector/multi-level governance collaboration amongst policymakers? What sectoral issues are identified as the main goals (e.g. sectoral growth and job creation), and whether or not the implication of implementing commitments under climate agreements and adopting green growth on sectoral growth are analysed in detail?

Follow-up questions – depending on the answers from the respondents.

Supplementary material to Chapter 4 and Chapter 5

With Nepal, Vij et al. (2018) found that the climate policy paradigm in Nepal developed from being based on 'disaster response and relief' in the late-1990s to an existing 'localised action for climate change adaptation and disaster risk reduction' paradigm. These are adaptation-based climate policy paradigms. With climate mitigation in Nepal, Chapter 4 found that an existing climate mitigation-based policy paradigm emerged post-2005. It co-exists with the climate adaptation-based policy paradigm in Nepal. To better comprehend the paradigmatic change in climate change-oriented policies of Nepal, I use policy delivery and development perspectives. While the policy delivery perspective analyses the existing policy paradigms outputs on the ground, the development perspective analyses important relationships of climate change adaptation and mitigation with the development objectives of Nepal.

I start by using empirical evidence on climate change adaptation and mitigation in Nepal. For example, I analyse Nepal's Economic Vulnerability Index (EVI) time-series data (2002-2021) to study progress in the climate change adaptation front. The EVI was developed by the United Nations Committee for Development Policy (UNCDP, 2021). Therefore, it integrates with international development policies, including foreign aid for climate change adaptation and mitigation in the least developed countries (e.g., Nepal). The economic vulnerability of a country is measured by the risk to its development objectives from 1) environmental and natural shocks, such as the droughts, floods, storms, and earthquakes, and 2) trade and exchange-related shocks, such as the commodity price instability and other international financial fluctuations (Guillaumont, 2009). The EVI includes the following sub-indices: 1) share of agriculture, fisheries, and forestry (AFF), which is the share of these sub-sectors of an economy in the gross domestic product (GDP); 2) remoteness and landlockedness (REM), 3) export concentration (XCON), 4) export instability (XIN); 5) share of population living in low elevated coastal zones (LECZ); 6) population living in drylands (DRY); 7) agricultural instability (AIN); and 8) victims of disasters (VIC). Of these, I exclude (5) and (6) from analysis because these sub-indices are not relevant for Nepal, and therefore, there is a lack of data for Nepal (UNCDP, 2021). The EVI's sub-indices explain exposure to any external events and the corresponding shocks on the socio-economic system

(Feindouno and Goujon, 2016). I got the EVI and its sub-indices data from the United Nations Committee for Development Policy Secretariat's LDC-specific database (UNCDP, 2021). I also collected the GNI per capita (GNIC) data due to its relationship with climate change adaptation and mitigation.

For climate change mitigation, I use absolute GHG emissions (GHGE), GHG emissions per capita (GHGPC), and carbon productivity (CarbPro) to account for both absolute and relative progress made in climate change mitigation front. The GHGE is the quantitative change in GHG emissions values in an absolute sense, and the GHGPC and CarbPro are quantitative changes in a relative sense. While the GHGPC explains the absolute GHG emissions generated by a single person each year, carbon productivity explains the economic value added (GDP) per unit of absolute GHG emissions (Hu and Liu, 2016). I collect quantitative time-series data (2002-2021) of GHGE, GHGPC, and CarbPro from the World Development Indicator database (World Bank, 2021).

Then, I create a relative change index (RCI) for two main reasons to analyse climate change adaptation and mitigation's quantitative data. First, to benchmark the values of EVI and its sub-indices and the climate change mitigation-related variables, such as the GDGE, GHGPC, and CarbPro. Second, to note their relative progress in the last two decades between 2002 and 2021. The following equation expresses the RCI.

Relative change index (RCI) = x_i/x_0 …………………..Eq. (1)

Where 'x_0' is the variables data for the base year 2002, and 'xi' is the yearly values of the variables for i = 2003 to 2021.

I also calculate the annual change values of the variables data by using the following equation.

Annual change = $(x(i+1)/xi)\times 100$ …………………..Eq. (2)

Where 'xi' is the variables data for 'ith' year and 'xi+1' is the variables data for the '(i+1)th year.

Figure 1 shows the relative change index values of EVI, GNIC, GHGE, CarbPro, and GHGPC. While the lower relative change index values of EVI, GHGE, and GHGPC suggest progress, higher relative change index values of GNIC and CarbPro imply progress. In the first decade between 2002 and 2011, the EVI and the GHGPC decreased slowly, meaning the progress on climate change adaptation and mitigation were slow but steady. In the same period, the GHGE increased slightly. Despite the rise in absolute GHG emissions (GHGE), the notable increase in CarbPro, which performed better than the GNIC, indicates significant progress in the climate mitigation front. The annual change in the CarbPro (Figure 2) outperformed others as the scale of its yearly change is highest amongst all. In the later period (2012-2021), the GNIC shows strong progress relative to others as its annual change is mostly positive (Figure 1 and Figure 2). In the later period (2011-2021), the EVI, GHGE, and the CarbPro trend appears stable amidst strong progress in the GNIC (Figure 1). Therefore, while the income (GNIC) grew strongly, climate change adaptation and mitigation progress slowed down relative to earlier (2002-2011).

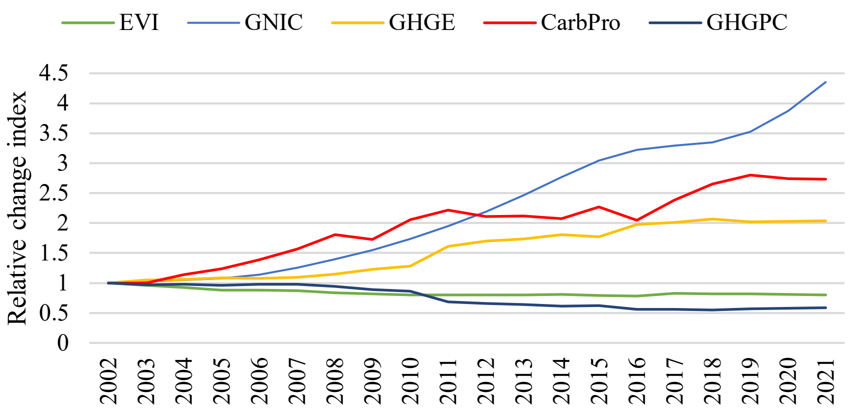

Figure 1. Relative change index between 2002 and 2021

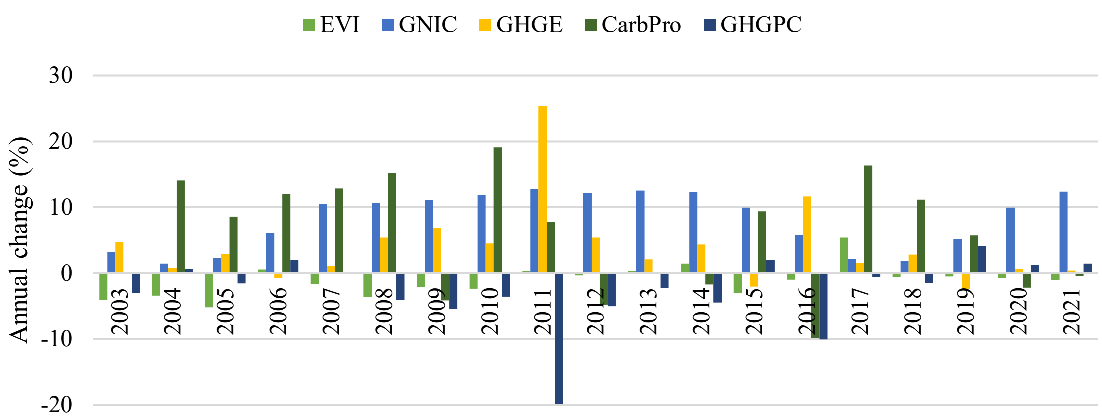

Figure 2. Annual change of EVI, GNIC, GHE, CarbPro, and GHGPC.

I found a negative correlation between GNIC and the EVI (Figure 3), implying that EVI has reduced with an increase in the nation's income (GNIC). A negative correlation between EVI and CarbPro and a positive correlation between EVI and GHGPC implies that Nepal's adaptative and mitigative capacities have been strengthened together in the last two decades. The GNIC has a negative correlation with the GHGPC but positive correlations with GHGE and CarbPro. This indicates that whilst increasing income, the mitigative capacity has been improved. However, there remains a concern regarding absolute GHG emissions (GHGE) amidst Nepal's small share in the global GHG emissions (0.04%). Figure 4 shows the correlation between variables for two periods under the study (2002 to 2011 and 2012 to 2021). As shown by Figure 1 and Figure 2, Figure 4 shows that much of the progress in climate change mitigation and adaptation happened in the earlier decade, which subsided in the later decade. In the earlier decade, the correlation values (both negative and positive) are relatively higher than in the latter decade, meaning the progress on climate change adaptation and mitigation fronts was initially more intense than the recent progress. Thus, I infer that climate change adaptation and mitigation-based policy paradigms are: 1) weakly operationalised in recent years; 2) the impact of climate change has become far more intense in recent years and that the climate adaptation policy actions and on-ground actions are insufficient. Similarly, the mitigation efforts have become least compatible with the economic development objectives (e.g. LDC graduation). Nevertheless, the recent empirical evidence indicates the need for more climate adaptation and mitigation efforts reflected into the climate adaptation- and mitigation-based paradigms in Nepal.

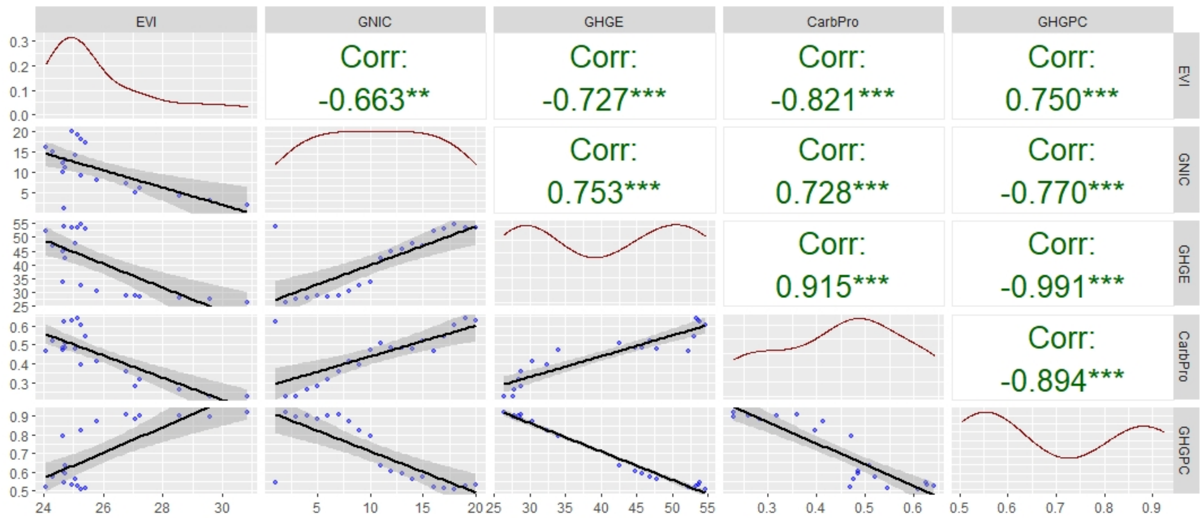

Figure 3. Bivariate plots and correlation values of EVI, GNIC, GHE, CarbPro, and GHGPC (2002 to 2021 data).

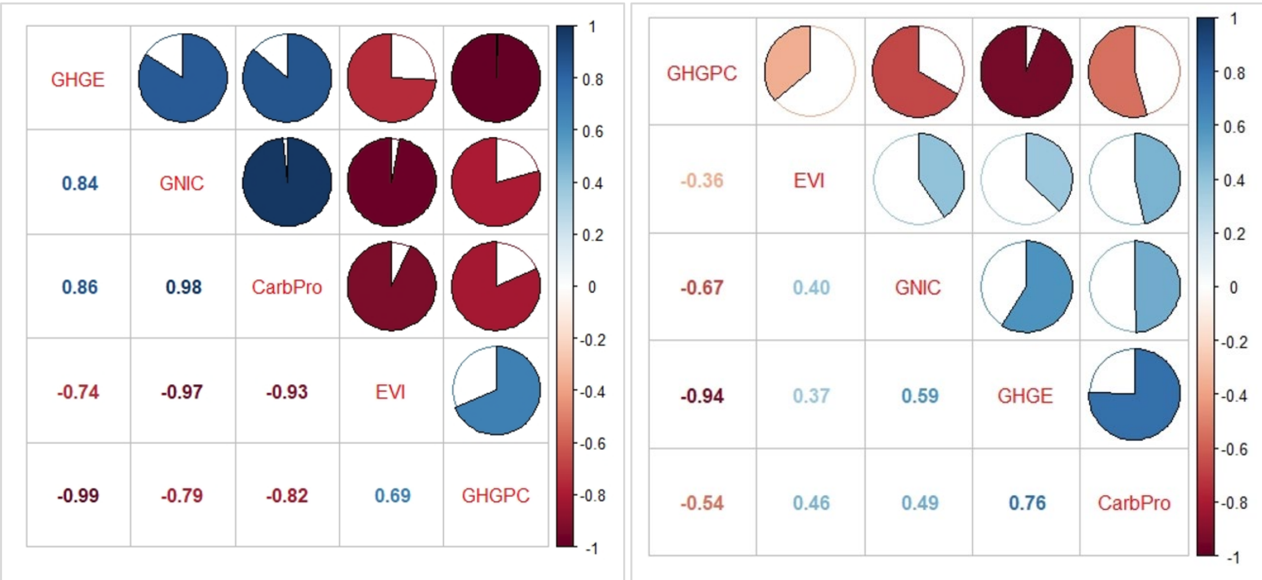

Figure 4. Correlation plots in the two time periods between 2002 and 2021 (left: 2002 to 2011, right: 2012 to 2021).

Chapter 5 to Chapter 6 transition paragraphs

The previous chapter created a conceptual framework for studying the mainstreaming of climate mitigation actions into government policies in Nepal. By applying the conceptual framework, the previous chapter concluded that the policy discourse on global environment-related initiatives and green growth drives mainstreaming of climate mitigation in Nepal. The submission of Nationally Determined Contributions (NDCs) to the UNFCCC, as part of a global environment-related initiative (the Paris Climate Agreement), and the consideration of green growth by policymakers in Nepal present as important issues in Nepal's policy landscape. The next chapter covers both of these important topics by exploring the case for green growth for the effective implementation of Nepal's NDC. The implementation of NDCs will be considered effective when the economy-wide energy and carbon productivity and the nation's absolute GHG emissions decrease by 2030 with respect to the benchmark values in 2015.

Another important conclusion from the previous chapter is that the level of mainstreaming of climate mitigation varies across different policies. For example, the level of mainstreaming is prioritisation for the energy and forest sector, harmonisation for the transport sector, and coordination for the agriculture and industry sectors. The varying levels of mainstreaming implies that the sectoral policies prioritise climate mitigation actions differently. Therefore, the prospect for delivering GHG emissions reductions via sectoral policies, particularly during the policy implementation phase, depends largely on further mainstreaming climate mitigation into sectoral policies. For example, the two NDC documents Nepal submitted to the UNFCCC in 2016 and 2020 focus largely on the energy and forest sectors and also on the transport sector. These are the sectors with prioritisation and harmonisation levels of climate mitigation mainstreaming. However, the agriculture sector is responsible for about half of the nation's GHG emissions, as stated by the NDC document of Nepal. Therefore, the next chapter uses different climate policy scenarios to focus on the possibility of using green growth to create coherence between sectoral policies for achieving jointly agreed policy goals, which are the climate mitigation actions.

Chapter 6: Linking climate policy across economic sectors: green growth potential in Nepal

Paper preface

This chapter includes a co-authored peer-reviewed paper, which is in a second review stage after revision. The full bibliographic details of the paper, including all authors are:

> Baniya, B., Giurco, D., & Kelly, S. (2021). Linking climate policy across economic sectors: A case for green growth in Nepal, Submitted to *Natural Resources Forum* Journal (in a second review stage after the submission of a revised manuscript that responded to initial reviewer comments).

Bishal Baniya led the research project, collected and analysed the data, and wrote the full paper. Damien Giurco (Principal supervisor) and Scott Kelly (Co-supervisor) provided supervisory guidance and reviewed the paper.

Research highlights

- The Nationally Determined Contribution (NDC) of Nepal focuses primarily on the energy sector despite the agriculture sector contributing to about half of the nation's GHG emissions.
- The predicted values of energy use and GHG emissions of Nepal until 2030 revealed that the delivery of NDCs would likely be ineffective.
- There exist a weak coherence between policies focused on climate mitigation and sector policies.
- Green growth seems to offer an attractive value proposition for policymakers, especially in improving policy coherence between the NDC and sectoral policies.

Abstract

While the energy sector is the largest global contributor to greenhouse gas (GHG) emissions, the agriculture, forestry and other land use (AFOLU) sector account for up to 80 per cent of GHG emissions in the least developed countries (LDCs). Despite this, the nationally determined contributions (NDCs) of LDCs, including Nepal, focus primarily on climate mitigation in the energy sector. This paper introduces green growth – a way to foster economic growth while ensuring access to resources and environmental services – as an approach to improving climate policy coherence across sectors. Using Nepal as a case country, this study models the anticipated changes in resource use and GHG emissions between 2015 and 2030, which would result from implementing climate mitigation actions in Nepal's NDC. The model uses four different scenarios. They link NDC and policies across economic sectors and offer policy insights regarding (1) energy losses that could cost up to 10 per cent of gross domestic product (GDP) by 2030, (2) protection of forest resources by reducing the use of biomass fuels from 465 million gigajoules (GJ) in 2015 to 195 million GJ in 2030, and (3) a significant reduction in GHG emissions by 2030 relative to the business-as-usual (BAU) case by greater use of electricity from hydropower rather than biomass. These policy insights are significant for Nepal and other LDCs as they seek an energy transition towards using more renewable energy and electricity.

Keywords: Climate mitigation; GHG emissions; energy loss; green growth; policy coherence.

6.1. Introduction

Although development issues are given greater priority in political discourse in least developed countries (LDCs), almost all LDCs are required to implement nationally determined contributions (NDCs) under the Paris Climate Agreement. However, despite the obligation to implement NDCs and focus on socio-economic development issues, only a limited number of studies focus on the links between NDCs and socio-economic development (Altieri et al., 2016; von Stechow et al., 2016). Whilst recent research on NDCs aims to promote discussions on the nexus between NDCs and socio-economic development, there is still a lack of appropriate approaches for assessing the linkage between NDCs and economic development, especially for low-income countries and within the government policy landscape. This research uses the concept of green growth as a strategic approach to assess linkage between NDCs and key sectors of the economy in Nepal, which is a case country. Green growth is defined as a way to foster economic growth and development while ensuring access to resources and environmental services from natural capital (OECD, 2011; OECD, 2018). Hallegatte et al. (2011) further clarify that green growth is resource-efficient, clean and resilient growth. The reference to resource-efficient and clean growth implies that using fewer, renewable and clean resources will potentially improve carbon and energy productivity. Resilient growth is economic growth amidst economic threats from climate change. In this paper, the green growth approach is viewed as having potential to improve coherence across policies representing different economic sectors in the context of implementing climate mitigation actions as NDCs. This is because green growth is one of the strategies favoured by mainstream economists and policymakers in studies related to addressing climate change. They see it as a means of reconciling the conflict between economic growth and environmental protection (Antal and van den Bergh, 2016).

Nepal is deemed a suitable case country for two main reasons. First, Nepal is a LDC with minimum levels of climate policy mainstreaming. Saito (2013) notes that the level of mainstreaming of climate change-related policies and actions is minimal in Nepal. This implies that one of the most vulnerable countries is yet to fully recognise the importance of climate change policies, particularly by covering the mitigation aspect that has been traditionally ignored in favour of climate adaptation. Second, because of the priority placed on non-climate benefits such as socio-economic development. NDCs were introduced by the UNFCCC as a policy initiative for countries to declare their intended climate actions post-2020. However, Shockley (2019) states that achieving mitigation and adaptation goals in NDCs depends on the determination of nations, meaning that the LDCs could operate on a business-as-usual basis (BAU) to deliver committed climate actions, especially in the absence of other benefits in delivering NDCs. Therefore, climate policies could also incorporate non-climate objectives (Vogt-Schilb and Hallegatte, 2017). This is important for an LDC like Nepal, where policymakers prioritise addressing their economic and social problems as well as reducing GHG emissions.

Nepal contributes 0.027% of total global GHG emissions (MoPE, 2015). The Third National Communication (SNC) report on GHG emissions submitted by the Government of Nepal (GoN) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2017 highlighted the agriculture, forestry and other land-use change (AFOLU) sector as the largest contributor (50%), followed by energy (46%), and others (4%). These figures are similar to aggregated figures from low-income countries, as mentioned in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, where the AFOLU sector is the major contributor, representing up to 80% of total GHG emissions (Edenhofer et al., 2014). Previous literature has already highlighted the negative impacts of climate change on key economic sectors in Nepal, including agriculture, forestry, energy and water (Chalise et al., 2017; Devkota and Gyawali, 2015; IDS-Nepal et al., 2014). In 2015, the economy-wide impact of climate change was equivalent to a 1.5 to 2% decrease in GDP per year. This impact is expected to increase to 5% per year in the future under extreme conditions. These are high figures by international standards (IDS-Nepal et al., 2014). Effective implementation of committed climate mitigation actions in the NDC document is therefore essential if future economic losses arising from climate change are to be minimised. It is assumed that climate mitigation actions can be considered to be effective when, if implemented within a defined time, they: (i) do not negatively impact economic growth, and (ii) improve carbon and energy productivity on an economy-wide scale. It has been proposed that these conditions can be achieved by greening economic growth, also called 'green 'growth'. While this approach is not universally embraced, mainly because the approach typically focuses on efficiency and does not sufficiently consider ecological limits (Santarius, 2012; Ferguson, 2015), it does have a potential to help achieve decoupling of GHG emissions and resource use from economic growth.

The objective of this paper is to study the potential role of the green growth approach in delivering climate mitigation actions identified in the NDC, given the structural change in resource use and GHG emissions at the micro-economic level. The analysis of projected resource use and GHG emissions is used to discuss a case for better coherence between NDCs and policies across different economic sectors, thus ensuring NDC implementation is effective and well-aligned with other policies. The remainder of the paper is organised as follows: Section 2 describes the methods used. Section 3 presents the main results and discussion from this analysis. Section 4 presents the conclusions.

6.2. Methods

6.2.1. Case country

Whilst this paper focuses on Nepal, the case country is explored in the light of issues common to LDCs in the Asia region that have historically focused more on climate change adaptation. Nepal is a least developed country in terms of the United Nation's classification of countries. It is highly vulnerable to climate change and has minimum climate policy mainstreaming (Saito, 2013). As with most low-income countries, the AFOLU sector is the major contributor to Nepal's total GHG emissions—however, the focus of Nepal's NDC is more on reducing GHG emissions from the energy sector (MoPE, 2015). Nepal's GHG emissions share is about 4% of the total GHG emissions generated from seven LDCs in Asia (Afghanistan, Bangladesh, Bhutan, Cambodia, Lao PDR, Myanmar, and Nepal) despite contributing to about 9% of the population and 6% of the gross domestic product (GDP). However, the per capita energy use of Nepal (18 GJ) is the highest of these seven Asian LDCs. Green growth was introduced in the government policy landscape in Nepal by the global green growth Institute (GGGI) in 2015, although it is not a mainstream policy agenda yet (GGGI, 2017). Higher energy use per capita, the presence of a green growth program, and its being a country in transition to graduate from the LDC status of the United Nations, make Nepal a good case country for exploring the NDC and socio-economic development linkage.

6.2.2. Model framework

A quantitative approach was used to forecast and analyse energy use and GHG emissions data from Nepal's energy and AFOLU sectors between 2015 and 2030 and to estimate energy productivity and carbon productivity in 2030. High energy productivity is desirable, as it indicates high economic output per unit of energy. High carbon productivity is also desirable and could be achieved by lowering GHG emissions from economic activities. The Long-Range Alternative Energy Planning (LEAP) is used to forecast future energy use and GHG emissions in Nepal, particularly for the energy sector. LEAP is widely used for energy policy analysis and climate change mitigation assessment. At least 32 countries have used LEAP to create energy and GHG emission scenarios to develop their NDCs (Heaps, 2016). However, LEAP does not model non-energy-related GHG emissions from the AFOLU sector, so the IPCC guidelines for national GHG emission inventories (2006 version, volume 4) were used to estimate these emissions.

The LEAP model was used by Sapkota et al. (2014) to study the role of renewable energy technologies for rural communities in Nepal. Similarly, Bhandari and Pandit (2018) used LEAP to model residential sector energy demand in Nepal, and Pradhan et al. (2006) used LEAP to study GHG emissions from the transport sector in Nepal. While Pokharel (2007) and Parajuli et al. (2014) used an econometric approach (multivariate regression analysis) to model future energy consumption in Nepal, Baniya et al. (2021) use machine learning via Python programming to model energy and material consumption for Nepal and Bangladesh. For the AFOLU sector, Pradhan et al. (2017) use the 'AFOLU-B' model to study GHG emissions abatement in Nepal. This paper builds on previous works on energy use and GHG emissions modelling for both energy and AFOLU sectors in Nepal to study a case for an effective implementation of NDCs. A focus on economy-wide improvements in carbon and energy productivity via modelling NDCs and using both the LEAP tool and IPCC guidelines for national GHG emission inventories are deemed ways of adding value to the existing energy and GHG emissions modelling studies pertaining to Nepal.

Four scenarios with different levels of resource use and different GHG mitigation targets were developed—namely, 1) a business-as-usual (BAU) scenario; 2) a nationally determined contribution (NDC) scenario; 3) an 'other policies' scenario (OPS); and 4) a 'beyond NDC' (BNDC) scenario. The BAU scenario is a reference scenario that assumes no sectoral policy interventions and no NDC implementation. The NDC scenario assumes that all climate mitigation actions in Nepal's NDC are implemented. The OPS scenario assumes that the NDC is not implemented, but that sectoral policies are implemented on a nationwide scale. The BNDC scenario assumes that the NDC is implemented to address perceived gaps. Future resource use and GHG emissions data for all scenarios were then used to see how green growth indicators (OECD, 2017b), carbon productivity and energy productivity would change between 2015 and 2030 across all scenarios.

6.2.2.1. Data types, sources and modelling

Figure 6.1 depicts the methods used for projecting future GHG emissions from the energy and AFOLU sectors between 2015 and 2030, and for estimating the carbon and energy productivity values in 2030. Data types and sources are also shown in Figure 6.1. The year 2015 was chosen as the base year for all four scenarios. This was the year when the first NDC for Nepal was submitted to the UNFCCC. Two types of data inputs were used, namely activity data and scenario data. Activity data are socio-economic data that depend on sectoral and human consumption activities. Scenario data are data generated from climate mitigation commitments made in the NDC, and from assumptions made in the scenarios.

Base-year activity data: These were taken from reports produced by the Government of Nepal (MoAD, 2016; MoFSC, 2015; MoPE, 2015; MoSTE, 2014) and development indicator databases established by international agencies: the Asian Development Bank (ADB, 2018), the World Bank

(World Bank, 2021), International Energy Agency country statistics for Nepal (IEA, 2018), and the Food and Agriculture Organisation of the UN database (FAO, 2018).

End-year scenario data: LEAP projects future energy consumption and GHG emissions for all years between 2015 and 2030, based on activity data from the base year and scenario data from the end year. However, end-year scenario data such as sectoral value-added data, nominal GDP per capita and energy consumption by fuel types (all variables affecting energy demand) are difficult to estimate without a proper data modelling technique. Sectoral energy consumption data for 2030 were predicted by using regression analysis of sectoral value-added data between 2005 and 2015. The sectoral energy consumption data for 2030 is used to estimate the factor increase for each of the fuel types between 2015 and 2030. The factor increase is an input data under the BAU scenario which together with socio-economic data—such as increase in number of households, sectoral value-added growth, and increased population with access to energy—project total energy demand for each of the four scenarios via the LEAP model. The assumption about factor increase of each fuel types is explained in detail in section 2.4 and Table 6.3.

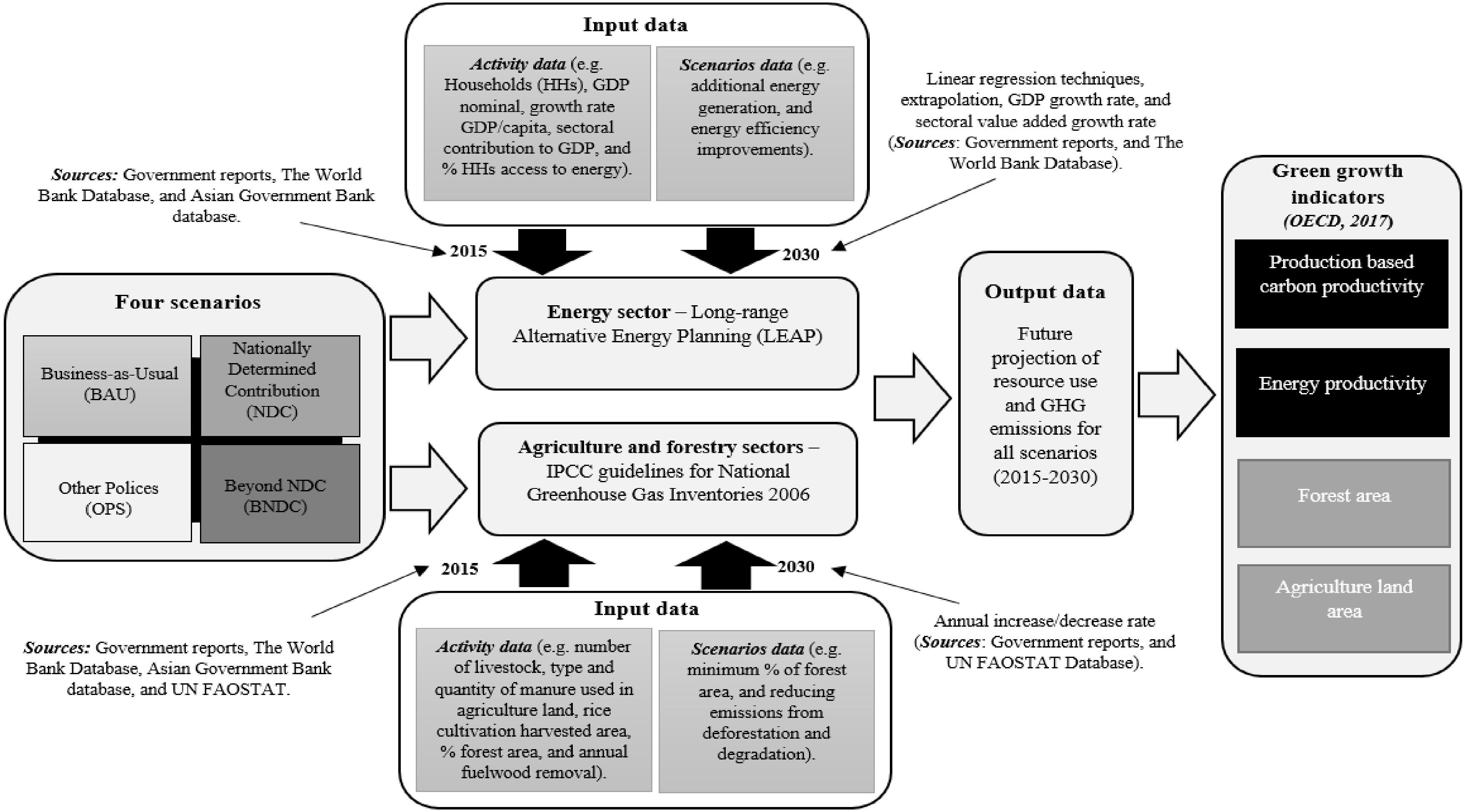

Figure 6.1. Methods used for estimating future energy use and GHG emissions from energy and agriculture, forest, and other land-use sectors

To estimate the factor increase of each fuel type between 2015 and 2030 for the BAU scenario, a linear-regression method $y = \beta x + c$, was used. A forecasted sectoral value-added data in 2030 was also used as a predictor variable for the agriculture, service, and mining and manufacturing sectors. Nominal GDP per capita in 2030 was used as a predictor variable for the residential and transport sectors. A linear-regression method was preferred over a multiple regression model. This was done to avoid duplication when the LEAP model used the number of households and access to energy services (percentage of households) as additional explanatory variables along with sectoral value-added data to estimate sectoral energy consumption in 2030. Table 6.1 shows the value of sectoral energy consumption and the values of relevant predictor variables, constants and R^2.

Table 6.1. Forecasted sectoral energy consumption values in 2030 to estimate the factor increase in the consumption of different fuel types in the BAU scenario.

Sectoral energy consumption (million gigajoules (GJ)) ($\hat{y}$)	**Predictor variable (x)**	**β (Coefficient of the linear regression model)**	**c (constant values)**	**R^2 (Coefficient of determination)**	**p-value (Statistical significance)**
Residential energy consumption (472)	Gross Domestic Product (GDP) per capita (1475 current USD)	2.67	7327	0.62	0.004
Agriculture energy consumption (11)	Agriculture value added (15 billion USD)	15.8	23.53	0.80	0.000
Service and commercial sector energy consumption (15)	Service value added (22 billion USD)	12.5	83.08	0.77	0.000
Mining and manufacturing sector energy consumption (52)	Mining and manufacturing value added (6 billion USD)	200.5	-23.10	0.77	0.000
Transport sector energy consumption (72)	GDP per capita (1475 current USD)	1.3	-135.4	0.90	0.000

The limitation of using a simple linear-regression method is that it assumes a linear relationship between energy consumption and sectoral value-added data. However, given the available data and recent trends (2005–2015), which were more or less linear with relatively high R^2 values ($0.60<R^2<0.90$), this method was deemed to be suitable for this study. Higher R^2 values imply a better relationship between the observed data and predictor variables. Previous studies have used a similar approach to estimate future energy consumption in Nepal (Bhattarai, 2015; Parajuli et al., 2014; Pokharel, 2007).

Table 6.2 shows the base-year and end-year data for all scenarios. The energy and emission parameters, and green growth indicator values shown in Table 6.2, are the results of the study. Therefore, these are discussed in greater detail in the results and discussion section. The impacts of changing economic growth rates on energy demand and supply were not considered. This was because the World Bank database (World Bank, 2021) showed a linear growth in value-added data, with an average annual growth rate of 4.4% between 1990 and 2018. In addition, the core focus of this study is on the effective implementation of climate mitigation actions, given the submitted NDC and sectoral policies that are already in the delivery phase. However, the impact of low-to-high growth rates on energy demand and supply is discussed in Section 6.3.

For NDC, BNDC and OPS scenarios, activity data and scenarios data were used as inputs in LEAP to model and estimate energy consumption and GHG emissions between 2015 and 2030. The activity and scenarios data were added in the LEAP model (see supplementary materials to Chapter 6, Fig.1 and Fig. 2). The scenarios and assumptions made are explained in the following sub-section.

Table 6.2. Key socioeconomic parameters, and input and output data for four scenarios (business-as-usual (BAU) scenario, nationally determined contribution (NDC) scenario, 'beyond NDC' (BNDC) scenario and 'other policies' (OPS) scenario

Key parameters		Unit	2015	2030				Remarks on data
				BAU	NDC	OPS	BNDC	
Socio-economic parameters *(Inputs)*	Households	million	6	7.7	7.7	7.7	7.7	Forecasted data (*CBS, 2018*).
	GDP (nominal)	billion USD*	21.4	43.6	43.6	43.6	43.6	The scenarios socio-economic data for 2030 are same for all scenarios.
	GDP/capita	USD/capita	747.2	1475	1475	1475	1475	
	Agriculture sector value added	billion USD	7	15	15	15	15	
	Service sector value added	billion USD	11	22.2	22.2	22.2	22.2	
	Mining and manufacturing sector value added	billion USD	3.3	6.3	6.3	6.3	6.3	
Energy parameters *(Outputs)*	Total Energy Demand	million GJ	487.9	662.9	544	542.3	481.6	The data for 2030 are generated from energy modelling via LEAP, and by using 2015 activity data and 2030 scenarios data.
	Energy resource requirements - allocated to demand	million GJ	497.3	686	690.3	561.9	595.1	
	Energy loss	million GJ	9.6	23.1	146.3	19.7	113.5	
	Capacity added (Electricity)	million GJ	24.1	62.2	436.4	53	416.8	
Emissions parameters *(Outputs)*	GHG emissions (Energy)	MtCO2e	10.1	16.5	5	13.5	4.4	The data for 2015 and 2030 are generated from energy modelling via LEAP, and by using 2030 scenarios data.
	GHG emissions (Agriculture)	MtCO2e	25	33.5	33.5	33.5	30	The data for 2015 and 2030 are generated from IPCC guidelines for national GHGs inventories 2006, and by using 2030 scenarios data.
	GHG emissions (Forestry)	MtCO2e	4.3	4.3	-9.7*	-9.7*	-9.7*	The data for 2015 and 2030 are generated from IPCC guidelines for national GHGs inventories 2006, and by using 2030 scenarios data.
Green growth indicators *(Calculated values)*	Energy Productivity	USD/GJ	43.9	65.8	80	80.6	90	Productivity calculations.
	Carbon productivity (Energy sector)	USD/tCO2e	2.1	2.6	8.7	3.2	9.9	
	Carbon productivity (Economy-wide)	USD/tCO2e	0.5	0.8	1.5	1.2	1.8	

*considering a carbon offset of 14MtCO2e per year from REDD
**USD (United States Dollar)

6.2.2.2. Scenarios and assumptions

Table 6.3 shows the scenario descriptions, actual data and assumed data as inputs, and the model's outputs. The rationale for assumptions is explained in the following paragraphs.

Business-as-usual (BAU) scenario – The assumption, in this case, is that economic activity will continue in a similar manner over the next 15 years and that NDCs and new sectoral policies will not be implemented. We assume that the economic growth rate will average 4.4% per annum, as it has for the last three decades (World Bank, 2021), and that sectoral contributions to GDP (nominal) will follow the same trends as in the last ten years. Table 6.2 shows nominal GDP and sectoral contributions in 2015 and the estimated values in 2030. The number of households will rise from 6 million in 2015 to 7.7 million (with an average household size of 4.6) in 2030, in line with the projections of the Government of Nepal (CBS, 2018). Income per capita will almost double, based on the assumption that trends over the last ten years will continue, with 100% of urban and rural households gaining access to electricity as per the recent progress in electrification rate (World Bank, 2021). In terms of energy use, consumption of all fuel types within each sector is likely to increase by the same factors related to consumption by associated sectors (households 1.16, service and commercial 1.68, agriculture 1.95, mining and manufacturing 1.7 and transportation 2.32). Energy in households is the energy consumed by residential buildings and houses. Energy in the transport sector is energy consumed by public, private and logistics vehicles. Energy in the mining and manufacturing sector refers to energy consumption for mining activities and for the manufacture of goods. Energy in the agriculture sector refers to energy consumption for agricultural activities such as the use of pumps, cool storage, tractors and other electro-mechanical harvesting equipment. Energy in the service and commercial sector refers to energy consumption within service organisations and commercial entities like banks, public and private organisations, and restaurants.

For the agriculture sub-sector, the number of livestock will increase, with an annual growth rate for each livestock category as determined by Upadhyay et al. (2017). The area of land under rice cultivation

(1.42 million ha/year) will decline by approximately 6% by 2030, relative to 2015 figures (MoAD, 2016). The amounts of nutrients added to the soil will follow the same trends as in previous years. The amount of forested land will remain similar (41% of total land area), based on historical data (MoPE, 2015).

Nationally determined contribution (NDC) scenario – While economic performance in this scenario will remain similar to the BAU, there will be changes to the figures for energy demand, energy mix and the way energy is distributed. This is because the NDC aims to reduce dependence on fossil fuels by 50% by 2050. Fossil fuels contributed only about 11% of total energy consumption in 2015. An additional capacity of 4000 megawatts (MW) was planned to be operationalised by 2020, and rise to 12,050 MW by 2030, in line with the NDC as mentioned in the NDC document. As much as 75% of total energy demand was being met by biomass energy in 2015 (MoPE, 2015). An assumption can therefore be made that the dependence on fossil fuels can be reduced by 50% by 2030. In addition to electricity generation in the BAU scenario, there are plans to generate energy from various means in line with the NDC document. This includes 4000MW of hydroelectricity by 2020, and 12000MW of hydroelectricity by 2030, 2100MW of electricity from solar photovoltaic (PV), 220MW of electricity from bioenergy, and 50MW from small and micro hydropower plants (MoPE, 2015).

For agriculture, commitments are subjective. One example is 'promoting climate-friendly agricultural practices'. Energy supply and demand in the agriculture sub-sector, and measures to reduce agricultural GHG emissions, are already covered in the energy sector. Therefore, the NDC scenario is assumed to be 'not applicable' for the agriculture sub-sector. For forestry and other land-use change, the NDC states that Nepal's forests will continue to cover a minimum of 40% of the nation's total land area. This will reduce greenhouse gas emissions by about 14 million tonnes (Mt) CO_2e per year by 2020 (MoPE, 2015).

Nepal submitted its second NDC in December 2020 to the UNFCCC. While the GHG emissions-related commitments across the energy and AFOLU sectors remains almost the same as in the first NDC, transport sector-related commitments are added in the second NDC. These are discussed in the results section and are covered largely by the energy demand analysis within the transport sector. Commitments related to the transmission and distribution losses and the energy efficiency targets—omitted from the first NDC—are still missing in the second NDC. These are also discussed in the results section.

Other policies (OPS) scenario – The assumption in this scenario is that, instead of the NDC, almost all relevant government policies are implemented. These policies are the Climate Change Policy (2011); the National Energy Strategy (2013); the Agriculture Development Strategy (2015-2035); the Forest Sector Development Strategy (2016-2025); the Nepal Reducing Emissions from Deforestation and Forest Degradation (REDD) Strategy (2015); and the Industrial Policy (2011). These policies include some statements on reducing energy demand and the use of renewable energy but they do not currently have any quantitative targets. In terms of modelling via LEAP, it is therefore assumed that sectoral energy consumption will be reduced by 20% between 2015 and 2030 if the abovementioned policies are implemented but NDCs are not delivered. The value of 20% has been assumed based on improvements in the energy intensity (unit megajoules (MJ) of energy used per unit GDP) of Nepal, which had improved by 20.5% in 2015 (7.4 megajoules (MJ)/GDP) compared to 2000 (9.3 MJ/GDP) (World Bank, 2021). While it is understood that there might be relatively little potential to improve energy intensity between 2015 and 2030 in comparison to the 15 years leading up to 2015, the energy intensity of Nepal is still one of the highest in the Asia-Pacific region (World Bank, 2021). A comparison of the energy intensity of Nepal with other South Asian countries such as Bangladesh shows that a further reduction of 20% by 2030 is a reasonable estimate. In addition, biomass is the main energy source that comprises almost three-quarters of Nepal's total energy demand (MoPE, 2015). A transition from low-intensity biomass to high-intensity energy sources such as electricity could reduce energy consumption per unit GDP generated (Nag and Parikh, 2000).

There is no OPS scenario for agriculture. The intention to reduce GHG emissions has already been covered by the OPS for the energy sector, assuming a reduction of energy consumption by 20% by

2030. The REDD strategy aims to reduce emissions from forestry by approximately 14Mt CO_2e per year by 2030 (MoPE, 2015).

Beyond NDC (BNDC) scenario – This scenario was developed to investigate how the NDC will perform if its perceived gaps are resolved. For example, losses from the transmission and distribution of electricity were not addressed in the NDC scenario but would be in the BNDC scenario. In the base year 2015, 32% of the total dispatched electricity was lost during transmission and distribution (World Bank, 2021). While the aggregate electricity transmission and distribution loss has been reported to be about 15% in 2020 (NEA, 2020, p. 74), in the BNDC scenario this loss is assumed to decrease to 10% by 2030. The implementation of energy-efficiency improvement targets is not explicitly mentioned in the NDC, so the BNDC scenario assumes that the consumption of non-renewable fuels will decrease by a further 20% due to improvements in energy efficiency. The share of renewable fuels could also be increased by the addition of another 2500 MW of hydropower. Nepal has the potential to develop about 54,000MW more hydropower even under Q40 (40% exceedance) water discharge and with a production efficiency of 80% (Jha, 2013). In addition, the electricity demand forecast report of the GoN states that approximately 15000MW of electricity will be required by 2030 under a GDP growth rate of 4.5% (WECS, 2017). Therefore, adding a further 2500MW to the targeted 12,500MW in the NDC scenario seems reasonable.

The agriculture sub-sector offers fewer areas for improvement in terms of reducing GHG emissions other than effective manure management, and management of soil and nutrients (MoSTE, 2014). However, there could be other options, such as no-till farming, crop management and supply chain management of agriculture products (Cole et al., 1997; Wollenberg et al., 2016). Non-energy GHG emissions are not covered by the NDC scenario, and therefore the BNDC scenario assumes that GHG emissions could be reduced by 10% by 2030 compared to a BAU scenario. Forests already cover about 41% of Nepal's total area, so the BNDC scenario does not change assumptions in terms of the forestry sector.

Table 6.3 Scenarios descriptions, model inputs, and model outputs for two main GHG emissions source sectors under study (Energy and Agriculture, Forest, and Other Land-Use (AFOLU) sectors).

<table>
<tr><th rowspan="2"></th><th rowspan="2">Definition</th><th colspan="2">Inputs</th><th>Outputs</th></tr>
<tr><th>Actual data</th><th>Assumed data</th><th rowspan="4">Energy use (demand and supply) and GHG emissions for each of the four scenarios</th></tr>
<tr><td rowspan="2">BAU scenario</td><td rowspan="2">Economic activity will continue in a similar manner</td><td>Energy sector: Number of households, gross domestic product (GDP) and the annual growth rate, sectoral value-added and the annual growth rate, % of the population with access to energy/electricity, types of energy used and their growth rate, energy transmission and distribution loss in % of total supply, historical and planned production of electricity by energy type (process efficiency, exogenous capacity, maximum availability, capacity credit, and merit order).</td><td>Energy sector: Consumption of all fuel types within each sector increase by the same factors as the overall sectoral consumption between 2015 and 2030 (households 1.16, service and commercial 1.68, agriculture 1.95, mining and manufacturing 1.7 and transportation 2.32).</td></tr>
<tr><td>AFOLU sector: Number of livestock, and the annual growth rate for each of the livestock type, the area of land under rice cultivation and the annual decline rate, amount of nutrients added to the soil.</td><td>AFOLU sector: The forest land area will remain the same based on historical data.</td></tr>
<tr><td rowspan="2">NDC scenario</td><td rowspan="2">All climate mitigation actions in Nepal's NDC are implemented</td><td>Energy sector: Built on the BAU scenario data. An additional capacity of 4000MW of hydroelectricity by 2020, 12000MW of hydroelectricity by 2030, 2100MW of electricity from solar photovoltaic (PV), 220MW of electricity from bioenergy, and 50MW from small and micro hydropower plants. Increase in the share of biogas up to 10% as energy for cooking. Every household in rural areas has access to improve cook stoves (number and efficiency). Fossil fuels to be reduced by 50% by 2030 relative to 2015, as mentioned in the first NDC.</td><td></td></tr>
<tr><td colspan="2">AFOLU sector: The NDC scenario is assumed to be 'not applicable' for the agriculture sub-sector. For forestry and other land-use change, forests will continue to cover a minimum of 40% of the nation's total land area. This will reduce greenhouse gas emissions by about 14 million tonnes (Mt) CO_2e per year by 2020 as per the NDC document.</td><td></td></tr>
<tr><td rowspan="2">OPS scenario</td><td rowspan="2">NDC is not implemented, but sectoral policies are implemented</td><td>Energy sector: Built on the BAU scenario data.</td><td>Energy sector: Sectoral energy consumption will be reduced by 20% between 2015 and 2030 if the sectoral policies are implemented but NDCs are not delivered.</td><td></td></tr>
<tr><td colspan="2">AFOLU sector: There is no OPS scenario for agriculture. The intention to reduce GHG emissions has already been covered by the OPS for the energy sector. The REDD strategy aims to reduce emissions from forestry by approximately 14Mt CO_2e per year by 2030.</td><td></td></tr>
</table>

	Definition	Actual data	Assumed data	
BNDC scenario	NDC is implemented with an intention to address perceived gaps	**Energy sector:** Built on the BAU scenario data.	**Energy scenario:** The electricity transmission and distribution loss is assumed to decrease to 10% by 2030. The consumption of non-renewable fuels will decrease by a further 20% due to improvements in energy efficiency as the NDC does not mention energy efficiency improvements. Adding a further 2500MW capacity to the targeted 12,500MW in the NDC scenario seems reasonable based on Nepal's immense hydropower potential	
			AFOLU sector: Non-energy GHG emissions are not covered by the NDC scenario, and therefore the BNDC scenario assumes that GHG emissions could be reduced by 10% by 2030 compared to a BAU scenario. Forests already cover about 41% of Nepal's total area, so the BNDC scenario does not change assumptions in terms of the forestry sector.	

6.3. Results and discussion

6.3.1. Energy sector

6.3.1.1. Change in energy demand and supply

Nepal's Total Energy Demand (TED) in 2015 was 488 million gigajoules (GJ). By 2030 TED is significantly higher in the BAU scenario at 663 million GJ, representing an increase of 36% (Figure 6.2 2). The NDC and OPS scenarios also show an increase in TED. In both scenarios it increases to 545 million GJ by 2030, representing an increase of 11%. On the other hand, in the BNDC scenario, the TED value drops to 482 million GJ in 2030 from 488 million GJ in 2015, representing a decrease of 1.3% (Table 6.4). Although there are similarities between the NDC (544 million GJ) and OPS (542.3 million GJ) scenarios in terms of the TED, the NDC scenario is favoured because of the higher percentage of renewable energy in the energy mix (Figure 6.4). Thus the total CO_2 emissions will be lower. The quantity of GHG emissions will drop by almost 50% in the NDC scenario by 2030 compared to 2015, whereas in the OPS scenario, GHG emissions will increase by almost 24% (Table 6.4).

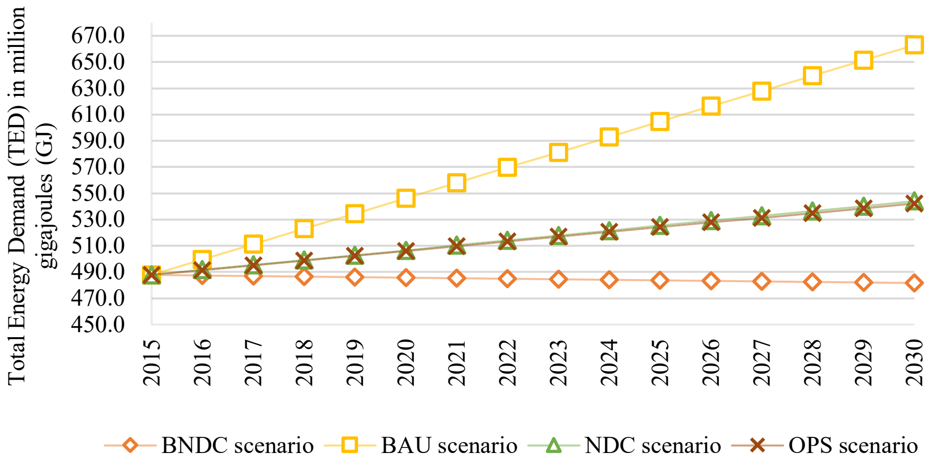

Figure 6.2. Change in Total Energy Demand (TED) in million gigajoules (GJ) for four different scenarios between 2015 and 2030

Table 6.4 Percentage change in Total Energy Demand (TED) and greenhouse gas (GHG) emissions between 2015 and 2030

Scenarios	Total Energy Demand (TED) % change	GHG emissions % change
business-as-usual (BAU) scenario	35.9	63.4
nationally determined contribution (NDC) scenario	11.5	-50.0
'other policies' (OPS) Scenario	11.1	23.8
'beyond' NDC (BNDC) scenario	-1.3	-56.8

The energy demand for all key sectors will also change by 2030, as shown in Figure 6.3. In all scenarios, the energy demand for the household sector will account for the largest share of TED in 2030, which was also the case in 2015. However, between 2015 and 2030, the household sector will have the lowest growth in energy demand. Energy demand by households accounted for almost 80% of total energy demand in 2015. This figure is likely to drop to 70% by 2030, owing to the growth in demand from other sectors. In the BNDC and OPS scenarios, total household energy demand will decrease by 8.7% and 5.6% respectively. In the BAU and NDC scenarios, household energy demand will increase by 16% and 7.3% respectively. The transport sector shows the highest percentage increase in energy demand. In the BAU scenario the increase is 190% and in the OPS scenario it is 132%. A rapid increase in the number of vehicles driven by improvements in overall GDP and per capita income in recent years has contributed to the highest percentage increase in the transport sector's energy demand. The second NDC submitted to the UNFCCC in December 2020 has upscaled the target share for electric vehicles to 25% by 2025 and 90% by 2030. While achieving these electric vehicle targets may be challenging given the current share of less than 5% (in 2020), a focus on climate mitigation-oriented actions in the transport sector is a positive step, given the notable increase in private vehicles in recent few years. In the BAU scenario, energy demand in the mining and manufacturing, agriculture and service, and commercial sectors increases by 70%, 95% and 68% respectively. In the NDC scenario, energy demand for agriculture shows the highest percentage increase (93%), followed by the mining and manufacturing sector (39.6%) and the service and commercial sector (37.7%).

Energy sector transformation and efficiency are key elements of green growth, which advocates resource efficiency and a clean environment (Hallegate, 2011). A drop in TED in the NDC, OPS and BNDC scenarios compared to the BAU scenario suggests a transition towards energy-efficient growth. The GDP of Nepal is expected to double by 2030 relative to 2015, with an annual growth rate of 4.4%. During the same period, TED and sectoral energy demand are expected to grow much more slowly across all scenarios, at rates ranging from 0.8% (NDC scenario) to 2.2% (BAU scenario) per annum. These figures suggest a partial decoupling of energy demand from economic growth.

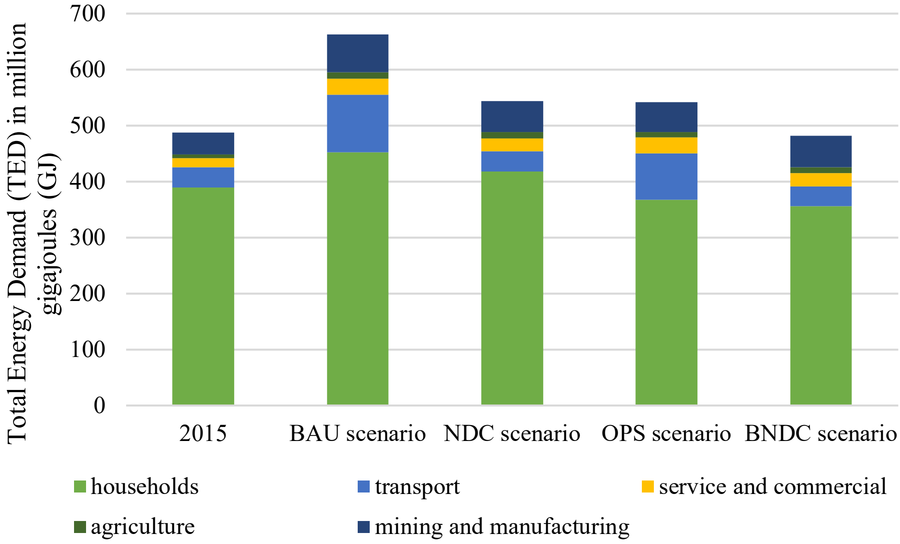

Figure 6.3. Changes in the Total Energy Demand (TED) in million gigajoules (GJ) between 2015 and 2030 for four scenarios, and the change in demand for major energy consuming sectors: households, transport, service and commercial, agriculture and mining and manufacturing between 2015 and 2030.

The energy resource requirements allocated to demand (Figure 6.4) give an insight into the energy mix needed to meet TED (see the supplementary materials to Chapter 6, Fig. 3 to Fig. 7 for energy balance diagrams for each scenario). In 2015, fuelwood was the major source of energy, representing almost 79% of total energy supply. This will change in each of the scenarios. In the BAU and OPS scenarios, fuelwood (465.5 million GJ) will continue to be a major energy source, followed by diesel (70.8 million GJ) and electricity (61 million GJ). In contrast, in the NDC and BNDC scenarios, electricity from hydropower becomes the major energy source. However, unlike TED figures, the energy requirements will be highest for the NDC scenario and increase in the BAU, BNDC and OPS scenarios. This is because electricity will be a major energy source in 2030, and electricity loss in transmission and distribution will be almost 15% of total generation capacity. Electricity loss will consume almost 21% of the energy requirements due to losses in transmission and distribution and electricity theft. This is a significant gap in Nepal's NDC, and the NDC does not identify actions to reduce electricity loss. The GoN (2011) reports that large-scale hydropower plants with an accumulated capacity of 8150MW are likely to be commissioned by the end of 2030. Despite focusing on the large-scale development of hydropower plants to generate electricity as the primary source of renewable energy in 2030, neither of the two NDCs submitted to the UNFCCC included any actions to target reductions in the transmission and distribution losses.

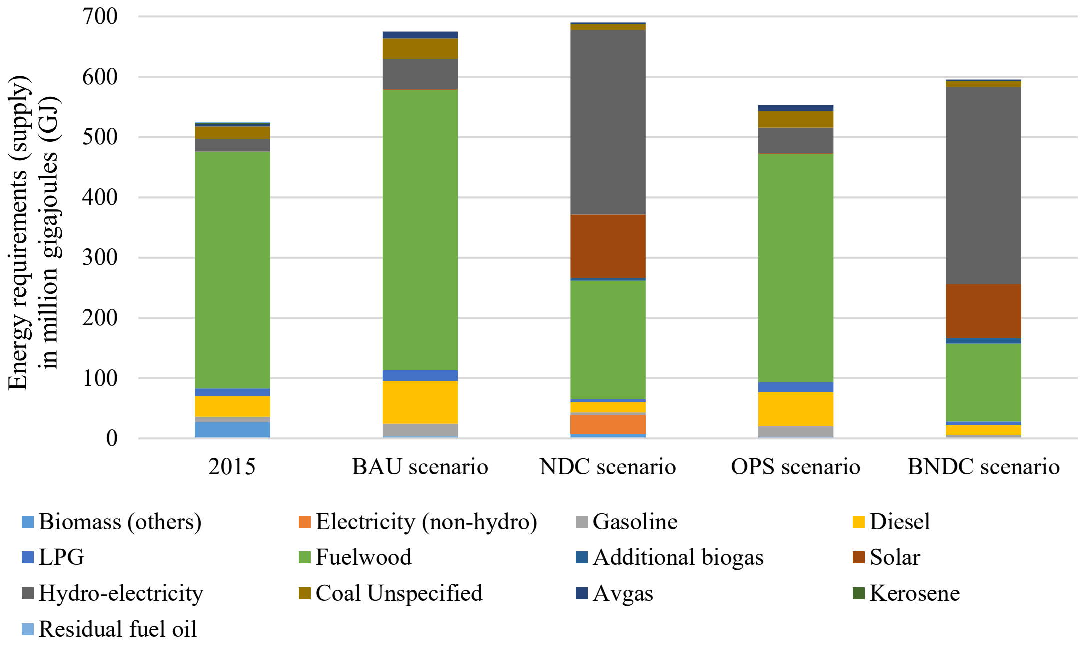

Figure 6.4. Energy resource requirements in million gigajoules (GJ) allocated to demands for four scenarios between 2015 and 2030 based on fuel type. The fuel type and the composition of fuels varies between 2015 and 2030 as the energy mix changes based on intended actions for each of four scenarios.

6.3.1.2. GHG emissions from the energy sector

Total GHG emissions from the energy sector will continue to increase in the BAU and OPS scenarios. However, they will decrease in the NDC and BNDC scenarios. If the NDC is not implemented, GHG emissions could reach 16.5 Mt of CO_2e per year by 2030. If the NDC is implemented, GHG emissions from the energy sector could be reduced by up to 47% relative to the base year of 2015. A further reduction of up to 64% can be achieved under the BNDC scenario relative to the base year. This will contribute to the pursuit of low-carbon development in Nepal, mainly because the NDC document prioritises aggressive development of hydropower to add to existing capacity.

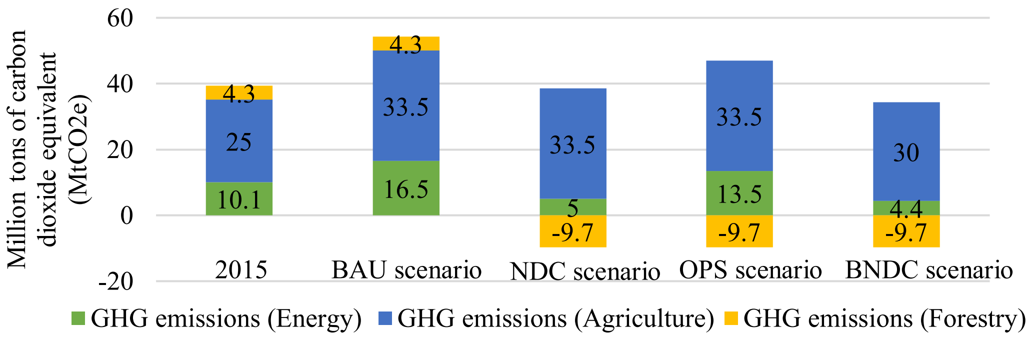

Figure 6.5. Greenhouse gas (GHG) emissions in million tons of carbon dioxide equivalent from energy sector and AFOLU sector (expressed in terms of agriculture sub-sector and forestry sub-sector) in 2015 and in 2030 for four different scenarios.

6.3.1.3. Green growth in the energy sector

Green growth in the energy sector implies an increased share of renewable energy, increased energy productivity and carbon productivity, and reduced electricity losses (OECD, 2017b). Whilst renewable energy's contribution to TED will increase in the NDC scenario, electricity loss is emerging as one of the most important gaps in the nation's NDC (both first and second) as the energy requirements allocated to demand is maximum (690 GJ) in the NDC scenario (Figure 6.4). The additional allocation for demands in the NDC scenario is to offset the electricity loss. The losses, which occur during the transmission and distribution of electricity, will challenge the energy sector's capacity to meet energy demands and potentially impact the overall efficiency of the economy. The World Bank (World Bank, 2021) reports a high transmission and distribution loss for Nepal—in 2015 this was 32% of total electricity generated. The high loss is attributed to the poor transmission and distribution infrastructure and low power factors in electricity-intensive industries. In contrast, the Nepal Electricity Authority reports significant progress in the last five years and states that the transmission and distribution loss has been reduced to 15% in 2020 from 32% in 2015 (NEA, 2020).

In the NDC scenario, the loss of potential value-adding as a result of transmission and distribution loss is likely to be approximately 10% of the total GDP in 2030 (Table 6.5), if the value of energy productivity in 2030 is considered as an indicator to measure the productive use of energy. The potential loss under the BNDC scenario is almost 7% of GDP in 2030. While it might be difficult in practical terms to keep transmission and distribution losses below 10%, as assumed under the BNDC scenario, the loss of approximately 1.2 billion USD in value-adding potential could be avoided under the BNDC scenario by better energy management—for example, by ensuring transmission and distribution losses of no more than 10%, and by end-use efficiency measures that remain excluded in the NDC. In addition, minimising energy loss could ensure that latent energy demand is met, as the NDC, OPS and BAU scenarios assume that almost 100% of households will have access to electricity by 2030, while the rise in energy consumption is likely to place stress on supply and demand as incomes increase. In 2015, approximately 87% of the population had access to electricity in Nepal (World Bank, 2021). This figure is likely to increase and reach up to 100% in 2030 as more rural people have access to off-grid and locally distributed micro-hydro and solar home systems.

Table 6.5. Energy loss and potential value loss in four scenarios between 2015 and 2030

Scenarios	**Energy loss (million gigajoules (GJ))**	**Potential value loss (billion USD)**	**% of Gross Domestic Product (GDP) in 2030**
BNDC scenario	34	3.1	7%
BAU scenario	19	1.3	3%
NDC scenario	54	4.3	10%
OPS scenario	16	1.3	3%

Energy productivity will have similar values (80 USD/GJ) in 2030 under the NDC and OPS scenarios (Table 6.2 and Figure 6.6). However, the carbon productivity of the energy sector under the NDC scenario is likely to be almost 2.5 times greater than under the OPS scenario in 2030. The energy loss (and value loss) that results from an inefficient electricity transmission and distribution system in the NDC scenario is about three times the corresponding loss in the OPS scenario. Despite this, the NDC scenario looks better from the point of view of carbon productivity improvement. However, the implementation of climate mitigation actions in the NDC does not seem to simultaneously satisfy the three green growth conditions (resource-efficient, clean and resilient growth) as explained by Hallegatte et al. (2011), especially for the energy sector in Nepal. Under the BNDC scenario, carbon productivity and energy productivity fare far better in 2030 than in any other scenarios. Energy loss and value loss are marginally higher than in the OPS scenario; however, the significant improvements in carbon and energy productivity show a potential to offset energy loss. Energy and carbon productivity are projected to improve, mainly because of the use of high-intensity and commercial energy source (electricity) instead of low-intensity biomass and partly because of changes in the structure of the economy. The change in the structure of the economy refers to the change from an agro-based economy to a services-based economy in Nepal (World Bank, 2021). Regardless of the different scenarios, less energy and a less carbon-intensive service sector will continue to generate more than half of Nepal's GDP in 2030 (GoN, 2011, World Bank, 2021). Service sector-based economic growth is a key indicator of green growth (OECD, 2017b; UNDESA, 2019).

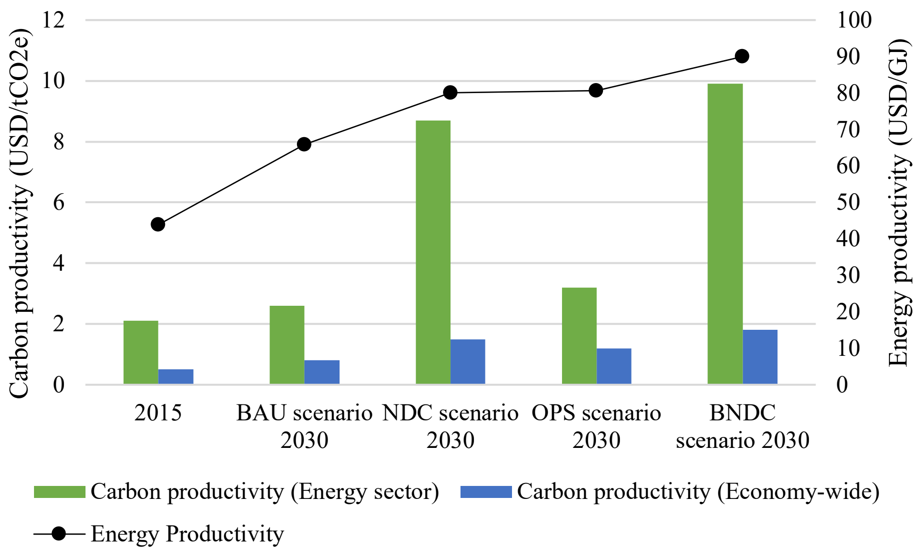

Figure 6.6. Carbon productivity (Energy sector), carbon productivity (Economy-wide), and energy productivity values for base year (2015) and four scenarios in 2030.

The four scenarios provide TED estimates for different sectors based on the assumption that the average annual economic growth rate of 4.4% will remain the same until 2030. However, TED could change with a change in the annual economic growth rate. A causal relationship between economic growth and energy consumption has already been identified for Nepal in previous empirical studies (Dhungel, 2008; Nepal and Paija, 2019). This means that energy consumption is a critical production factor for economic growth in Nepal. This study analysed future TED based on a single growth rate. With a view to providing further analytical insights, we compared our TED estimates, especially in the NDC scenario, with estimates from previous studies that use different annual growth rates to estimate future TED. It has been estimated that in 2030 TED will be at least 700 million GJ at a high growth rate (10% per annum), 550 million GJ at a medium growth rate (6.4–7% per annum), and 520 million GJ at a normal-growth rate (3.3–5% per annum) (GoN, 2011; Parajuli et al., 2014). If medium and high growth rates are to be considered for the NDC scenario, energy loss is an even more significant issue that must be resolved. Eliminating the energy loss of approximately 33 million GJ, even after considering a transmission and distribution loss of 10%, could enable the energy sector to meet the extra demand coming from increased economic activities. Additionally, the higher scale of decoupling of energy use and GHG emissions from economic growth under a transmission and distribution loss of 10%, as in the BNDC scenario, means a step towards achieving green growth. Decoupling of energy use and GHG emissions from economic growth is an important condition for achieving green growth (OECD, 2017b).

Energy transition appears to be another important contribution for delivering energy-related climate mitigation actions, as the NDC scenario aims for a nationwide clean energy transition. The percentage of electricity in the energy mix is projected to be only approximately 11% at a maximum in 2030, considering all normal- to high-growth rates (Parajuli et al., 2014). GoN (2011) projected that the share of hydropower-based electricity in the energy mix will reach up to 25% in 2030. Contrastingly, in the NDC scenario, even at the normal growth rate of 4.4% per annum, the share of electricity will be more than 50% of total energy supply in 2030. However, the efficiency of the transmission and distribution system must be managed. Energy efficiency improvements and the integration of renewable energy into the existing energy supply system have been identified as critical drivers of green growth (Jouvet and Peerthuis, 2013; Jupesta et al., 2011; van Vuuren et al., 2017). Whilst the integration of renewable energy (hydro-based electricity) into the existing energy system is an important climate mitigation action in the NDC scenario in Nepal, energy efficiency targets are missing in both the first and the second NDC. In considering the lack of energy efficiency measures in the NDC to be the major gap, it was decided to model the potentially feasible energy efficiency measures under the BNDC scenario. The finding is that energy productivity in the BNDC scenario is approximately 11% greater than it is in the NDC scenario. Similarly, the economy-wide carbon productivity is 20% greater in the BNDC scenario than it is in the NDC scenario.

6.3.2. Agriculture, forestry and other land-use change (AFOLU) sector

6.3.2.1. GHG emissions from the AFOLU sector

GHG emissions from agriculture in Nepal come primarily from enteric fermentation, manure management, managed soil, rice cultivation, and field burning (MoSTE, 2014). The GHG emissions from these sources within the agriculture sector are shown in Figure 6.7. In the BAU, NDC, and OPS scenarios (Figure 6.5 and Figure 6.7), total GHG emissions from the agriculture sector will increase by almost 36% by 2030 (33.5 Mt CO_2e) compared to 2015 (25 Mt CO_2e). The NDC document and the Agriculture Development Strategy (2015-2035) of Nepal do not specifically mention reducing GHG emissions from the agriculture sector. Therefore, GHG emissions from the agriculture sector under BAU, NDC, and OPS scenarios are similar. In the base year, enteric fermentation (14 Mt CO_2e) from livestock was the highest contributor to GHG emissions. This figure will increase steadily up to 18 Mt CO_2e per annum by 2030. This will be mainly because of an increasing number of livestock.

Annual emissions from agricultural soil were 6.5 Mt CO_2e in 2015 and will increase to 9.8 Mt CO_2e by 2030. This will be due to an increasing use of fertilizers because of a potential reduction in the amount of agricultural land (MoAD, 2016). Emissions from manure management will be almost 1.4 times higher in 2030 (4 Mt CO_2e) than they were in 2015 (2.9 Mt CO_2e). The contribution of rice cultivation to GHG emissions will be slightly lower in 2030 (1.4 Mt CO_2e) compared to 2015 (1.5 Mt CO_2e). This is because of changes in the annual harvested area, which is likely to decrease from 1.42 million hectares in 2015 to 1.34 million hectares in 2030, based on the continuation of the harvested area reduction rate of approximately 6% in the 15-year period between 2001 and 2015 (FAO, 2018; MoAD, 2016).

However, given a significant increase in rice consumption in future, and the limited ability to increase the amount of harvested land, the yield has to increase from 3 tonnes/hectare in 2012 to 6–7 tonnes/hectare in 2035 (Tripathy et al., 2019). Increasing the intensity of rice cropping has been proposed as a measure to improve yield, but this could increase energy consumption and GHG emissions in the agriculture sub-sector. In the BNDC scenario, which aims to strengthen the case for the implementation of the NDC by addressing its gaps, the GHG emissions from the agriculture sector increase slightly from 25 Mt CO_2e in 2015 to 30 Mt CO_2e in 2030.

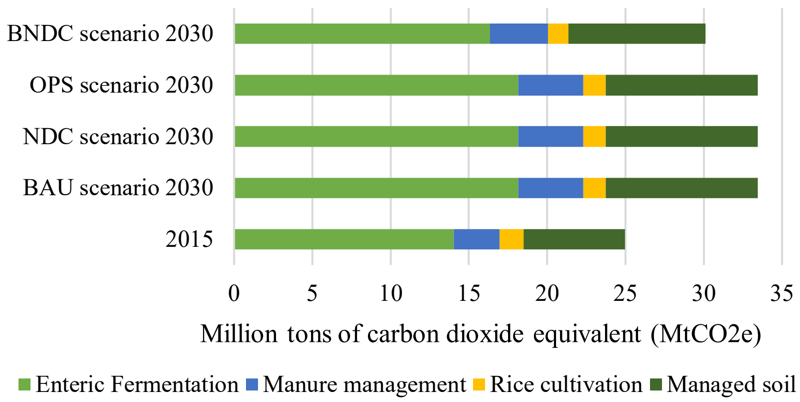

Figure 6.7. Greenhouse gas (GHG) emissions in million tons of carbon dioxide equivalent from the Agriculture sector in 2015 and in 2030 for four different scenarios.

With regard to forestry and other land-use, forest soil, deforestation and forest degradation are responsible for emissions of approximately 4.5 Mt CO_2e per year (MoSTE, 2014). There are a few other sources of GHG emissions—for example, the use of limestone to neutralise the acidity of soil—but their contribution is negligible. 41% of Nepal is forested, so the existing biomass stock of the Nepalese forest has the potential to sequester approximately 30 Mt CO_2e per year (MoPE, 2015). If this were to be considered, and if the REDD strategy were to be implemented as stated in the NDC scenario, net GHG emissions from the forest sub-sector could be less than zero (Figure 6.5).

6.3.2.2. Green growth in the AFOLU sector

Achieving green growth in the AFLOU sector via improving non-energy carbon productivity appears to be challenging for Nepal. On the one hand, the nation's agriculture and forest sector strategies aim to improve productivity and value outputs in absolute terms to meet food and biomass demands in future (MoAD, 2016; MoFSC 2015); on the other hand, the AFOLU sector is a major contributor to national GHG emissions. The AFOLU sector of Nepal is also reported as having minimum potential to reduce GHG emissions, except for the forest as a carbon sink (MoPE, 2015). Therefore, much of the economy-wide carbon productivity improvement is mainly attributable to improvement in the energy sector (Figure 6.6). This corresponds to the reluctance of policymakers in explicitly stating GHG emissions reduction measures related to the AFOLU sector in the NDC and the relevant government policies. In developing countries, a significant proportion of non-energy GHG emissions are generated from agriculture, yet their climate mitigation commitments are weakly related to agriculture because doing more could jeopardise food security (Amjath-Babu et al., 2019). Efforts to reduce GHG emissions are, therefore, focused more on the energy sector.

In the agriculture sub-sector, the use of nutrients, rice cultivation and livestock farming for dairy and meat products (including mechanisation in agriculture) will be likely to lead to efficiency gains and increased emissions in the future. Similarly, in the forestry and other land-use sub-sector, biomass will continue to be used as a source of energy, especially in the BAU and OPS scenarios. The percentage of energy coming from biomass sources decreases from 80% in 2010 to less than 30% in 2030 in the NDC and BNDC scenarios. This means that the aim of the REDD strategy (i.e. to reduce emissions from deforestation and forest degradation) is also likely to be met in the NDC and BNDC scenarios. In these circumstances, and despite not having an explicit statement on GHG emissions reduction from the AFOLU sector in the NDC, the implementation of NDC that focuses more on the energy sector would be a practical way to continue improving economy-wide carbon productivity. However, the significant energy loss and potential value loss associated with NDC implementation, coupled with an added pressure on the energy sector to improve economy-wide carbon productivity, mean that a sustainable supply of energy and reduction in GHG emissions cannot be guaranteed under this scenario. Consequently, the sustainable management of forest resources and the target forest area (40%) could be at risk. Forest resources (i.e. the percentage of a nation's total land area covered by forest) represents one of the important green growth indicators that measure the natural asset base of a country (OECD, 2017b). In 2030, economy-wide carbon productivity will be twice as high in the NDC scenario (1.5 USD/tCO_2e) and the BNDC scenario (1.8 USD/tCO_2e) than it will be in the BAU scenario (0.8 USD/tCO_2e), while the forest is likely to remain at least 40% of total area in 2030. The improvements in economy-wide carbon productivity can be attributed to the transition from a biomass-based energy source to a commercial energy source (electricity). Even if agricultural emissions do not decrease, implementing the climate mitigation actions of NDC—and, more importantly, the REDD strategy—could ensure that economy-wide carbon productivity improves.

6.3.3. Green growth for policy coherence and delivery of climate mitigation actions

6.3.3.1. Better delivering the policy outcomes for effective climate mitigation actions

Previous studies (Choi et al., 2016; Gazheli et al., 2016) note that achieving green growth could be costly due to the monetary expenditure required to create structural change in the economy. Amidst this challenge, are there any benefits in incorporating a green growth approach in NDC implementation? For a low-income country such as Nepal, which is likely to double its GDP over the 15-year period between 2015 and 2030 (even at a current average annual growth rate of 4.4%), there are areas within the scope of the NDC scenario for which it is worth considering green growth as an approach for delivering climate mitigation actions. The green growth approach can link NDC and other policies to maximise outcomes for the NDC and other policies. Potential outcomes include: (1) improved energy productivity (by addressing energy losses that could cost the economy up to 10% of GDP in 2030); (2) protection of forest resources through a reduction in the use of biomass fuels from 465 million GJ in 2015 to 195 million GJ in 2030, which will potentially help to ensure that the forest area is at least 40% of land area (as mentioned in the NDC scenario); and (3) doubling carbon productivity by 2030 relative to the business-as-usual case by energy transition (from biomass-based fuel to a hydropower-based economy).

Transforming the energy mix requires phasing out non-renewable energy, while at the same time progressing climate-sensitive design and installing hydropower plants at a rapid pace (Shakya et al., 2012). However, a dependence on hydropower plants as a future source of energy raises some concerns. Climate change-induced temperature rise in high-altitude Himalayan regions could have an impact on the generation capacity of hydropower plants (Bhutiyani et al., 2010; Gippner et al., 2013). In the AFOLU sector, the intended climate targets can only be achieved by improving productivity and implementing the REDD strategy. Again, improving agriculture productivity by increasing the yield from a limited and gradually shrinking area of agricultural land entails increased energy consumption and GHG emissions. Improving the productivity of forests by sustainably managing forest resources (e.g. biomass) could have a negative impact on energy access for the majority of the rural population. Protecting forest resources and croplands whilst simultaneously utilising them requires both policy and technological changes, which inevitably has financial implications. This is challenging, not only for Nepal but also for most LDCs. Barbier (2016) argues that green transformation is possible in developing countries, but only where growth can reconcile the structural features of natural resource use and poverty reduction. In the case of Nepal, green growth appears to enable structural changes in resource use while at the same time supporting the livelihood of the rural population by energy transition.

Charley and Taerup (2018) analyse the NDCs of 71 emerging markets and argue for a better process of technology need assessment that could fill gaps in the existing NDC scenario and promote conditions for diffusing technologies to low-income countries. While this study calls for narrowing financial and technology gaps, NDCs can leverage the existing policy landscape—for example, by utilising policy instruments)—but there must be policy coherence if the outcomes and impacts of NDCs are to be maximised. NDC implementation in isolation appears to be ineffective, with the value proposition being relatively weak. This is one of the reasons why the NDC scenario should incorporate a green growth approach, as it links the NDC to sectoral policies. In addition, reducing GHG emissions is one of the main goals of the NDC scenario. However, as can be seen from the above analysis, focusing solely on reducing GHG emissions cannot ensure improved sectoral productivity. Incorporating the conditions for achieving green growth (e.g. resource-efficient, clean and resilient growth) into an NDC will ensure that the NDC and sectoral policies are not seen as different sets of standalone policies with different kinds of goals. Instead, the idea is to leverage common goals whilst implementing the NDC.

6.3.3.2. Improving policy coherence between sectoral and climate-specific policies

The focus of NDCs is primarily on reducing GHG emissions. Approximately 175 countries that are party to the Paris agreement have declared their intention of reducing their GHG emissions in the energy sector (Senshaw and Kim, 2018). The energy sector has been emphasised in studies more frequently than the AFOLU sector (Siagian et al., 2017; Tran et al., 2016; Wu et al., 2017) in relation to the NDCs of Asian countries. This could be because, on a global scale, GHG emissions from the energy sector are significantly greater than emissions in any other sector, including the AFOLU, industry, buildings and transport sectors. In accordance with the IPCC's Fifth Assessment Report, this is true for upper-, middle- and high-income countries (Edenhofer et al., 2014). However, for low-income countries (i.e. LDCs), the AFOLU sector is the main contributor of GHG emissions. Therefore, it is clear that policies focusing on reductions in AFOLU emissions have to be linked with NDCs, especially for LDCs. NDCs do not have direct connections with other policies (mostly sectoral), especially in terms of objectives, actions and impacts. Therefore, green growth has been introduced as an approach to link two seemingly disparate policy goals, namely climate action and economic growth, by means of policy coherence. Green growth is the only strategy to which mainstream economists and policymakers refer when aiming to address climate change (Antal and van Den Bergh, 2016).

Policy coherence entails non-conflicting signals and converging opinions on certain policy actions that could promote synergy between different policy areas (Mickwitch et al., 2009; Nilsson et al., 2012). This implies that, for NDC and sectoral policies to be coherent, there should be synergistic effects and objectives, and intended actions should create complementary and immediate end goals. Whilst the objectives of the NDC and sectoral policies are different, intended actions inevitably focus on the productive use of resources (e.g. forest biomass and energy). The means/tools required for the productive use of biomass and energy resources, such as technological change and financial flows, are probably limited in LDCs, which means that there could be conflicts in priorities (e.g. between NDCs and sectoral policies) when there is limited access to technology and financial resources. However, as mentioned above in the OPS scenario section, sectoral policies contain subjective statements regarding reductions in resource use and emissions. Therefore, opportunities exist to align sectoral policy goals with NDCs, for example by mentioning quantitative targets to reduce GHG emissions. The green growth approach can help policymakers to align sectoral policy goals that could include addressing energy and GHG emissions issues by balancing structural change in resource use.

6.4. Conclusion

Addressing losses from the transmission and distribution of electricity and reducing the use of forest resources (fuelwood) as an energy source have emerged as important issues for the NDC of Nepal. Under the NDC scenario, the loss in GDP as a result of electricity loss could be almost 4.3 billion USD per year by 2030. However, if transmission and distribution losses of 10% are considered to be acceptable, as in the BNDC scenario, the loss in GDP would be approximately 1.3 billion USD per year. The loss of value-added potential in the NDC scenario is approximately one and a half times greater than in the BNDC scenario, and more than three times what it is in the BAU and OPS scenarios. However, GHG emissions under the NDC and BNDC scenarios would be lower than in the BAU scenario. This suggests that commitments in the NDC might be sufficient in terms of reducing GHG emissions, but future economic loss associated with NDC implementation would be significant for a low-income country. To offset non-energy-related GHG emissions from the agriculture sub-sector, to improve the carbon productivity, and to leverage the CO_2 absorption capacity of existing forest resources, the REDD strategy must also be implemented.

Cross-sectoral collaboration between government agencies is therefore needed for economy-wide implementation of sectoral policies. This could improve the productivity and efficiency of sectors of the economy and it could also address the gaps in the NDC by meeting conditions needed to achieve green growth. A green growth approach has not been used extensively in Nepal and other LDCs, probably because there are other similar competing and aligned concepts such as sustainable development and low-carbon economy approaches. However, a green growth approach seems to offer an attractive value proposition for policymakers, especially in improving policy coherence between the NDC and sectoral policies. By improving policy coherence, policymakers could align sectoral policy goals with the NDC by introducing objective targets for GHG emission reductions and resource use in the energy and AFOLU sectors. In LDCs, the most significant sources of GHG emissions are found in the AFOLU sector, mainly because of their dependence on biomass fuels as their main energy source. The priority for LDCs, especially from the viewpoint of climate mitigation, is a renewable energy-based, efficient energy transition. However, given the critical role of biomass as an energy source in LDCs, there appears to be a strong energy-AFOLU nexus that remains unexplored, especially in studies focusing on NDC implementation in LDCs.

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Supplementary materials to Chapter 6

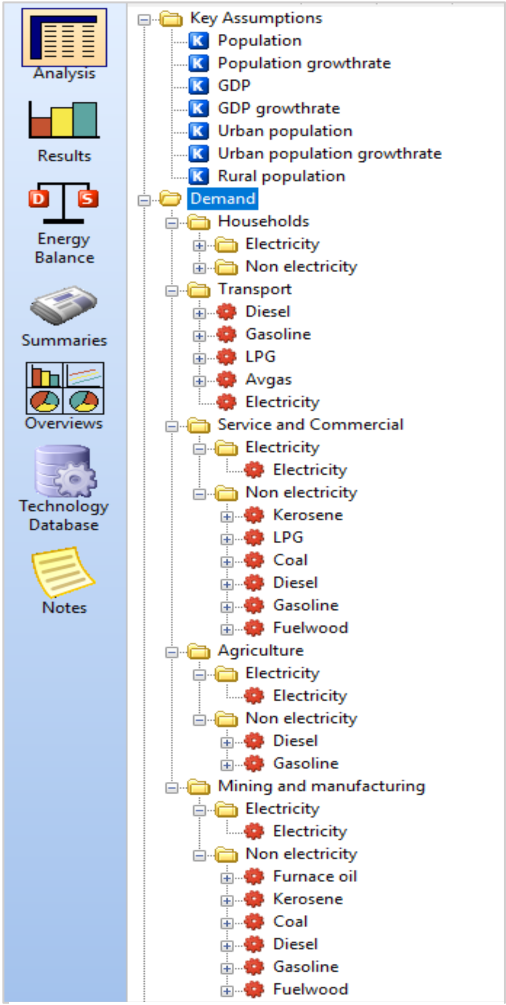

Fig.1 Demand-related technologies

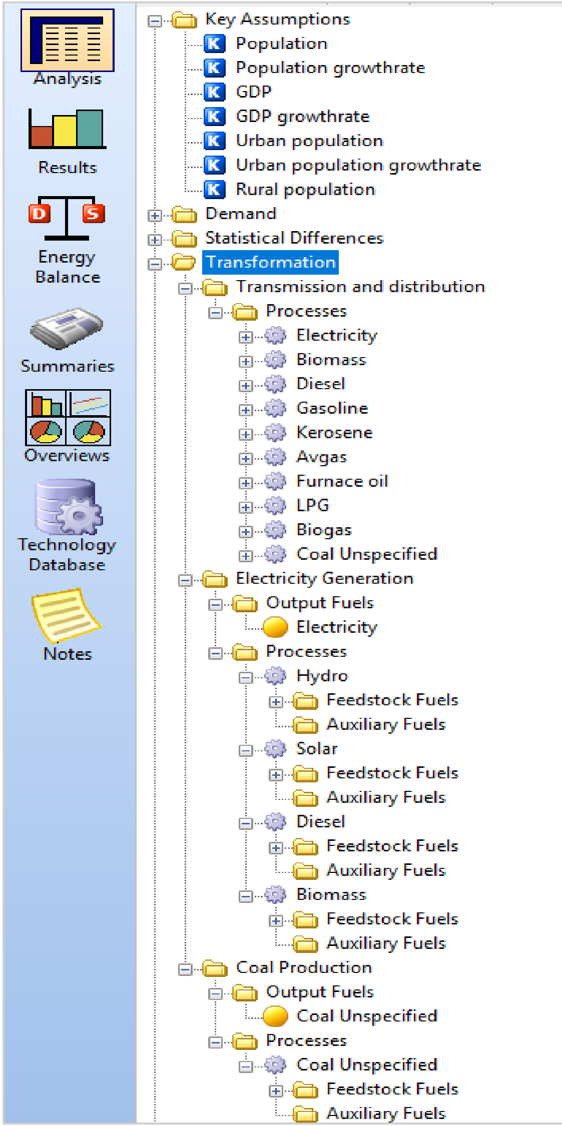

Fig.2 Supply-related technologies

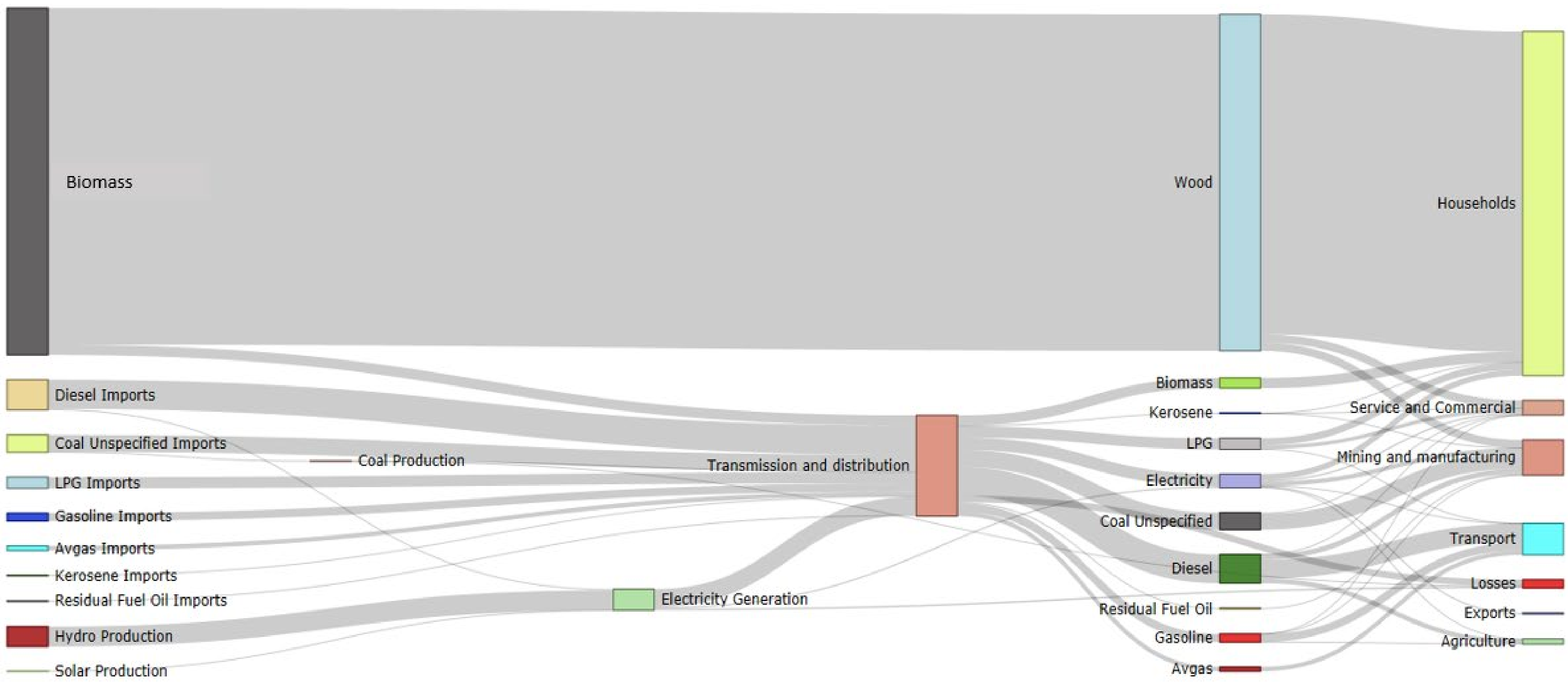

Fig 3. Energy balance diagram for the base year 2015

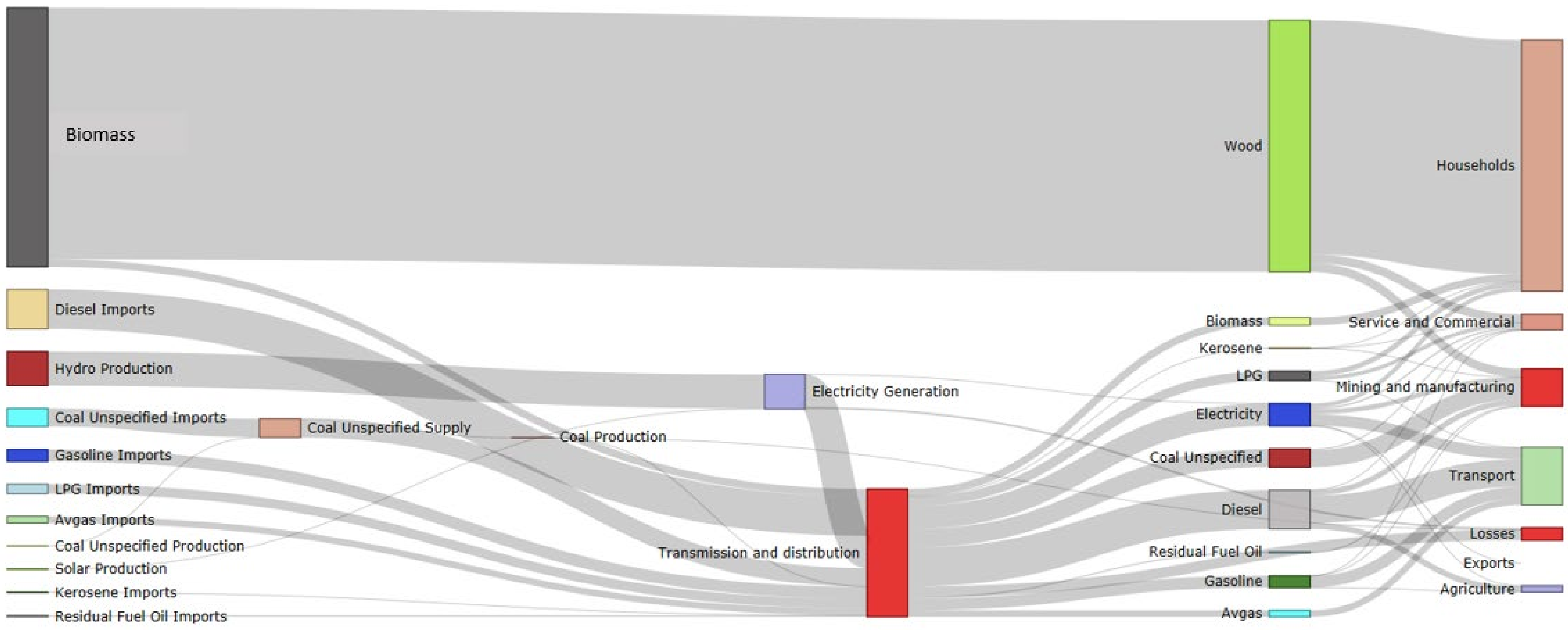

Fig 4. Energy balance diagram for the BAU scenario 2030

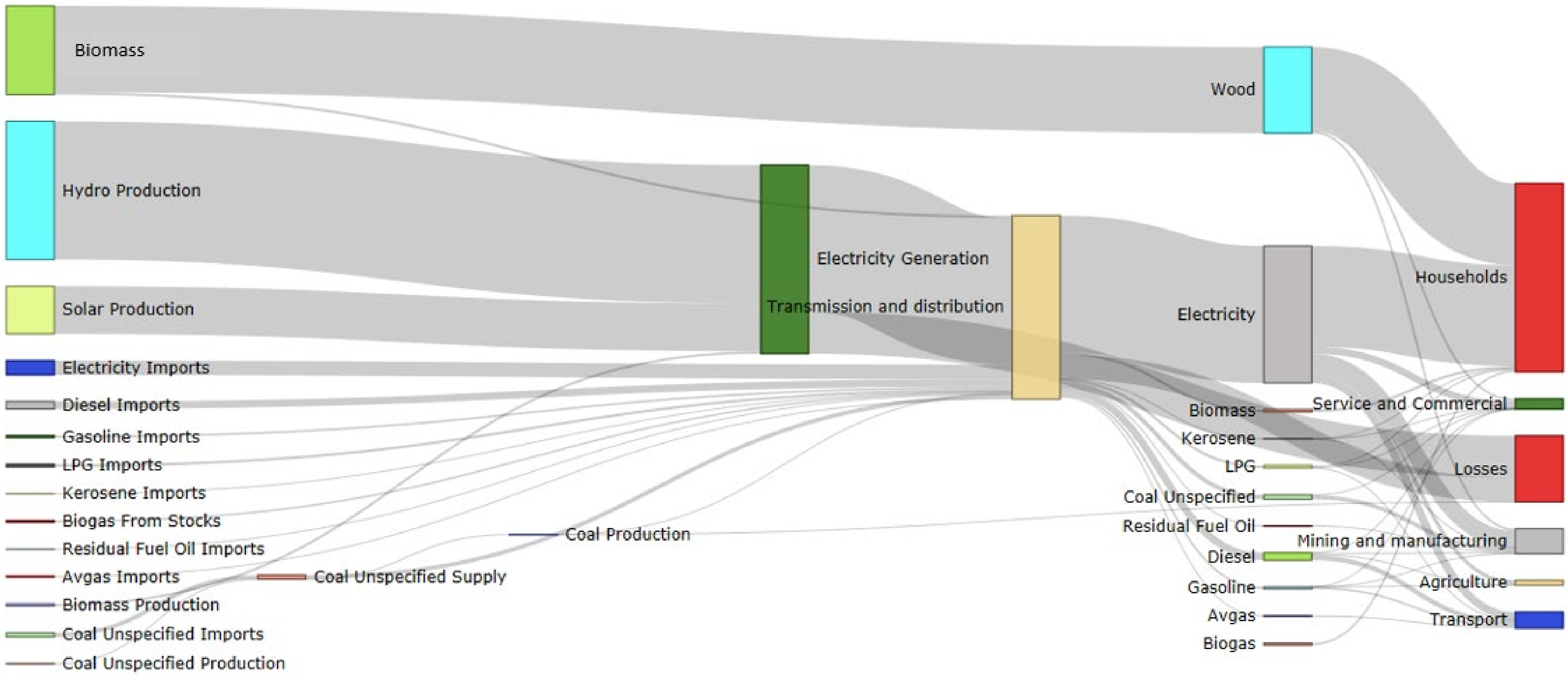

Fig 5. Energy balance diagram for the NDC scenario 2030

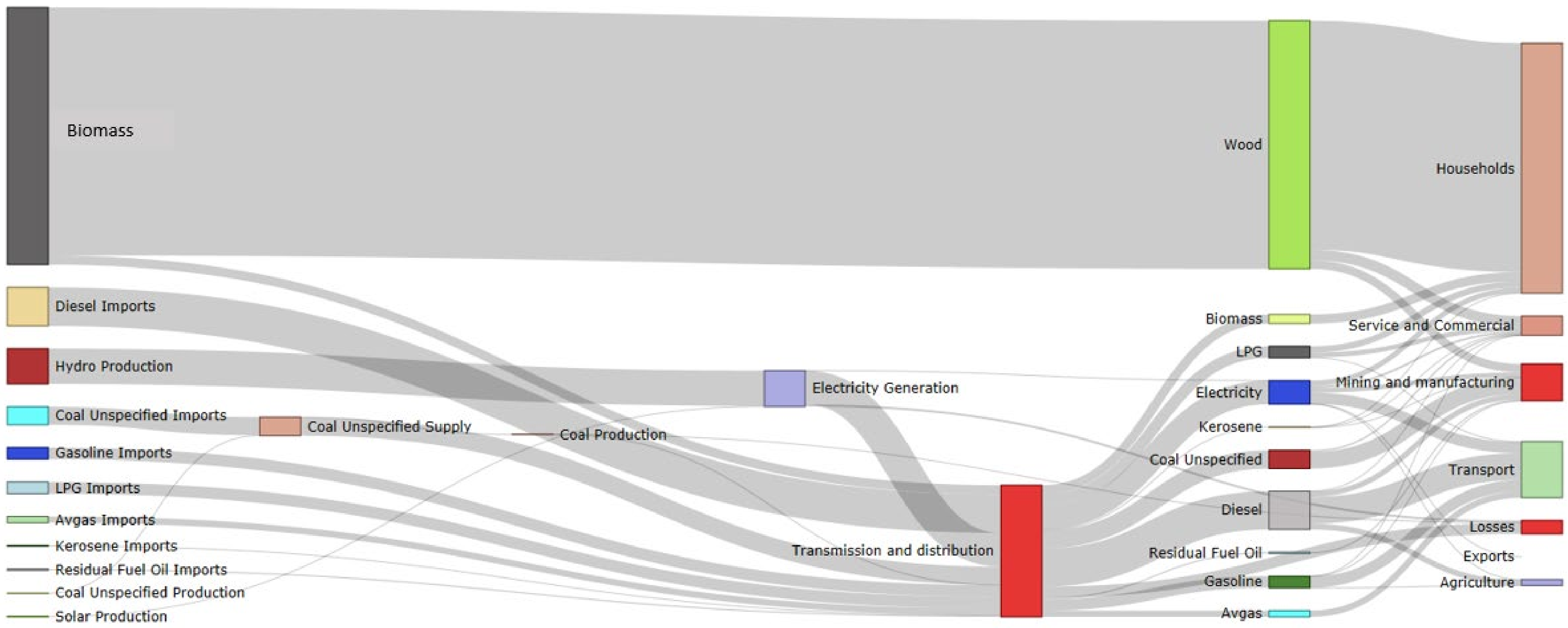

Fig 6. Energy balance diagram for the OPS scenario 2030

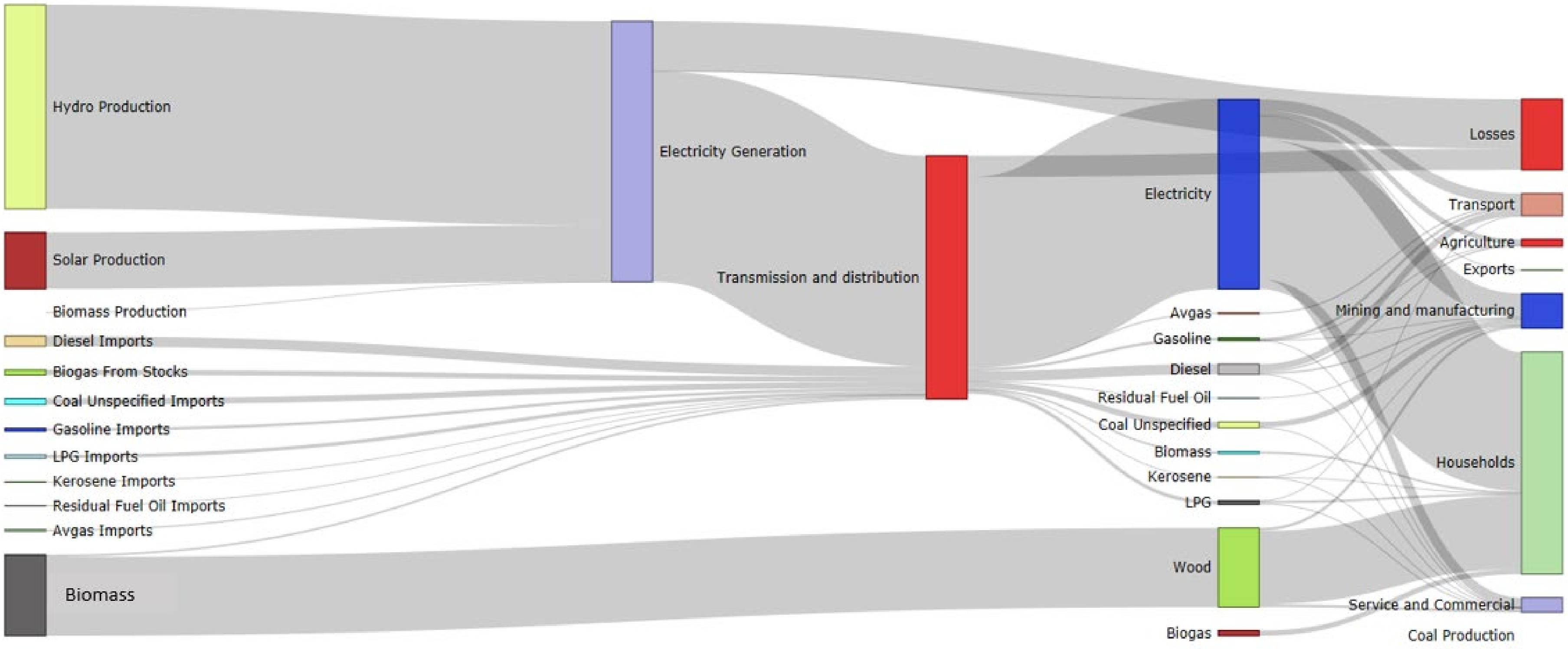

Fig 7. Energy balance diagram for the BNDC scenario 2030

Chapter 6 to Chapter 7 transition paragraphs

The previous chapter concluded that improving policy coherence can help reduce conflict amongst sectoral policies and the NDC, thus better delivering an economy-wide reduction in GHG emissions and resource use (e.g. forest biomass and fossil fuels) in Nepal. The analysis of green growth's role for improving policy coherence revealed that it could be useful in terms of aligning the climate mitigation-oriented sectoral policy goals with the NDCs. However, the modelling of GHG emissions and energy resource supply and demand analysis identified that Nepal's sectoral policies and the NDCs have several gaps that will undermine the effectiveness of climate mitigation actions in the policy implementation stage. The gaps are the lack of quantitative targets on GHG emissions reduction, energy efficiency, and a renewable energy transition in most of Nepal's sectoral policies, including the NDC, submitted to the UNFCCC. Further, Nepal's NDC does not include GHG emissions reduction targets for the agriculture sector which contributes to almost half of the nation's GHG emissions. Therefore, recognising the need to investigate further the prospect of delivering Nepal's NDC while the country embarks on greening growth, the next chapter explores the empirical evidence and future prospect of green growth in Nepal.

Additionally, whilst the previous chapter analysed the sectoral resource use and GHG emissions, it did not analyse their dynamics and micro-level changes in their contribution (share) to the nation's GDP. Consideration of the sustainable development goals, the LDC graduation, and possible economic growth rate scenarios in future are the focus of the next chapter, which explores how low-income countries pursue LDC graduation while delivering the international climate mitigation commitments via NDCs. Bangladesh has been added as a case country in the next chapter because it is also facing a dual challenge to deliver climate mitigation actions while achieving LDC graduation before 2030. A study of two South Asian countries with a similar challenge will present additional insights from a comparison point of view. The Bangladesh-related findings from the next chapter will also allow for an additional discussion about Bangladesh's new climate mitigation-based policy paradigm that this research found in Chapter 4.

Chapter 7: Green growth in Nepal and Bangladesh: empirical analysis and future prospects

Paper preface

This chapter includes a co-authored peer-reviewed paper. The full bibliographic details of the paper, including all authors are:

> Baniya, B., Giurco, D., & Kelly, S. (2021). Green growth in Nepal and Bangladesh: Empirical analysis and future prospects. *Energy Policy*, 149. https://doi.org/10.1016/j.enpol.2020.112049.

Bishal Baniya led the research project, collected and analysed the data, and wrote the full paper. Damien Giurco (Principal supervisor) and Scott Kelly (Co-supervisor) provided supervisory guidance and reviewed the paper.

Research highlights

- Empirical evidence on green growth was analysed for Nepal and Bangladesh.
- Energy and material consumption models were developed to forecast the energy and material productivity values up to 2030.
- Both the historical progress and the future-prospect for delivering green growth appears to be weak for Nepal and Bangladesh.
- Improvements in energy and material productivity are primarily because of the structural changes in an economy.
- Technological changes across the energy sector seem to be a way forward to deliver green growth.

Abstract

Nepal and Bangladesh aim to reduce their greenhouse gas emissions as part of their commitments to implementing the Paris Climate Agreement and United Nations Sustainable Development Goals (SDGs). In addition, both countries are seeking to move from being categorised as low to middle-income countries. This study analyses the empirical evidence on greening of economic growth in Nepal and Bangladesh between 1985 and 2016, and looks ahead to 2030 to discuss the future prospects in their efforts to deliver on both environmental and economic goals. To analyse their historical progress, six green growth indicators are used, and to look ahead to 2030, energy and material consumption models are used. For both countries, energy and material productivity improvements were mainly driven by structural changes in an economy, which is a transition from agricultural to service-based economies. Yet these are found to be insufficient to deliver green growth. An increase in the share of renewable energy in the energy mix and the absolute reduction of energy and material consumption in future are found to be important not only for greening the growth but also for delivering abovementioned commitments. Technological changes such as the substitution of biomass by electricity from renewable resources can be a part of sustainable strategy for reconciling the climate mitigation actions with graduation to the middle-income country category.

Keywords: Green growth; energy and material productivity; structural changes; climate mitigation; renewable resources; technological change

7.1. Introduction

About a decade ago, an environmental policy strategy called 'green growth' was introduced with the aim of bringing about a decoupling of economic growth from resource use. The United Nations Environment Program (UNEP) policy-oriented definition of green growth states that green growth requires absolute decoupling of GDP from resource use and environmental impact (Hickel and Kallis, 2020). While the promise is to align ecology with economy via an 'efficiency revolution', the downside to the implementation is that the efficiency concept on which green growth is based, often entails economy-wide rebound effects that weakens the prospect of achieving absolute reduction of resource use (Jacobs, 2013). A tendency to focus exclusively on efficiency measures and a failure to address irreversible damage to ecosystems have been identified as notable limitations of green growth (Stoknes and Rockstorm, 2018). Notwithstanding the limitations, Hellegatte et al. (2011) developed a framework for analyzing transitions from conventional economic growth to 'green growth'. Higher economic growth has been the unquestioned priority of most countries around the world, but in developed countries economic growth has either remained steady or even decreased after a certain level of income has been achieved, especially in countries that have exceeded their bio-capacity (Gordon, 2012; Juknys et al., 2018). This is an unfamiliar situation for countries like Nepal and Bangladesh which are focused on economic growth as they aim to graduate from low to middle-income status (UNESC, 2018). Hence there is little research on how these countries should approach managing their economic growth strategies in order to minimize their environmental impacts, including as part of official international commitments.

Governments around the world, including those in Nepal and Bangladesh, are signatories to official international commitments that articulate a vision for the future in terms of achieving economic, social and environmental progress. Three official commitments in Nepal and Bangladesh relevant to the theme of this paper are: (1) to graduate from the low-income category to the middle-income country category of the United Nations; (2) to achieve the nationally determined contributions (NDCs) of the Paris Agreement and (3) to show progress on sustainable development goals (SDGs). Whilst NDCs are purely climate targets, graduation from least developed country (LDC) status is largely to do with socio-economic development. The SDGs are focused on economic development but they also include environmental and climate-focused goals. They are proposed as core strategies for reconciling economic, environmental and social priorities (Campagnolo & Davide, 2019). Scholarly articles which analyze the synergies and trade-offs between the abovementioned priorities have suggested that the pursuit of any one of these goals will, to some extent, impact the pursuit of the others (Campagnolo & Davide, 2019; Qian-Qian et al., 2015; von Stechow et al., 2015). For low-income countries, trade-offs and synergies seem to be equally prominent, as climate change mitigation actions could harm economic growth (Jakob and Steckel, 2013). Achieving LDC graduation, delivering on NDCs, and efforts to achieve the resource use and climate mitigation-related SDGs (e.g. goals 7, 12 and 13) therefore have the potential to have positive or negative impacts on Nepal's and Bangladesh's efforts to further improve and green their economic growth (Abeysinghe et al., 2016). SDG7 emphasizes improved access to affordable and clean energy; SGD12 aims to ensure responsible consumption and production; and SGD13 stresses urgent climate action – both mitigation and adaptation.

Green growth as an alternative growth model to a conventional growth is relatively widespread across the international development space. The World Bank (WB), the Organisation for Economic Cooperation and Development (OECD), the UNEP, and the Green Growth Knowledge Platform (a coalition of the Global Green Growth Institute, OECD, UNEP, United Nations Industrial Development Organisation (UNIDO) and the WB) have produced some notable reports on how theoretical developments on green growth can be realized in practice (GGKP, 2013; Hellegatte et al., 2011; OECD, 2010; UNEP, 2012). These organizations have foregrounded green growth as an important agenda (Hickel and Kallis, 2020), and have also channelled funds for green growth-related projects through official development assistance (ODA). However, there is no appropriate criteria for ODA linked development projects to be classified as green growth projects. The Government of Nepal (GoN) and the Government of Bangladesh (GoB) have not officially specified any development projects as green growth projects despite the fact that both Nepal and Bangladesh are major recipients of ODA in Asia (OECD, 2019). However, government policymakers in Nepal and Bangladesh often partner with ODA providers to make critical decisions regarding environmental strategies (Vij et al., 2018). Therefore, given that Nepal and Bangladesh are likely to receive ODA from international development partners in future and considering the abovementioned three strategic priorities, green growth could become the most relevant growth paradigm for policymakers in these countries to engage with. Further, the green growth narrative relies on the notion that promises and encourages growing affluence (Lorek and Spangenberg, 2014) which presents an attractive value proposition for policymakers from low income countries. We discuss the challenges in Nepal and Bangladesh to achieve the three key strategic outcomes (LDC graduation, NDCs and SDGs) when green growth is positioned as the dominant way to pursue both to economic and environmental goals.

The purpose of this paper is to analyze the empirical evidence for the greening of economic growth in Nepal and Bangladesh between 1985 and 2016, and discuss the future challenges up to 2030 whilst continuing to improve energy and material productivity[33]. The rest of the paper is structured as follows: Section 2 explains the methodological approach, Section 3 presents the historical empirical data and future modelling results, and discusses the findings, and Section 4 presents a conclusion.

7.2. Methodology

This research uses quantitative methods for analyzing the empirical evidence for green growth, and for estimating future total primary energy consumption (TPEC) and domestic material consumption (DMC) in Nepal and Bangladesh. For reviewing the historical data on the greening of growth, six green growth indicators were chosen: (i) energy productivity; (ii) carbon productivity; (iii) material productivity; (iv) percent GDP from services; (v) share of renewable energy in the energy mix; and (vi) proportion of land area covered by forest (Figure 7.1). These indicators were chosen from the set of green growth indicators developed by OECD (2017) and are amongst the most frequently used green growth indicators (Merino-Saum et al., 2018). The two South Asian countries, Nepal and Bangladesh were

[33] Energy productivity = million USD per kilo tonne of oil equivalent energy input, Material productivity = million USD per ton of material input.

chosen to examine how the shift towards the greening of economic growth and away from business-as-usual economic growth in LDCs is linked to 1) the strategic context created by Paris Agreement and the SDGs, especially Goals 7, 12 and 13; and 2) the socio-economic development aspirations of low-income countries (UNESC, 2018). For the Paris Agreement, NDC documents were taken as national policies that stated specific climate commitments. Nepal and Bangladesh were chosen as case countries to investigate greening of economic growth in low income countries that have taken some initial steps towards reduction of resource use and climate mitigation despite not being a major contributor to global greenhouse gas (GHG) emissions. Bangladesh was the first low income country to formulate the climate change policy with a strong climate mitigation component in 2009. Bangladesh's 'climate change strategy and action plan (2009)' was followed by Nepal's 'climate change policy (2011)'. Bangladesh and Nepal emphasized climate mitigation in their climate policies to achieve low carbon development via seeking synergies with climate adaptation and economic growth (Fisher, 2013). Additionally, their NDCs have explicitly mentioned resource efficiency and climate mitigation actions they wish to deliver by 2030 along with the climate adaptation actions.

In light of the Paris Agreement, the SDGs and efforts to achieve LDC graduation, one question of interest is how these countries have fared in terms of greening their economic growth in last few decades. Nepal and Bangladesh achieved almost sixfold improvements to their GDP per capita between 1985 and 2016 (WB, 2019). This scale of improvement in GDP per capita is similar to the improvements of other LDCs from Asia, for example, Bhutan, Cambodia, Lao PDR, Myanmar and Timor-Leste (WB, 2019). In fact, most developing countries in the world have improved their GDP per capita by almost 80% in the 20 years to 2010 (Hellegatte et al., 2011). Conventional economic growth entails the consumption of energy and materials including biomass, fossil fuels, metallic ores and minerals. Therefore, given the significant growth they have achieved in last three decades and the potential LDC graduation by targeting higher GDP per capita, Nepal and Bangladesh are expected to achieve at least some decoupling of their economic growth from their use of energy and materials, and from their GHG emissions. Further, the energy and material consumption pathways they have followed in the last three decades, and their forecasted energy and material productivity values in future, influence their prospects of honouring their Paris and SDG commitments. However, empirical evidence on the greening of economic growth in Nepal and Bangladesh has not previously been assessed, and this is a gap which this paper addresses.

7.2.2. Selection of green growth indicators

There are well-established frameworks and indicators for measuring green growth (ADB, 2018; AfDB, 2014; Georgeson et al., 2017; Kim et al., 2014; Lyytimaki et al., 2018; OECD, 2017; PAGE, 2017; Spangenberg, 2004; Tamanani and Valenciano, 2016). Of these, the set of green growth indicators developed by the OECD (2017) has made the greatest practical contribution (Englemann et al., 2019). However, there are about fourteen indicators that are frequently referred in almost all the green growth-related performance measurement frameworks (Merino-Saum et al., 2018). This study chose six of these indicators because all of them align well with the goals of the three strategic priorities NDCs, SDGs and LDC graduation. Moreover, TPEC and DMC are the core focus of the study, and biomass from forests is the major energy source and the main contributor to DMC in both Nepal and Bangladesh. The use of these indicators makes it possible to explore the relationships between the development of service-based economies and energy and material productivity. Other indicators such as waste generation, waste recycling, absolute CO_2 emissions, absolute GHG emissions, land and marine conservation areas, employment in the environmental goods and sectors, water intensity, and level of environmentally related taxes, were not considered for this study.

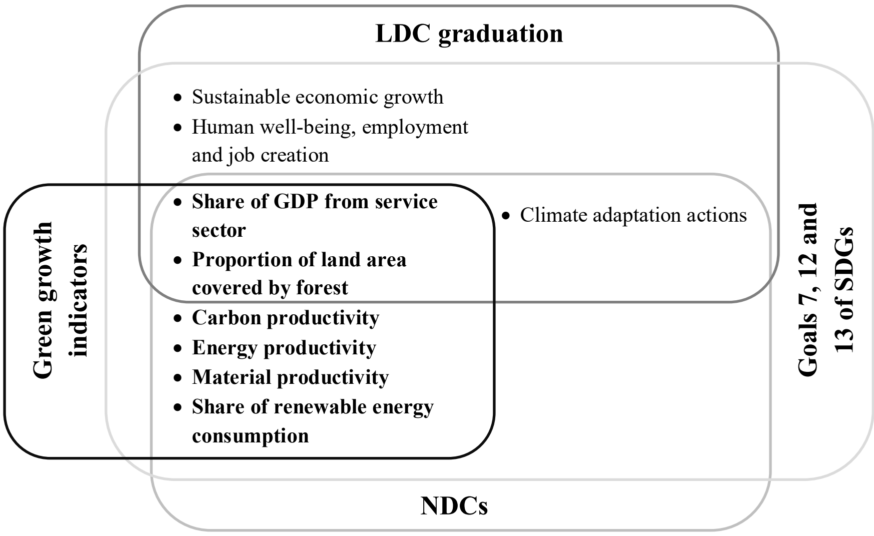

Figure 7.1. Alignment of chosen green growth indicators with the goals of three strategic priorities – low income country (LDC) graduation, nationally determined contributions (NDCs) and sustainable development goals (SDGs).

7.2.3. Exploratory data analysis of selected indicators

The next step was to analyse changes in the values of the selected indicators between 1985 and 2016. The use of a thirty-one year period time-series data on the indicators was thought to be sufficient to support the validity of data analysis, and to observe changes in key variables such as GDP, population, TEPC and DMC, and GHG emissions. Most of the time-series data related to the selected indicators until 2016 was available from the database managed by the World Bank (World Bank, 2021). Data on forest land area was not available for most of the years under study, and therefore only start-year and end-year data are shown and discussed in this paper. Data for the selected indicators used different units and values. Therefore, to normalize the data and to depict them in a single frame, a metric, 'Normalized Index (NI)' is used which is expressed as:

$$\hat{X}_y = \left(\frac{X_y}{X_0}\right).100$$

Where, $\hat{X}_y$ is the normalized index (NI) value for each year from 1985 to 2016, X_y is the non-normalized yearly values, and X_0 is the start-year (1985) value of the indicator. The advantage of using a normalized index is that it provides a benchmark against which progress towards the greening of growth can be measured. However, composite indicators like 'NI' rarely explain the quantum of progress made until the start-year, as the values are fixed for the start-year. Nonetheless, the NI values could very well show the progress made in a time-series context, and they can be used for comparison of progress across the years under study.

7.2.4. Modelling and scenarios for future projection of TPEC and DMC

7.2.4.1. Models for prediction of TPEC and DMC values in future

A multivariate regression model for TPEC and DMC with nominal GDP and population as independent variables were developed for both Nepal and Bangladesh. Modelling of TPEC and DMC are done primarily to estimate the energy and material consumption in 2030, and to calculate the energy and material productivity values in 2030. The variables were standardized and the models were statistically tested using Python software and statistical libraries – Pandas, StatsModels and scikit-learn (McKinney, 2010; Skipper and Perktold, 2010; Pedregosa et al., 2011) – to find the values of t-stat, p-stat, significance F-stat and R^2. The models were considered acceptable if the p-values were within a prescribed limit (< 0.05), and had higher R^2 (>0.95) with statistically significant F-stats. To check the validity of the multivariate models, the available dataset was split into training and testing data using the scikit-learn library's train, test and split function, for which the test size was 30% of the available dataset. A 'K-fold cross validation' method was then used to calculate the accuracy score of the predicted data with respect to test data for the dependent variable. The advantage of using the 'K-fold cross validation' method is that multiple models ($K = 4$) are created for which accuracy scores are calculated for each model, and finally the model with higher accuracy score is recommended. This process was repeated for each of Nepal's and Bangladesh's TEPC and DMC models.

7.2.4.2. Scenarios

Four scenarios were created based on different economic growth rates for Nepal and Bangladesh to explore the future relationship between economic growth and resource consumption. The anticipated economic growth rates for each of the four scenarios were calculated by extrapolating annual growth rates of the ten-year period between 2008 and 2018. Unlike economic growth rates, annual average population growth rates have not fluctuated significantly over last two decades for either country, and have remained at just over 1%. Therefore, these population growth rates were assumed for projections between now and 2030. However, to account for the changes in TPEC and DMC values as a result of changes in population, the annual average population growth rate was used to estimate the population in 2030 as population is the predictor variable for both TPEC and DMC models. The scenarios considered are: 1) Business-as-usual (BAU) growth 2030, 2) Low growth 2030, 3) Medium growth 2030, and 4) High growth 2030. The BAU growth assumes that the economies will grow at their average annual rates in 2016 which were 4.7% for Nepal and 6.4% for Bangladesh. The low growth scenario assumes that the economies will grow at their lowest growth rates in the ten years to 2018 (Nepal – 3.4% and Bangladesh – 5%). In the high growth scenario, it is assumed that the economies will grow at their highest growth rates in the ten years to 2018 (Nepal – 8.2% and Bangladesh – 7.8%). In the medium growth rate scenario, it is assumed that the economies will grow at the average growth rates for the ten-year period to 2018 (Nepal – 5.8% and Bangladesh – 6.4%).

7.2.4.3. Models for understanding the relationship between DMC and different material types

In addition to the TPEC and DMC models for which nominal GDP and population were taken as exogenous variables, another set of DMC models was developed for each country by using Ridge Regression. In this case, the standardized exogenous variables of biomass, fossil fuels, non-metallic minerals and metal ores were used to predict the future contribution of each exogenous variable to potential changes in DMC values based on historical data. The DMC models were deemed sufficient to explain the change in TPEC as biomass and fossil fuels are two major energy sources in both countries. The Ridge Regression was favoured over other regressions because it is able to deal with high levels multicollinearity amongst the exogenous variables. Ridge Regression reduces the impact of the high multicollinearity by introducing a hyper-parameter (λ) whose value ranges from 0 to ∞. To select an appropriate hyper-parameter and for model validation, the 'Grid Search Cross Validation' method was used which is available in the scikit-learn library (Pedregosa et al., 2011). The hyper-parameters with higher cross validation scores gave the best fits for the model.

7.3. Results and discussion

7.3.1. Greening of economic growth in Nepal and Bangladesh – findings from analysis of empirical evidence

Figure 7.2 shows the changes in the Normalized Index (NI) values of selected green growth indicators and GDP per capita for Nepal and Bangladesh between 1985 and 2016. The changes in NI values show that both countries have improved their GDP per capita and their energy, material and carbon productivity, and increased the share of GDP from services. However, the share of renewable energy in the energy mix decreased from 95% to 85% for Nepal, and from 71% to 35% for Bangladesh between 1985 and 2016 (WB, 2019). In Nepal, electricity from hydropower plants and biomass contribute to majority of renewable energy. For Bangladesh, renewable energy is generated from off-grid solar home system, biomass, and from hydropower plants (IEA, 2020). Forest area remained constant for both countries despite the fact that biomass from forests comprised almost three quarters of TPEC in Nepal, and almost one third in Bangladesh in 2016 (WB, 2019).

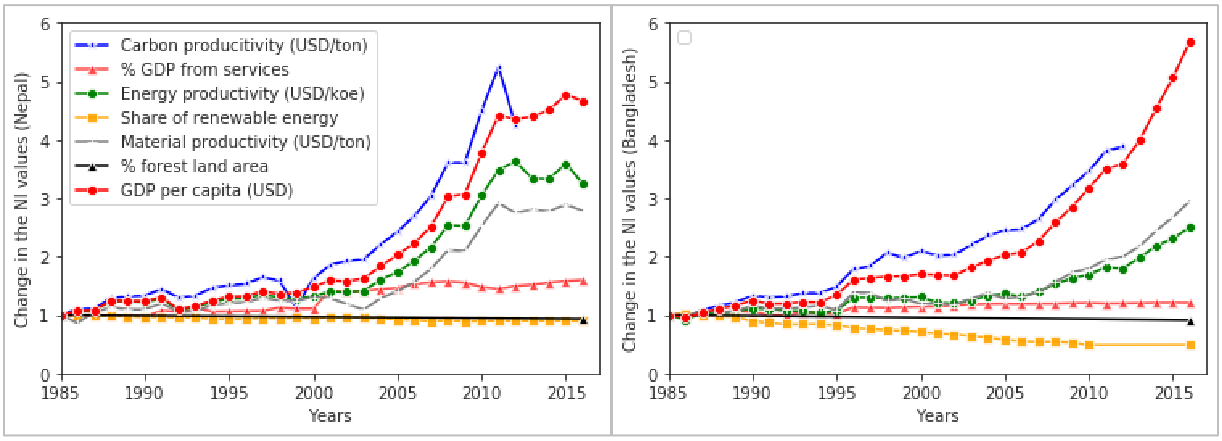

Figure 7.2. Change in the Normalized Index (NI) values of selected green growth indicators for Nepal and Bangladesh between 1985 and 2016.

The correlation analysis of green growth indicators are depicted in the correlation heat maps for three periods between 1985 and 2016, each of which is about a decade long (Figure 7.3). The share of renewable energy is negatively correlated with each of three productivity indicators between 1985 and 2006 for Nepal which becomes positively correlated in the later period between 2007 and 2016. However, the magnitude of correlations are marginally above ‘0' in the later period for Nepal. This could be because of the fact that the productivity indicators and the share of renewable energy did not show significant progress in Nepal after 2010 (Figure 7.2). Hence the correlation is positive in later period as a result of shift in the same direction. For Bangladesh, correlations between share of renewable energy and productivity indicators are negative throughout 1985 to 2016 except for the material productivity between 1996 and 2006. In this middle period, productivity indicators showed minimum progress in comparison to the later period between 2007 and 2016 when share of renewable energy fell significantly. Hence, the magnitude of correlations have high negative values, meaning the shift in the opposite direction in terms of the progress.

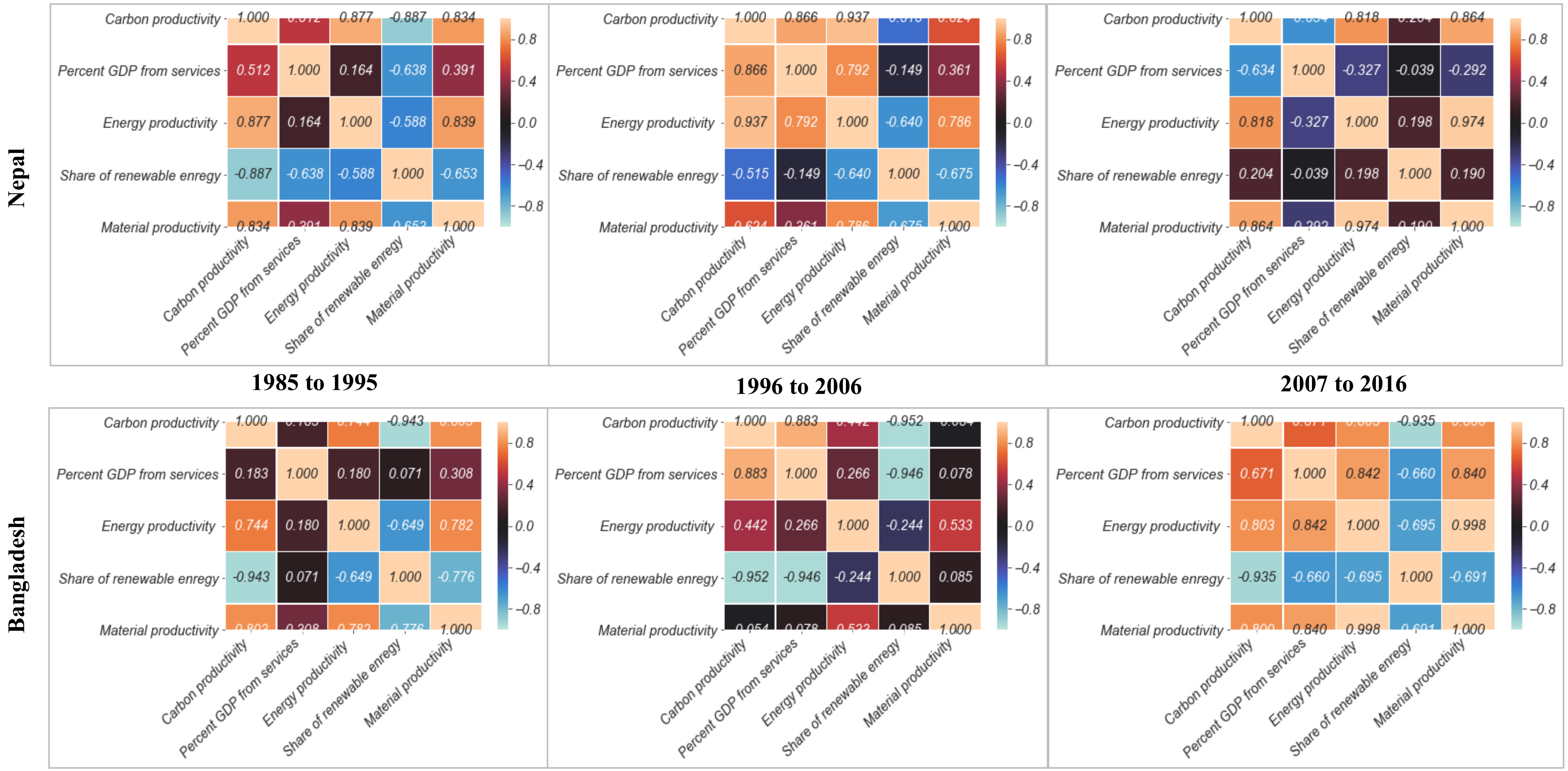

Figure 7.3. Correlation heat maps of green growth indicators for Nepal and Bangladesh for three periods between 1985 and 2016

A correlation analysis shows that for both Nepal and Bangladesh there are strong positive correlations between three key productivity indicators – carbon, energy, and material productivity. Improvements in carbon productivity could therefore be largely due to improvements in energy and material productivity, and changes to the use of renewable energy are a minor factor. There is also a positive correlation between carbon productivity and GDP from services except for the later period for Nepal, which means that in both countries transitioning from agro-based to service-based economies has improved carbon productivity. The share of GDP from services in Bangladesh was already about 45% in 1985. Nepal achieved a similar share of GDP from services in 2004. In 2016, Nepal's share of GDP from services was 50% and that of Bangladesh was 54%. Therefore, the impact of structural changes to carbon productivity over the period 1985 to 2016 has been greater in Nepal than in Bangladesh. In 1985, Nepal had more potential than Bangladesh to achieve productivity improvements via structural changes because in Nepal, a smaller share of GDP came from services. Bangladesh was already more productive back in 1985 in terms of resource use (Table 7.2).

Structural change i.e. transition from energy-intensive sectors like manufacturing and agriculture towards services can help alleviate environmental issues arising from fossil fuel consumption (Mulder et al., 2014). In addition to the effect of structural change, technological change such as resource efficiency interventions across economic sectors may have contributed to productivity improvements which seems more to be for Bangladesh. After 2010, when the share of GDP from services was similar for the two countries, technological change may have improved Bangladesh's productivity rate faster than Nepal's, despite Nepal's significant progress until 2010. The historical data shows that Nepal and Bangladesh improved their GDP per capita, and their energy, material and carbon productivity, over the 30 years to 2016. The interesting period, however, seems to be after 2000 when the NI values of three productivity indicators (energy, material and carbon) started to grow exponentially (Figure 7.2). The rate of progress seems to be stable for Nepal after 2010.

Whilst the productivity values improved in 2016 compared to 1985, the absolute values of TPEC, DMC, and GHG emissions increased significantly for both countries. DMC increased by almost three times for Nepal and by three and half times for Bangladesh over the 30-year period to 2016. TPEC increased by two and half times for Nepal and four times for Bangladesh. Further, GHG emissions increased by at least one-and-a-half times for both countries. This efficiency gain method of achieving the greening of growth can be regarded as weak (Ward et al., 2016). Efficiency gain method focus more on increasing the efficiency of resource use i.e. higher energy and material productivity values, and relatively less on reducing the absolute values of TPEC and DMC. However, the change in energy and material productivity values per annum are less than the annual changes in GDP values for both Nepal and Bangladesh. Stoknes and Rockstörm (2018) define this kind of trend over a longer period of time as 'grey growth' if natural resources are considered to be finite. The selected green growth indicators – barring the declining share of renewable energy in the energy mix – are shown to indicate a positive trend towards greening of economic growth for the period between 1985 and 2016. However, the energy and material productivity improvements are insufficient for achieving absolute reduction of TPEC and DMC, meaning no green growth in technical terms in Nepal and Bangladesh.

Achieving green growth does not have a fixed meaning and is, therefore interpreted in different ways. For example, Frankhauser et al. (2013) interpret green growth as an economy-wide transformation for the creation of a green economy. The Asian Development Bank (ADBI, 2013) describes low-carbon green growth as a process of structural change that could stimulate low-carbon development. As a concept, green growth is understood as economic growth that also achieves environmental protection (Jacobs, 2012). The OECD's (2017) green growth indicator framework provides a basis for measuring progress on green growth by using productivity indices. Therefore, to explain the greening of growth in the absolute sense with a specific reference to the requirements of the Paris Climate Agreement, this paper uses the UNEP (2011) definition of green growth also applied by Hickel and Kallis (2020) that suggest a policy-oriented definition is the most appropriate. Nepal and Bangladesh do not meet the absolute reductions condition between 1985 and 2016, and therefore the progress on achieving green growth was insufficient.

7.3.2. Future prospects for greening of economic growth in Nepal and Bangladesh?

The TPEC and DMC models and the relevant statistics for both Nepal and Bangladesh are shown in Table 7.1. For all models barring Bangladesh's TEPC, population seems to have more influence on resource consumption than GDP. The GDP per capita of Nepal and Bangladesh are on the lower side because both are low income countries. Therefore, majority of absolute increase in TPEC and DMC were driven by population. However, relatively lower percentage of population having access to energy in Bangladesh means that GDP as an energy consumption factor is stronger for Bangladesh. Further, as of 2016, Nepal's TPEC per capita was more than twice of Bangladesh, meaning the population factor is stronger for Nepal.

The reasons for Nepal's higher TPEC per capita are twofold. First, access to local energy sources (e.g. biomass) and imported energy sources (e.g. fossil fuels) are different for both countries because of the geographical difference and resource endowments. The mountainous terrain of Nepal makes it rich in forest resources. The large forest area (40% of total land area) and a landlocked geography makes low-cost access to biomass better in Nepal than in Bangladesh. Therefore, although less efficient, biomass is a preferred energy resource in comparison to severely underused hydroelectricity and fossil fuels that have to be imported and accessed through Indian water ports and land. The local and imported energy sources are used differently between the two countries. For example, Nepal uses biomass energy, mainly in the residential sector for heating and cooking, and Bangladesh is dependent on commercial energy sources like fossil fuels that are used in manufacturing, services, and agriculture sectors. Biomass is of poor quality in terms of generating heat energy in cookstoves, meaning the energy conversion factor is low in comparison to using commercial energy sources. Thus, an individual using biomass consumes more energy than an individual using commercial energy sources for the same work, which appears to be a case for Nepal. The efficiency of energy use measured in terms of energy productivity is higher for Bangladesh than Nepal, meaning Nepal uses more energy to generate each unit of GDP and hence higher TPEC per capita.

Second, the geographical factor which has been assumed as an exogenous variable for the TPEC per capita. Despite having a similar total land area (Nepal – 147,516 km2 and Bangladesh – 148,460 km2), the population density and the total population are far higher in Bangladesh than in Nepal. Both the population density and total population are approximately six-times more for Bangladesh than for Nepal. In Bangladesh, the population is spread throughout the country. By contrast, the major share of the population resides in non-mountainous plain terrain along the Indian border in Nepal. Lower population density of Nepal implies that an individual in Nepal is likely to use more energy if they have a similar or marginally different levels of access to energy resources. Although empirical evidence suggests a negative correlation between energy consumption and population density (Osorio et al., 2016), this may not always be true, especially if the comparison is made between countries with extremely varying level of income. However, it may be reasonable to assume the negative correlation between energy consumption and population density for countries that have similar income levels, meaning that Nepal with a lower population density than Bangladesh, would have a higher per capita energy consumption.

Table 7.1. Energy use and material consumption models for Nepal and Bangladesh.

Predicted values (ŷ)	**Standardized coefficient of Log(GDP) (β1)**	**Standardized coefficient of Log(population) (β2)**	**F-stat**	**R^2**
Log(TPEC) Nepal) (ktoe)	0.354	0.656	5.463E-28	0.95
t-stat	*6.231*	*11.560*		
p-value	*0.000*	*0.000*		
Log(DMC) Nepal) (ktons)	0.460	0.539	2.701E-21	0.95
t-stat	*4.761*	*5.578*		
p-value	*0.000*	*0.000*		
Log(TPEC) Bangladesh) (ktoe)	0.757	0.240	4.227E-25	0.97
t-stat	*8.174*	*2.595*		
p-value	*0.000*	*0.014*		
Log(DMC) Bangladesh) (ktons)	0.287	0.714	1.091E-28	0.98
t-stat	*4.129*	*10.270*		
p-value	*0.000*	*0.000*		

The absolute values of TPEC and DMC will increase by 2030 (Figure 7.4 and Figure 7.5) for all scenarios (BAU, low growth, medium growth and high growth). These are greatest in the high growth scenarios and lowest in the low growth scenarios. The increases in TPEC and DMC occur mainly because of the increases in GDP and population growth, and partly because of increases in the number of people gaining access to electricity, especially in rural areas. The percentage of the population with access to electricity for a given year was not used as an exogenous variable in the TPEC and DMC models (Table 7.1). However, the projected values of TPEC and DMC might have been influenced by this percentage as the models were developed based on time-series data on changes in TPEC and DMC values for the period between 1985 and 2016. During this period, the percentage of the population with access to electricity increased from less than 15% to more than 85% in both countries (WB, 2019). By 2016 access to electricity had reached almost 99% for urban populations in both countries, and access to electricity for rural populations had reached 95% for Nepal and 80% for Bangladesh (WB, 2019). Other forms of energy such as biomass are easily accessible for most rural people in Nepal and Bangladesh who do not have access to electricity (Debnath et al., 2015; WECS, 2010). For all scenarios, by 2030 TPEC and DMC are projected to increase drastically to 67.8% and 61% respectively for Bangladesh. For Nepal, TPEC and DMC are likely to increase by 14.9% and 39.3% respectively.

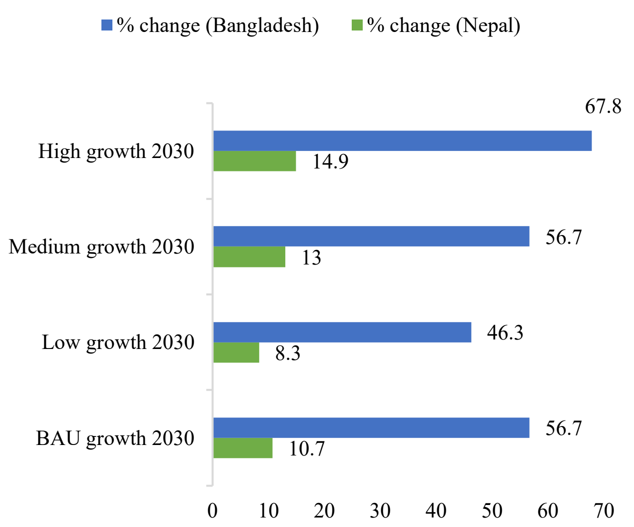

Figure 7.4. Change in TPEC values of Nepal and Bangladesh between 2016 and 2030

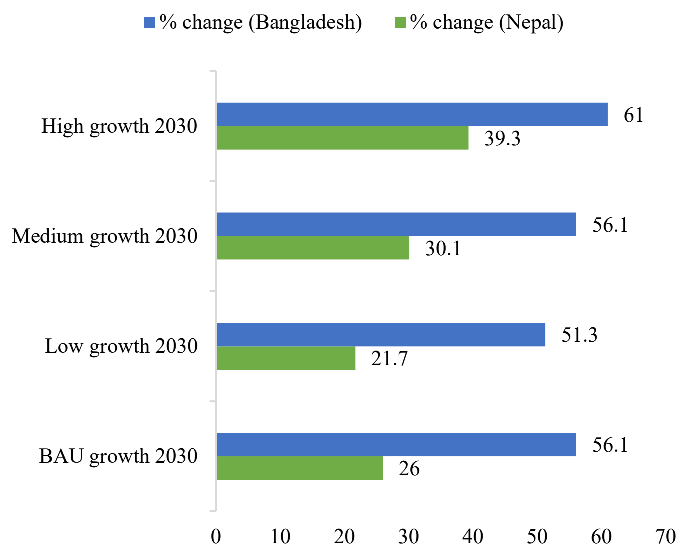

Figure 7.5. Change in DMC values of Nepal and Bangladesh between 2016 and 2030

The energy and material productivity values for four scenarios in 2030 are shows in Table 7.2. The projected productivity values were obtained TPEC and DMC models that accounted time-series data between 1985 and 2016 – a period in which the share of GDP from services increased for both countries. The share of GDP from services increased from 31% to 50% for Nepal between 1985 and 2016. For Bangladesh, the share of GDP from services increased from 45% to 50% during the same period. Therefore, one reason for an increase in the projected values of energy and material productivity could be due to the increased contribution of GDP from services. However, the GDP contributions from services of Nepal (50%) and Bangladesh (54%) in 2016 were both already higher than the averages for low-income countries (41%), and for lower-middle-income countries (49%) (WB, 2019). Therefore, in order to obtain continued energy and material productivity gains from the growth of services in 2030, Nepal and Bangladesh may have to increase the share of GDP from services up to 65%, which is the average for high-income countries. This percentage is theoretically possible, but is significantly higher than the average for upper-middle-income countries (55%). The World Bank reports that an immature deindustrialization and a shift towards service based economy in low income countries from Africa and South Asia that includes Nepal and Bangladesh is compatible with greener and inclusive growth (WB, 2014).

In addition to the effect of structural change in an economy, inflation may have affected the predicted energy and material productivity values. Therefore, the effect of inflation was considered by using the GDP deflator which measures the change in the price of goods and services produced within an economy in an annual basis in percentage. While the historical GDP deflator data were used for calculating the effect of inflation on energy and material productivity values between1985 and 2016, average annual GDP deflator data were used for forecasting real GDP for four scenarios in 2030 (Table 7.2). The average annual GDP deflator measured over thirty-one year period between 1985 and 2016 are 8.8% and 6.5% for Nepal and Bangladesh respectively (WB, 2019). The projected productivity values in 2030 are more than the 2016 values for all scenarios for both Nepal and Bangladesh. The productivity values will be greatest for the high growth scenarios and lowest for the low growth scenarios. The effect of inflation which is measured as the difference between the productivity values using the nominal GDP and real GDP seems to be more significant (8% to 33%) for changes in material productivity values between 2016 and four scenarios in 2030. For energy productivity values, the effect of inflation is between 8% and 27% of the change in energy productivity values between 2016 and four scenarios in 2030.

Table 7.2. Projected values of energy and material productivity of Nepal and Bangladesh for four scenarios in 2030.

Resource productivity Scenarios/years		Nepal			Bangladesh		
		Nominal GDP per unit resource used	Real GDP per unit resource used	Effect of inflation	Nominal GDP per unit resource used	Real GDP per unit resource used	Effect of inflation
Energy productivity (million USD/ktoe)	**1985**	0.51	0.45	0.06 (-)	2.23	1.82	0.41 (-)
	2016	1.67	1.58	0.09 (8%)	7.63	7.12	0.52 (10%)
	BAU 2030	2.86	2.61	0.25 (21%)	13.07	12.22	0.85 (16%)
	Low 2030	2.49	2.27	0.22 (27%)	11.65	10.89	0.76 (19%)
	Medium 2030	3.25	2.96	0.29 (18%)	13.07	12.22	0.85 (16%)
	High 2030	4.26	3.89	0.37 (14%)	14.67	13.72	0.95 (13%)
Material productivity (million USD/kton)	**1985**	0.06	0.06	0.00 (-)	0.17	0.14	0.03 (-)
	2016	0.19	0.18	0.01 (8%)	0.51	0.48	0.03 (9%)
	BAU 2030	0.28	0.26	0.02 (22%)	0.89	0.83	0.06 (8%)
	Low 2030	0.25	0.23	0.02 (33%)	0.76	0.71	0.05 (20%)
	Medium 2030	0.32	0.29	0.03 (23%)	0.89	0.83	0.06 (16%)
	High 2030	0.41	0.37	0.04 (18%)	1.03	0.97	0.06 (12%)

Inflation may continue to significantly affect energy and material productivity values in future – the magnitude of which may depend largely on inflation rate. However, like the effect of structural change, the effect of inflation can be regarded as an unintentional measures towards improving energy and material productivity values. Therefore, in future, both Nepal and Bangladesh may have to bank more on productivity improvements from technological change, and less on structural change. Examples of technological changes are resource and energy efficiency interventions across economic sectors, and transforming the energy mix to source more energy from secondary energy (electricity) generated from renewable resources, rather than biomass and fossil fuels. While the environmental impacts from increase in population and affluence are assumed to be compensated by technological solutions, even a significant improvement in efficiency and a policy measure like substantially higher carbon tax are not sufficient to achieve absolute decoupling (Hickel, 2018; Lorek and Spangenberg, 2014). Nonetheless, the abovementioned two technological changes that draw similarity with Georgian perspective on economic thinking have allowed growth despite reaching ecological limits. Georgian perspective on economic thinking emphasize long-term growth via substituting away from scarce resources such as fossil fuels for mitigation of resource scarcity (Bowen and Fankhauser, 2011).

Besides an unintentional effects of structural change and inflation, Nepal and Bangladesh may have initiated efforts to materialize the abovementioned technological changes at both the strategic level and on the ground. However, the future role of technological change across sectors in driving the continued progress on energy and material productivity appears to be challenging as absolute reductions of TPEC and DMC are unlikely to be achieved in future. This is true particularly for Bangladesh whose energy productivity (EP) and material productivity (MP) values of 7.63 million USD/ktoe and 0.51 million USD/kton respectively in 2016 are already on the higher side in comparison to other South Asian countries. Nepal's energy productivity and material productivity values of 1.67 million USD/ktoe and 0.19 million USD/kton respectively in 2016 are the lowest in comparison to other South Asian countries. For example, India (EP = 4.02 million USD/ktoe, MP = 0.31 million USD/kton), SriLanka (EP = 8.41 million USD/ktoe, MP = 0.72 million USD/kton), Pakistan (EP = 3.22 million USD/ktoe, MP = 0.32 million USD/kton), and Bhutan (EP = NA, MP = 0.26 million USD/kton) (IEA, 2020, WB, 2019). However, the world average for energy productivity and material productivity was 8.00 million USD/ktoe and 0.85 million USD/kton respectively in 2016.

Nepal appears to have more potential than Bangladesh to improve (i) energy and material productivity, and (ii) absolute values of TPEC and DMC as the percentage changes in absolute TPEC and absolute DMC between 2016 and 2030 are lower for Nepal than for Bangladesh (Figure 7.4 and Figure 7.5). However, the energy and material consumption models indicate an increase in the absolute values of

TPEC and DMC for all four scenarios in 2030 for both countries. Therefore, in technical terms, Nepal and Bangladesh do not seem to be in a pathway to achieving absolute decoupling of GDP from resource use in future. In addition to technological change, a policy instrument like a carbon tax has been viewed as a tool to creating an equitable access to clean energy in developing country, thus contributing to greening of economic growth (Azad and Chakraborty, 2020). We limit our discussion to technological changes as the price of carbon in the context of absolute decoupling of GDP from resource use is almost five-times the current price of carbon (Hickel, 2018).

7.3.3. Technological change as a key driver for reducing TPEC and DMC in the future

7.3.3.1. Substitution of biomass energy for managing absolute reductions of TPEC and DMC

Most primary energy sources in Nepal's TPEC are used for the less productive residential sector in the form of non-commercial biomass energy (WECS, 2010). For Bangladesh, commercial energy sources like coal, and petroleum products comprised more than 50% of TEPC in 2016 compared to 30% in 1985 (Munim et al., 2010). Most of Bangladesh's commercial energy goes to productive sectors like manufacturing and agriculture. Biomass comprised about 25% of Bangladesh's TPEC in 2016. Replacing primary energy sources (e.g. biomass) with transformed energy (e.g. electricity), and replacing traditional energy sources with commercial sources can significantly improve economy-wide energy productivity (Sengupta 1997; Nag and Parikh 2000). However, the historical evidence on the share of renewable energy in the energy mix shows that biomass has been substituted partly by non-renewable commercial energy resources in both countries, and in Bangladesh in particular, this seems to be a major issue. Moreover, biomass is still the dominant energy resource in Nepal and second-most used energy source in Bangladesh. Biomass contributed 62% of DMC in Bangladesh and 75% of DMC in Nepal in 2016. The share of biomass was about 95% of DMC for each country in 1985. The standardized coefficients of the Ridge Regression model (Table 7.4) shows that in 2030 biomass may still comprise about 43% and 52% of total DMC for Nepal and Bangladesh respectively if current trends continue. Fossil fuels appear to be the second-most favoured material in Bangladesh, and therefore will probably dominate the composition of TPEC in 2030 along with biomass as it did in 2016, thereby further weakening the share of renewable energy in the energy mix. Substitution of biomass energy in Nepal, and both biomass and fossil fuels in Bangladesh, by electricity from renewable resources appears to be one way forward for achieving absolute reductions of TPEC and DMC.

Table 7.3. Results from Ridge Regression analysis of DMC for Nepal and Bangladesh

	Standardized coefficient of Log(Biomass) (β1)	**Standardized coefficient of Log(Fossil Fuels) (β2)**	**Standardized coefficient of Log(Non-metallic minerals) (β3)**	**Standardized coefficient of Log(Metal ores) (β4)**	**Hyper parameter (λ)**	**Cross validation score (R2)**
Log(DMC) Nepal	0.429	0.087	0.483	0.048	0.1	0.855
t-stat	*5.238*	*1.488*	*11.548*	*2.365*		
p-value	*0.000*	*0.148*	*0.000*	*0.025*		
Log(DMC) Bangladesh	0.578	0.229	0.182	0.032	1	0.987
t-stat	*5.817*	*1.850*	*4.530*	*1.480*		
p-value	*0.000*	*0.025*	*0.000*	*0.150*		

7.3.3.2. Increasing resource efficiency as a strategy for minimizing the negative impacts of rising income elasticity of resource consumption

Figure 7.6 and Figure 7.7 shows the variation in resource consumption (TPEC and DMC) per capita with changes in income (expressed in terms of GDP per capita). Despite the higher energy and material productivity values for Bangladesh in 1985 and 2016, and also its higher GDP per capita, per capita resource consumption (TEPC and DMC) are lower for Bangladesh than for Nepal. The percentage of the population with access to energy was higher in Nepal than in Bangladesh throughout the 1985–2016 period. This might be a reason for the higher TEPC per capita in Nepal. Looking beyond 2016, the GDP per capita is likely to increase by almost 1.5 to 2.5 times for Nepal and by 2.5 to 3 times for Bangladesh between 2016 and 2030 for all scenarios. Despite this, TEPC per capita and DMC per capita are likely to increase much more slowly than the GDP per capita. This is indicated by the small coefficients (less than 1) of GDP in the TEPC and DMC models where the income elasticity of both TPEC and DMC is less than one. For an income elasticity value between 0 and 1, a one- percent increase in GDP per capita will result in smaller increase in resource consumption per capita (Steinberger and Krausmann, 2011). The larger change in Bangladesh's quantum of income outweighs the effect of its inelastic income elasticity of DMC in comparison to Nepal. However, after the LDC graduation, the inelastic income elasticity of resource consumption may become elastic as a result of changes in people's consumption behaviour and an increase in the size of the middle class population.

Because the effects of structural change is likely to tail off slowly, technological changes such as increased efficiency of energy use will need to be major drivers in pursuit to achieving absolute decoupling of GDP from resource use. For Bangladesh, the technical efficiency[34] of energy use was 0.85 in 1990 and this figure gradually decreased to 0.73 in 2016. For Nepal the figure has remained at almost 0.98 throughout last three decades (WB, 2019). The technical efficiency of energy use does not seem to be an issue for Nepal, but a transition from biomass to transformed energy like electricity will potentially reduce the technical efficiency of energy use in future. While electricity will have higher energy productivity, and that this will offset any energy loss due to the low technical efficiency of energy use, a significant shift away from biomass-based TPEC may impact productivity values in the long term. Nonetheless, in the absence of technological change and increased resource efficiency across sectors, the frontier of green growth for low-income countries appears to be an instance at which the structural effect on productivity indicators becomes saturated.

[34] The technical efficiency of energy use is defined as the ratio of TPEC to the total primary energy supply (TPES).

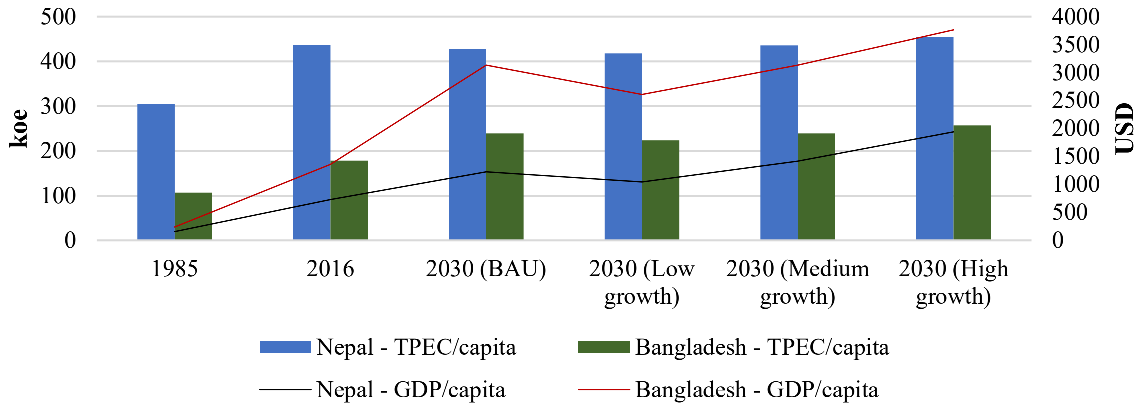

Figure 7.6. Total primary energy consumption (TPEC) per capita versus income per capita between 1985 and 2030 for Nepal and Bangladesh.

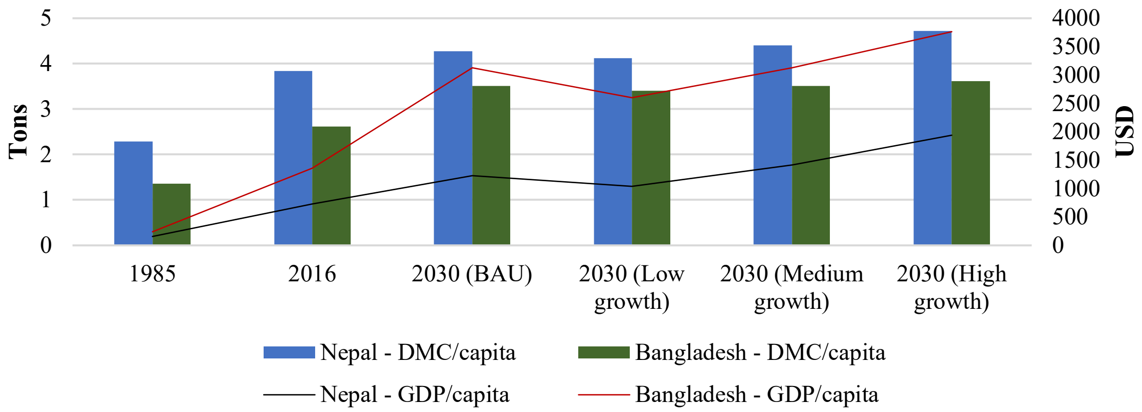

Figure 7.7. Domestic material consumption (DMC) per capita versus income per capita between 1985 and 2030 for Nepal and Bangladesh.

7.3.4. Are environmental and economic goals likely to be met by 2030?

Creating a strong connection between climate actions and SDGs maximizes and strengthens the effectiveness of the actions in both domains (Gomez-Echeverri, 2018 and Nerini et al., 2019). Table 7.3 shows the mapping of the goals of NDCs and SDGs against LDC graduation criteria that are expressed in terms of selected green growth indicators. For LDC graduation, there are certain thresholds against each of three metrics: gross national income (GNI) per capita, the human asset index (HAI), and the economic vulnerability index (EVI). The HAI is not considered for this study as the indicators of HAI, for example the under-five mortality rate, the population undernourished rate and the literacy rate do not seem to relate to the NDCs or SDGs goals 7, 12 and 13. As of 2018, Bangladesh’s GNI per capita was $1,274 which is just above the LDC graduation threshold value of $1,230, whereas Nepal's GNI per capita was $745. In 2020, Nepal met EVI and HAI criteria in two consecutive triennial reviews (UNESC, 2018), and Bangladesh met all three criteria for the first time in 2018. Bangladesh will have to meet at least two criteria again in 2021 to be eligible for LDC graduation. Nepal was eligible to graduate in 2018 after meeting the criteria for two successive triennial reviews, but deferred graduating until 2021 because of its low GNI per capita (UNESC, 2018).

For developing countries, there should be a linkage between the resource-based primary production sector and rest of the economy, and resource-enhancing technological change for green growth can be a catalyst for economy-wide transformation (Barbier, 2016). A study of the relationship between energy consumption and economic growth in Nepal found that there is a uni-directional causality from economic growth to consumption (Nepal and Paija, 2019). There is also a long-run co-integration between energy consumption, carbon emissions and industrial production, and a uni-directional causality relationship for GDP per capita to electricity consumption per capita in Bangladesh (Mozumder and Marathe, 2007; Rahman and Kashem, 2017). Whilst these relationships are between GDP and energy consumption, it can be assumed that, due to efforts to achieve higher GNI per capita for LDC graduation, TPEC is highly likely to increase. Similar relationships can be assumed between GNI per capita and DMC, since a significant proportion of DMC is represented by biomass and fossil fuels in both countries. The NDCs and SDGs are also related to the EVI, especially from a climate adaptation and economic growth point of view. The EVI has an indicator for the increased share of GDP from the less resource-intensive service sector. The share of GDP provided by services, along with the land area covered by forest, overlaps with the goals of each of the three strategic priorities. These two common indicators are also the points of tension between LDC graduation and the goals of achieving absolute reductions of TPEC and DMC of the NDC and SDGs as higher average incomes entail higher TPEC and DMC.

In 2018, the share of agriculture, forestry and fishing to value added was 25% for Nepal and 13% for Bangladesh while the annual growth rate was 2.8% for Nepal and 4.1% for Bangladesh (WB, 2019).

These sectoral annual growth rates are lower than the overall economic growth rates for Nepal (4.7%) and Bangladesh (6.4%) in business-as-usual scenario. Therefore, the share of GDP from industry and services could potentially increase to compensate for the reduction in the share of GDP from agriculture, forestry and fishing. While energy and material productivity goals are likely to be met, the absolute values of TPEC and DMC will increase (Figure 7.4 and Figure 7.5), and the percentage of renewable energy in the energy mix is likely to decrease if current trends continue (Figure 7.2). Nepal is likely to achieve 100% access to electricity by 2030. The electrification rate as of 2017 was 95%, and about 85% of energy was being generated from renewable energy sources (WB, 2019). The percentage of fossil fuels in the TPEC has been steadily increasing from 3.5% in 1985 to 15% in 2016, but absolute values of TPEC and DMC in Nepal will be driven by biomass if the standardized coefficients of biomass and fossil fuels in the Ridge Regression model (Table 7.4) are taken into account. The TPEC of Bangladesh, even in the low growth scenario (Figure 7.4) will increase by almost 46.3% by 2030 relative to 2016, and energy productivity will increase by a maximum of 67.8%. The absolute value of TPEC is therefore highly likely to increase by 2030, and if the energy mix of 2016 and the standardized coefficients of biomass and fossil fuels of the Ridge Regression model (Table 7.4) are taken into account, GHG emissions targets are unlikely to be met by 2030 for both countries. Therefore, the climate mitigation goals of the NDC and SDGs are unlikely to be met in 2030 despite improvements in energy and material productivity.

Table 7.4. Linking the key goals of NDCs and SDGs with the threshold criteria for LDC graduation for Nepal and Bangladesh.

<table>
<tr><td></td><td colspan="4">Least developed country (LDC) graduation criteria</td></tr>
<tr><td></td><td colspan="2">Increase Gross national income (GNI) per capita</td><td colspan="2">Decrease Economic vulnerability index (EVI)</td></tr>
<tr><td rowspan="3">Nationally Determined Contributions (NDCs)</td><td>absolute reduction of TPEC</td><td>×</td><td rowspan="3">maintaining 40% of land area as forest*</td><td rowspan="3">×</td></tr>
<tr><td>improvement in energy and material productivity*</td><td>✓</td></tr>
<tr><td>increased share of renewable energy in the energy mix*</td><td>?</td></tr>
<tr><td rowspan="4">Sustainable Development Goals (SDGs) – goals 7, 12 and 13</td><td>improvements in energy and material productivity*</td><td>✓</td><td rowspan="2">transition towards sustained economic growth</td><td rowspan="2">✓</td></tr>
<tr><td>absolute reductions of TPEC and DMC</td><td>×</td></tr>
<tr><td>increased share of population with access to electricity and other renewable energy sources</td><td>✓</td><td rowspan="2">reduced share of agriculture, forestry and fisheries in the GDP* (land area covered by forest, and increased share of GDP from service sector)</td><td rowspan="2">✓</td></tr>
<tr><td>increased share of renewable energy in the energy mix*</td><td>?</td></tr>
<tr><td></td><td colspan="2">CLIMATE MITIGATION</td><td colspan="2">CLIMATE ADAPTATION</td></tr>
</table>

7.4. Conclusions and policy implication

The analysis of empirical evidence and the energy and material consumption models shows that the existing progress pertinent to energy and material productivity improvements is not sufficient to green the economic growth in absolute sense in Nepal and Bangladesh. The normalized index values of energy and material productivity shed light on historically strong structural effects for both countries, particularly in the context of declining opportunities for productivity improvements via unintentional transitions from agro- to service-based economies and from the effect of inflation. Therefore, it appears that technological changes such as substitution of biomass and resource efficiency across sectors will have to play a major role as the climate mitigation targets of NDCs and SDGs 7 and 12 do not appear likely to be achieved by 2030. In the absence of these technological changes, the progress on greening of economic growth in low-income countries via efficiency improvements will stall as the effect of structural changes on energy and material productivity diminish.

While the overlapping goals and targets of three strategic priorities (NDCs, SDGs and LDC graduation) could be viewed as an advantage to both Nepal and Bangladesh, especially in terms of creating synergetic effects, an increase in GNI per capita may challenge climate mitigation targets and SDGs. Therefore, it is recommended that a policy response be foreshadowing two important factors. The first factor is a technological change across the resource-intensive industry and energy sectors to lessen the use of forest biomass and to enable a higher share of renewable energy in the energy mix. Lessening the use of forest biomass by substituting with renewable energy resources has two advantages from a green growth point of view – reduction in the absolute values of TPEC and DMC, and an increased share of renewable energy in the energy mix which has been in decline in recent years for both countries. The second factor is to use policies to maintain constant income elasticity of demand for resource consumption to counter the potential growth in incomes leading to an increase in demand for natural resources. For example, policies promoting technological changes that would allow Nepal and Bangladesh to utilize most of their potential to improve the values of productivity indicators further as both countries can target to go beyond the world average. As a long-term strategy to reduce TPEC and DMC and to enable protection of forest resources as income increases, a policy that subsidizes hydroelectricity specifically for residential use can be introduced that will substitute biomass consumption in the residential sector in Nepal. For Bangladesh, a policy that encourages a gradual reduction of subsidies on fossil fuels while increasing subsidies on renewable energy technologies concurrently can offset a part of rising TPEC and DMC consumption as income increases.

On one hand, strategic action will require the implementation of technological changes on the ground as well as significant financial resources and technical expertise; on the other hand, delivering outcomes in 10 years' time could be practically challenging. In conclusion, there has been significant historical progress in energy and material productivity improvements for Nepal and Bangladesh but looking ahead, there remains challenge for policymakers to explore strategies to continue efficiency gain whilst looking to minimize absolute values of TPEC and DMC.

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Chapter 8: Discussion

In this chapter, I discuss the research findings from each of the four results chapters (Chapter 4 to Chapter 7). First, I create a linkage between the research findings related to the policy formulation aspect of the objectives of global environment-related initiatives and green growth inclusion into government policies, and the research findings related to the implementation aspect of those objectives. Second, I explain how the research findings are related to each other. Finally, in an overall discussion, I emphasise the causal effects of global environment-related initiatives and green growth-related policy discourse on policy formulation pertaining to environment- and climate-specific and sectoral policies, and the delivery of climate mitigation actions via implementation of these policies. Figure 8.1 depicts the interrelationships between the research outcomes presented in the four results chapters (Chapter 4 to Chapter 7). The research findings indicate that global environment-related initiatives and green growth-related policy discourse are influencing the knowledge and ideas of stakeholders, i.e. the cognitive beliefs of the policy actors. Subsequently, norm-setting, which refers to making the framing of climate mitigation actions into policies normal in the policymaking process, results in the policy integration. The executive influence across relevant government institutions, their interactions regarding policy discourse, the exchange of knowledge and ideas between policy actors and their institutions, and the framing of the climate mitigation actions, mean that a new climate mitigation-based policy paradigm is appearing in both countries. The new climate mitigation-based policy paradigm shows a layering effect in terms of paradigmatic change, a shift in the financial mechanism from ODA-based to internal funding, and is transparent in the sense that intended climate mitigation actions are communicated to the UNFCCC. For both Bangladesh and Nepal, the new mitigation-based paradigms co-exist with the previous climate adaptation-based paradigms, which is a trait of the layering effect as explained by the institutional perspective on paradigmatic change. Regarding the delivery of the objectives of global environment-related initiatives and green growth, this research found two key policy issues. First, the need to improve policy coherence between environment- and climate-specific policies, and sectoral policies. Second, the requirement for greater mainstreaming of climate mitigation actions across sectoral policies instead of simply integrating for delivery of an economy-wide reduction of GHG emissions and sustainable use of resource. The following sections discuss the research findings in detail.

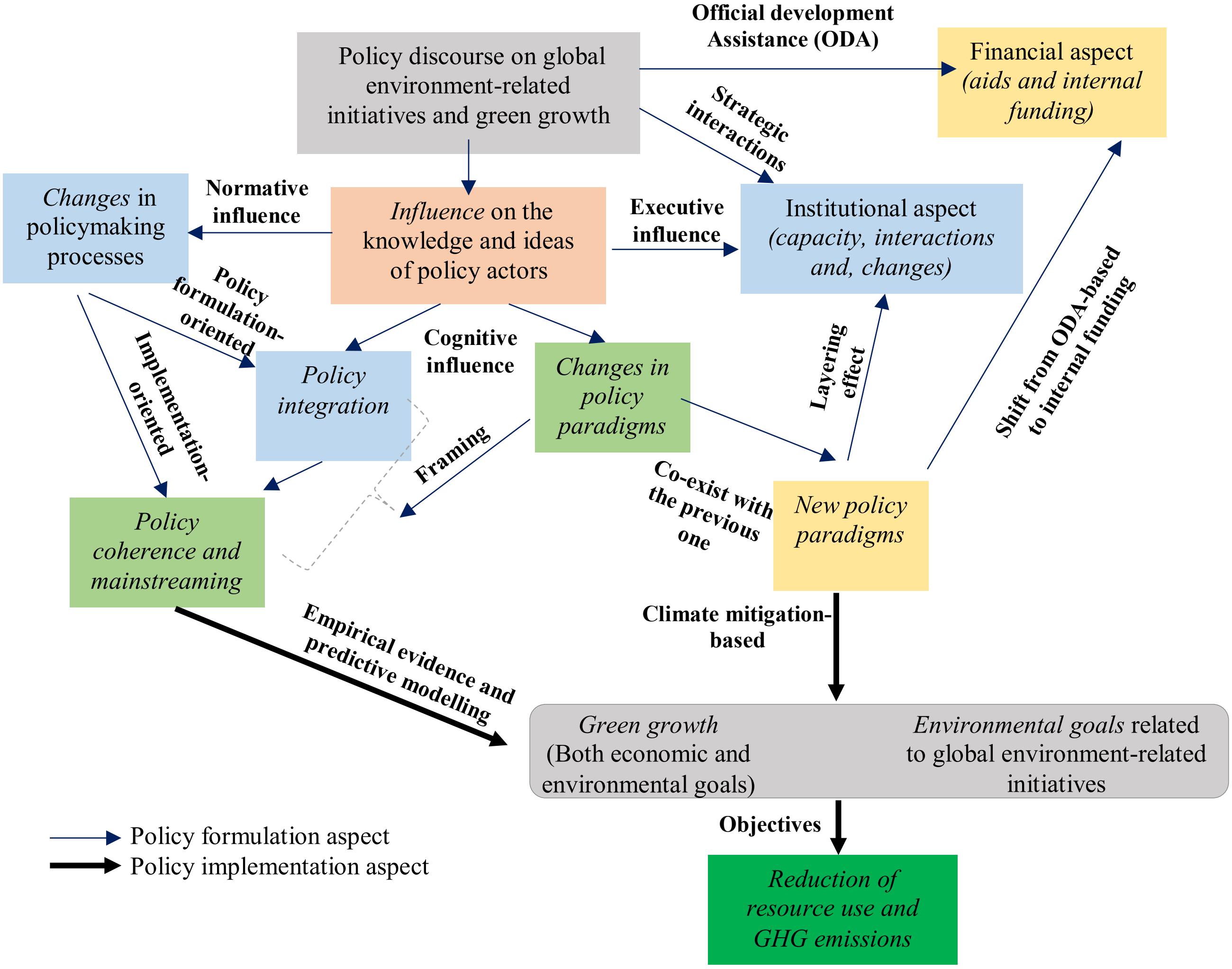

Figure 8.1. Causal effect across policy formulation and implementation from policy discourse on global environment-related initiatives and green growth.

8.1. Key features of the new climate mitigation-based policy paradigms in Nepal and Bangladesh

The climate change-related policy paradigms have been changing for both Nepal and Bangladesh, and hence a new climate mitigation-based policy paradigm appeared in both countries after 2005. Initially, during the 1990s and until 2005, policy paradigms were climate adaptation-based in both countries. However, post-2005, the new policy paradigms in both countries embraced climate mitigation actions such as reduction of GHG emissions, improved efficiency of resource use, and sustainable use of resources. The new climate mitigation-based policy paradigm co-exists with the climate adaptation-based policy paradigms, with the latter being more prominent in both countries. The layering of the new climate mitigation-based policy paradigm with the climate adaptation-based policy paradigm means the introduction of new rules in the later government policies on top of the previous policies (Mahoney and Thelen, 2010). The review of climate, environment and sectoral policies in Nepal and Bangladesh identified the new norm in policymaking, which is the inclusion of the objectives of global environment-related initiatives and green growth in the policies.

As part of the normative influence, the new norm in government policymaking appears to emphasise climate mitigation-oriented actions (e.g. reduction of GHG emissions and sustainable use of resources), together with the climate adaptation actions. Further, the evidence from the review of current sectoral policies (Chapter 4) shows that policies have also given importance to co-benefits of climate mitigation actions such as the access to energy, sustainable transportation and sustainable agriculture. Nonetheless, despite the new norm and an emphasis on climate mitigation co-benefits, the climate adaptation-based policy paradigms are still prevalent and dominant in both countries as climate mitigation-based and climate adaptation-based policy paradigms layer up and co-exist in both countries. Another notable feature of new climate mitigation-based policy paradigms in both countries is the shift from ODA-based funding to internal source-based funding for implementing policies, meaning the governments have started to rely more on their own financial resources. This implies that the governments of Nepal and Bangladesh are willing to invest in climate mitigation actions such as the installation of renewable energy technologies (e.g. solar PV, micro-hydro, and improved cookstoves[35]) in rural areas that are off-grid and rely on either fossil fuels or primary energy biomass. However, the need to diversify funding arrangements related to climate mitigation is believed to be driven by global climate politics, which has complicated both international climate finance and development finance for low-income countries (Mahat et al., 2019). Thus, it is reasonable to infer that the policy discourse on global environment-related initiatives and green growth have not only changed the way climate mitigation issues are framed

[35] Improved cook stoves that uses fuelwoods are considered to be more efficient than traditional stoves for cooking. They reduce energy loss via heat radiation which is common in traditional cook stoves.

in government policies in Nepal and Bangladesh but also encouraged policymakers to diversify climate mitigation-related finance options.

8.1.1. The magnitude and mechanism of changes in policy paradigms

For both countries, the research found the scale of changes in each of three aspects of the policy paradigm to be of second-order. They were: the problems and focus of the policies, the contents of the policies, and consideration of global environment-related initiatives' objectives. A fourth aspect—institutional and strategic interactions between policy actors—indicated first-order change. First- and second-order changes imply minor adjustments in the hierarchy of policy goals and the mobilisation of new policy instruments, whereas third-order change entails a radical shift that re-orients the focus and purpose of the policy (Hall, 1993). Therefore, the new climate mitigation-based policy paradigms in both Nepal and Bangladesh share similarity with incremental policymaking that refers to an expected change in policies. In a Kuhnian sense [36] (Kuhn, 1962), first- and second-order changes are normal and do not entail a radical change in policy discourse or a significant shift in policy goals (Daigneault, 2014). The introduction of economic- and market-based policy instruments, the adoption of global environment-related initiatives, specific climate policies and NDCs, partnerships across government institutions across sectoral and multi-level governance, and increased allocation of funding from internal sources are part of normal changes during a paradigmatic change. However, these changes may or may not be sufficient to achieve required reductions in non-renewable resource use and GHG emissions. Nevertheless, the normative position of both Nepal and Bangladesh seems to have shifted, in line with the requirements of the international climate agreements that call for commitments regarding absolute reductions in GHG emissions, even in the developing and low-income countries.

The mechanisms of change vary across four aspects of the policies. For problems and the focus of the policies, the change mechanism is teleological in both countries, linear for the contents of policies in

[36] Kuhnian sense is based on the seminal work of Thomas Kuhn that explains the nature of scientific change via using the paradigm concept.

both countries, and dialectic for institutions and strategic interactions in both countries. For global environment-related initiatives, the change mechanism is linear for Nepal and teleological in Bangladesh. A change towards identifiable policy goals characterises teleological change mechanisms. The ideational constructs of the policy actors drive the dialectic change, and the linear changes are evolutionary without an identifiable end-point (Capano and Howlette, 2009). Therefore, the new policy paradigms resulted from a focus on climate mitigation actions and the ideational constructs of the policy actors were responsible for driving change in policy paradigm. However, the evolutionary changes to the consideration of global environment-related initiatives' objectives in Nepal mean that the policy actors in Nepal are yet to establish the objectives of global environment-related initiatives as essential policy goals. In contrast, the new policy paradigm in Bangladesh seems to have recognised the objectives of global environment-related initiatives as key policy goals in their sectoral policies. At a policy level, Bangladesh appears to be more proactive than Nepal despite the projected temperature rise ranging between 1.5^0 and 2^0C (relative to 2010) for both countries by 2050, and the total economic cost of climate change likely to reach up to 4% of GDP for both countries in 2050 (Ahmed and Suphachalasai, 2014). Bangladesh formulated its Climate Change Strategy and Action Plan in 2009, and Nepal formulated its first Climate Change Policy in 2011. Likewise, Bangladesh submitted its first NDC to the UNFCCC in 2015, whereas Nepal submitted its NDC in 2016.

8.1.2. Enabling the new policy paradigms in future

The new policy paradigms in both countries can be considered as a step towards integrating the objectives of global environment-related initiatives and green growth into government policies. However, the way policy evolves in future will determine if Nepal and Bangladesh will continue to emphasise climate mitigation in both policy formulation and implementation. Because the new policy paradigms in both countries co-exist with climate adaptation-based policy paradigms, and there could be contradictions in the ideational constructs of the policy actors in the focuses of the policies, in the policy instruments used, or in the allocation of financial resources. While the layering of policy paradigms does not mean that policies will remove or neglect old rules—for example, rules related to climate adaptation—there is a possibility that layering may entail contradictory pressures regarding strategies and competition over resources between responsible institutions (Mahoney and Thelen, 2010; Vij et al., 2018). Nevertheless, layering is normal according to the institutionalist approach to analysing policy change processes that focus on explanatory variables such as the role of policy actors and the policy instruments in policy changes (Van Der Heijden, 2011). Therefore, the co-existence of the new climate mitigation-based policy paradigms with the climate adaptation-based policy paradigms in both countries will likely continue to emphasise the objectives of global environment-related initiatives and green growth.

This research identified competition over financial resources as a critical factor in the co-existence of the policy paradigms in both countries because the new policy paradigms show a shift from ODA-based financial resources to internal funding. Competition over resources between government institutions in both countries is likely to become more intense after LDC graduation, as the volume of the ODA per capita from international donor organisations will likely decrease, based on the recent trend of ODA per capita inflow in both countries. Additionally, the development-related finance which is compatible with the climate adaptation-based policy paradigm (Klein, 2010) may not be equally compatible with the climate mitigation actions that are part of new policy paradigms in both countries. Climate adaptation is closely connected to development, which is why the Bali Action Plan recognised the need to incentivise adaptation actions based on sustainable development policies (Klein, 2010). Subsequently, the international development community (e.g. bilateral and multilateral agencies and non-government organisations) and developing country governments around the world started to converge around mainstreaming of climate change issues into development, particularly climate adaptation (Janetos et al., 2012). The donor agencies are also increasingly inclined to pledge climate adaptation funds. But they have tended to turn away without much contribution (Mahat et al., 2019). Therefore, the contents of the policies—the policy instruments (economic- and market-based) and the financing mechanisms—will have to evolve further to minimise any negative impacts of changes to ODA. Although the lower GDP per capita and larger carbon sinks that Nepal and Bangladesh have are key determinants of the climate mitigation finance under ODA delivery mechanisms (Halimanjaya, 2015), the recent trend is that ODA per capita received is declining for both countries (World Bank, 2021). Reduced ODA per capita implies that both countries may have to leverage the recent progress made on economic- and market-based policy instruments to deliver climate mitigation-oriented actions.

Although the new policy paradigm that relates to policy formulation focuses on climate mitigation, predictive modelling of resource use and GHG emissions in Nepal shows that policy coherence between sectoral growth-focused policies and climate policies (e.g. NDCs) is essential from a policy implementation perspective. The historical trend and predictive modelling of resource use (biomass and fossil fuels) and GHG emissions (as shown in Chapter 6 and Chapter 7) provided evidence on the continuous rise in non-renewable resource use and GHG emissions. Therefore, although this research noted new climate mitigation-based policy paradigms in Nepal and Bangladesh, the delivery of absolute reductions in non-renewable resource use and GHG emissions remains a concern. I found that this is mainly because of the conflict in policy goals across sectoral policies and weak coherence between sectoral policies that have included climate mitigation-related goals. Therefore, while better coherence between climate policies and sectoral policies is recommended, better policy coherence requires the presence of discursive institutionalism that embraces the content of policy actors' ideas and their institutional interactions (Schmidt, 2016). This implies that the common set of climate mitigation-related policy goals and policy instruments in sectoral policies that are a part of new policy paradigms will be a critical element of discursive policymaking in the future, for both Nepal and Bangladesh. The delivery-focused discourse, especially in an absolute sense, linking climate policies to sectoral policies, and the operationalisation of economic- and market-based instruments via collaboration with local financial institutions are key to enabling new policy paradigms. The collaboration with local financial institutions is an important step for delivering climate mitigation actions in the context of declining ODA per capita and existing economic- and market-based instruments that are yet to be fully utilised. For example, in both countries, the energy sector has taken most out of the existing economic- and market-based instruments. The agriculture sector—the major contributor to the GHG emissions in both Nepal and Bangladesh—has hardly utilised the existing economic- and market-based instruments for climate mitigation actions.

8.2. Mainstreaming climate mitigation actions into sectoral policies in Nepal

The semi-structured interviews' data from the chosen policy actors (n = 12) in Nepal, the analysis of the data, and a review of non-environment sector policies (n = 6) shed light into the integration of the objectives of global environment-related initiatives and green growth into the government policies (Chapter 5). The climate mitigation mainstreaming framework developed and elaborated in Chapter 5 provided further insights into conceptual criteria that distinguishes the concept of mainstreaming with policy integration. Further, the use of the concept of 'mainstreaming', a focus on the factors influencing the inclusion of climate mitigation actions into sectoral policies, and the entailing policymaking processes investigated the level of mainstreaming across sectoral policies. The investigation generated insights into the levels of mainstreaming which is 'prioritisation' for the energy and forest sectors, 'harmonisation' for the transport sector, and 'coordination' for the agriculture and industry sectors. Prioritisation implies inclusion of climate mitigation actions into sectoral policies as overriding objectives. Harmonisation refers to improving synergies between policies by including climate mitigation actions in similar fashion as in climate-specific policies. Coordination refers to simply adding climate mitigation actions as policy objectives to avoid contradictions between sectoral and climate-specific policies.

The prioritisation level of mainstreaming in energy and forest sectors means that the government policymakers are inclined to increase access to renewable energy technologies and strengthen the carbon sink potential of the forest that covers about 40% of the total land area of Nepal. In the first NDC that Nepal submitted in 2016, eight out of fourteen targets related to climate mitigation in energy and forest sectors (MoPE, 2015). Likewise, the second NDC of Nepal submitted to the UNFCCC in 2020 focuses extensively on climate mitigation in the energy, forest, and transport sectors. Surprisingly, the sectoral policy (Agriculture Development Strategy 2015) of an agriculture sector that contributes to more than half of the nation's GHG emissions has a coordination level of climate mitigation mainstreaming. However, although the agriculture sector contributes to the majority of the nation's GHG emissions, the energy, forest, and transport sectors may have more potential to reduce GHG emissions, more financially viable projects, and be able to bring about more significant co-benefits of climate mitigation actions than the agriculture sector of Nepal. The GHG emissions from the agriculture sector in Nepal come from enteric fermentation in ruminant livestock, manure management, rice cultivation, and managed soil (Chapter 6). In lieu of reducing GHG emissions from the aforementioned sources in the agriculture sector, improving access to clean and renewable energy technologies, enhancing the carbon sink by protecting the forest area, and replacing fossil fuels with electric vehicles present better co-benefits and appear to be more financially viable. Therefore, the framing of climate mitigation actions is relatively better in the energy, forest, and transport sector policies of Nepal. However, Laudari et al. (2021) identify a lack of rigorous consultations amongst key institutions, including the agriculture ministry. Consequently, the climate actions are framed and articulated to fulfil international climate obligations instead of determining nationally appropriate climate actions. This research identified the use of a discursive policymaking approach in Nepal as policy actors framed climate mitigation actions into sectoral policies. While this contradicts the findings of Laudari et al. (2021) regarding relevant institutions' collaborative practice in policymaking in Nepal, this research does confirm that global environment initiatives influence policy actors' response to international climate obligations.

The policy discourse on global environment-related initiatives and green growth is influencing the knowledge and ideas of the policy actors, especially those who are active in dealing with international development organisations working in Nepal. External forces, such as the global environment-related initiatives and green growth, can dictate the policymaking process, including policy formulation, by influencing the preferential values and interests of policy actors (Lovri et al., 2018). The policy actors' ideas and the discourse pertaining to any agenda are also key to influencing decision-making whilst formulating policies (Carstensen and Schmidt, 2016). This is the case in Nepal, where the global environment-related initiatives and green growth discourse is shaping and contributing to framing the climate mitigation actions into sectoral policies. Aryal et al. (2021) identified a similar trend in Nepal, where international development organisations play a critical role in the shaping of environmental policies. The external forces driving the climate mitigation mainstreaming in Nepal can be regarded as good as long as the climate mitigation actions included in sectoral policies are nationally relevant, are financially and technically feasible and, more importantly, fulfil the purpose of including them into sectoral policies. In the case of Nepal, Laudari et al. (2021) state that the climate actions are deliberated over largely because of international commitments, with less consideration given to the appropriateness in a national context.

The cross-sectoral nature of climate mitigation actions and the related projects and programs active on the ground means that the policymaking process, including policy formulation, has adjusted to practice collaboration across sectoral and multi-level governance in Nepal. While the central government's environmental organisation (e.g. environment ministry) leads the policy processes, local government organisations, the private sector, and international development organisations can lead the projects and programs active on the ground that deliver the objectives of global environment-related initiatives and green growth. The diversity of different organisations involved, discourses, and collaborative practice amongst policy actors and their institutions are reported to improve the credibility of public policies, such as the sectoral policies (Buijs et al., 2014). The notion of mainstreaming adopted by this research does not only focus on the mere inclusion of climate mitigation actions into policies but also on the influencing factors, discursive elements to institutionalism, and delivering the climate mitigation actions via policy implementation. These are explained in the following sub-sections.

8.2.1. External influencing factors and the related policy discourse

The policy discourse on global environment-related initiatives and green growth is influencing the framing of climate mitigation-oriented actions into government sectoral policies in Nepal, which are the entry-points for mainstreaming. The respondents reported that in the deliberative and collaborative environment for incorporating cross-cutting issues like climate change into government policies, strategic interactions between policy actors' institutions is critical to determining climate mitigation mainstreaming and its levels across entry-points. Discursive institutionalism, in which policy actors' ideas and their institutions' interests are exchanged, enriches in-country discourse and strengthens the analytical lens through which policy actors are better able to understand external and internal factors influencing policy change (Buijs et al., 2014). Consequently, government policies materialise in-country discourse, policy actors' ideas, and the institutional viewpoint. While the concept of mainstreaming is often referred to as incorporating issues (e.g. climate mitigation in this study) into government policies and related decision-making (Ayers et al., 2014), in a discursive institutionalism sense, mainstreaming can be understood differently. It can be referred to as materialising policy discourse (e.g. policy discourse on global environment-related initiatives and green growth), policy actors' ideas and their institutional viewpoint. The majority of respondents talked about leveraging policy discourse on global environment-related initiatives and green growth, utilising policy actors' knowledge and ideas, and considering the lead institution's capability as key to deciding the inclusion of climate mitigation actions in sectoral policies. Therefore, in the case of Nepal, the discursive element to institutionalism is identified to be important as external influencing factors.

The knowledge and ideas of the policy actors are influenced by policy discourse on global environment-related initiatives and green growth, mainly because of changes in the knowledge system within the government policy landscape, and because of changes in policy actors' ideas during policymaking. Policy actors can acquire new knowledge and ideas from platforms such as training and capacity development workshops that can be national or international. Bilateral and multilateral donors (international development organisations) have contributed to the knowledge generation of policy actors via supporting climate mitigation-oriented programs such as REDD in Nepal (Bastakoti and Davidsen, 2017). The shared policy beliefs and the historically constructed 'cognitive beliefs' of individual and collective policy actors can shape decision-making (Goldstein and Keohane 1993). Similarly, their shared policy beliefs and ideational constructs can shape policy actors' decision-making while the policy goes through changes (Béland, 2016). In Nepal, policy actors discuss the inclusion of climate mitigation-oriented actions, policy problems, policy instruments, financial mechanisms and institutional capacity as part of policy discourse related to global environment-related initiatives and green growth. These changes have contributed to the changes in knowledge and ideas of policy actors, which have contributed to the climate mitigation mainstreaming and changes in policy paradigms in Nepal.

The learning associated with international development is related to the enhanced technical and interpretative capacity of the policy actors by the policy actors during semi-structured interviews. While the policy actors' technical and interpretative capacity is strengthened, the strategic interactions between policy actors advance the policy discourse on global environment-related initiatives and green growth. However, the policy discourse is more relevant to the central government policy actors than to the local government and private sector policy actors, who appeared to be more engaged in the delivery of programs and projects on the ground. Therefore, in terms of materialising policy actors' ideas and their institutional interests in policymaking, central government policymakers and their institutions are found to be more critical. In environmental policymaking, some policy actors may get limited space to raise their concern even if they are included as key participants in deliberation for potential policy avenues (Aryal et al., 2020). This is the case for Nepal, where the directionality of interactions in multi-level decision-making stems from central government organisations and extends vertically to the local government organisations. While this can be regarded as a participatory exclusion or deinstitutionalisation of policy actors at the local level (Agarwal, 2001), the respondents from central government organisations referred to the way policy actors at different government levels deliver different responsibilities. For example, central government organisations (e.g. federal-level environment ministry) lead the interactions regarding global environment-related initiatives and green growth, whereas local government organisations are more active in delivering climate mitigation actions via various on-ground programs and projects. The separate roles and responsibilities of central and local government organisations are stated explicitly by the Climate Change Policy 2019 of the Government of Nepal (MFE, 2019). Therefore, for mainstreaming, local government and non-government stakeholders are equally important.

In discursive institutionalism, where limited policy actors and their institutions are at the forefront, the favourable result of the deliberation depends on the cognitive capacity of the participating policy actors.

However, de-emphasising the role of the policy actors' institutions in policymaking is also a part of normative policymaking (Carstensen, 2011; Wood, 2015). Therefore, undermining the role of local government organisations whilst operating at the intersection of international climate policy discourse and national policy discourse by the central government policymakers can be a part of normative policymaking. However, despite having a minor role, local government organisations participate in policy discourse, formulate local level climate-specific policies, and collaborate with central government organisations and non-government stakeholders in the implementation of on-ground programs and projects (MFE, 2019). This is also substantiated by the respondents from the local government organisations and international development organisations.

The research finds that environmental and climate policy-related ideas are more institutional and structural than just ideational for central government policymakers. The institutional and structural explanations detail the government policy landscape around the institutions, constraints and incentives, and material factors to present the construct in a logical way (Parsons, 2007). This implies that the influence of policy discourse on global environment-related initiatives and green growth creates a layering effect on the existing policies for two reasons. First, institutional capacity and material factors such as financial and human resources are limited in a low-income country like Nepal, meaning changes in policies are incremental because of the lack of resources needed for a radical change or paradigm shift. Second, policy actors mentioned that the inclusion of objectives of global environment-related initiatives and green growth were add-ons, particularly in the agriculture sector. In energy and forest sectors, climate mitigation actions are overriding objectives. This means existing sectoral policies added new elements (i.e. climate mitigation actions) and is in line with the findings from the research on changing policy paradigms in Nepal (Chapter 4), where the previous climate adaptation-based policy paradigm overlaps with the new climate mitigation-based policy paradigm. The new climate mitigation-based policy paradigm has focused on addressing institutional capacity and material factors by diversifying financial resources to reduce the threat of decreasing ODA per capita on effective operationalisation of the new climate mitigation-based policy paradigm and by strengthening the knowledge system.

Policy discourse on green growth presents environmental protection as a driver for economic growth (Bowen and Hepburn, 2014). Although the focus was more on climate change mitigation in its initial years (Huberty et al., 2011), it now focuses on diverse environmental issues ranging from biodiversity loss to minimising impacts of natural hazards. Presently, the green growth narrative underscores natural assets to generate economic outputs in a sustainable way, which is in line with the widely used OECD's definition of green growth (OECD, 2011, p.9). It is now familiar rhetoric for government policymakers and non-government stakeholders in many LDCs, including Nepal. International development organisations advocate green growth by citing its ability to help deliver the NDCs the SDGs for many countries, including the LDCs (ASI, 2017; Hickel and Kallis, 2020). The respondents reported that the international development organisations advocating green growth in Nepal introduce it as a growth pathway to achieving lower GHG emissions, meaning the green growth-related policy discourse is climate mitigation-oriented. The majority of respondents, mostly from government organisations, compared it with other economic growth-related narratives such as the green economy and sustainable growth, which were also introduced by international development organisations in Nepal. The respondents from the government organisations stated that green growth, green economy, and sustainable growth are usually discussed in the context of environmental policymaking in Nepal, and they emphasise climate mitigation actions.

Further, they mentioned that discourses on green growth became more prevalent after 2015 when the Paris Climate Agreement and the SDGs came into force. The primary goal of the Paris Climate Agreement is GHG emissions reduction, meaning the green growth has been portrayed as a growth pathway with a better prospect to delivering the NDCs in Nepal. This is despite the findings of Hickel and Kallis (2020) providing quantitative evidence on green growth not being an effective growth pathway to deliver the goals of the Paris Climate Agreement at a global level. The findings from chapter 6 and chapter 7 confirm that Nepal's green growth pathway is not sufficient to deliver its NDCs. These are discussed more in detail in section 8.3 and section 8.4. Finally, despite the recent re-orientation of green growth that focuses beyond the efficiency of natural resource use and GHG emissions, such as biodiversity loss and climate resilience (Fletcher et al., 2018; World Bank, 2020), this research found that green growth discourse in Nepal has not fully reflected the recent re-orientation of its focus. Thus, the green growth narrative in Nepal is still climate mitigation-based, and this is mainly because of its advocates (e.g. international development organisations), as mentioned by the respondents.

8.2.2. The process by which climate mitigation mainstreaming occurs in Nepal

The research found that the change in the knowledge and ideas of policy actors creates an opportunity for policy alignment, which is the first step to climate mitigation mainstreaming in Nepal. In the policy alignment stage, nationally appropriate climate mitigation actions are determined to align with sectoral policy goals. For example, a climate mitigation action—enhancing the carbon sink capacity—is related to the core goals of Nepal's Forest Sector Strategy (2015), which are the protection of forest resources and maintaining at least 40% of the total land area as forest. The majority of respondents linked the policy alignment with the discursive policymaking as it creates a platform for policy actors to discuss climate mitigation actions that align well with sectoral policy goals. Climate mitigation actions are discussed in detail to determine the scale of commitments as informed by the respondents. While the discursive policymaking approach may over-emphasise the preferential values of the policy actors and their beliefs (Lovri et al., 2018), a downside to the use of this approach is that it may de-emphasise the policy actors' institutions, particularly if the discourse is driven by unstructured and rhetorical argumentation of policy actors (Wood, 2015).

This research identified two key findings in relation to addressing the downside to the use of a discursive policymaking approach whilst identifying the scale of commitments for various sectoral policies. First, the respondents mentioned using a quantitative policy modelling approach that emphasises rationality and structured argumentation on practically deliverable climate mitigation actions based on the national context. This is usually in order to come up with a scale of commitments as numerical targets and explicit policy statements regarding the climate mitigation actions and to complement the preferential values of policy actors. Second, quantitative policy modelling is led by the responsible central government organisations, meaning the institutions of the policy actors are in fact getting involved. The interaction between policy actors can create an institutional context if policy actors pursue their interest because institutions can shape policy actors' interest and values (Schmidt, 2011). Therefore, in Nepal, both the discursive policymaking approach and quantitative policy modelling are found to operate in line with Hall's (1993) initial conceptualisation of the theory of policy paradigms that puts institutions and the ideas of policy actors at the centre of policy change. This approach to climate mitigation mainstreaming at a policy formulation level in Nepal is notable in the sense that climate mitigation as a policy issue is at an early stage in comparison to climate adaptation, as shown by the results of Chapter 4.

While the ideas, interests, and institutions of policy actors that are key to driving changes in policies (Walt, 1994) appeared to be important in climate mitigation mainstreaming in Nepal, the collaborative practice between policy actors shed light on creating an effective policy network[37]. Collaborative practice between policy actors in Nepal involves both the exchange of preferential values of the policy actors and evidence-based rhetorical argumentation. The decision-making regarding the prioritisation of sectors for potential interventions is mostly interest-based preferential values of policy actors in the beginning during policy alignment. The discourse-based rationalised propositions are mainly attributed with minimising the uncertainties associated with policymaking and is prevalent after policy alignment is achieved. These uncertainties include the scale of commitments expressed in numerical terms across sectors prioritised for climate mitigation mainstreaming, the financial viability of proposed policy measures, and the capability of policy actors and their institutions to deliver climate mitigation actions. These uncertainties interrupt institutional stasis and ideational responses to the policy discourse on global environment-related initiatives and green growth, especially for non-environment governmental organisations that can veto decisions. For example, critical ministries such as agriculture and forestry are major policy stakeholders for climate mitigation mainstreaming but may respond indirectly via coordination with the environment ministry.

[37] Policy network refers to the relationship and interaction between policy actors.

This research found that the collaborative practice occurs within the policy network realm, which is variable in the sense that it is likely to change as one or other institution becomes dominant (Shearer et al., 2016). Whilst mainstreaming the climate mitigation actions via government policies, the respondents did not report a history of fluidity in policy network in the context of climate-specific and sectoral policies in Nepal. However, this research found that the interaction between central and local level government organisations and the way they exercise their power differently have created conflicting responsibilities regarding climate mitigation mainstreaming in Nepal. This is usually the case when a policy network consists of either informal institutions or weak institutions (Helmke and Levitsky, 2004). The local level government organisation in Nepal appeared to be weak, particularly in policy formulation. However, since the policymaking process leverages a relational approach to involving multifarious institutions and actors, thereby creating a policy network, some actors' roles can be reactive while the lead institution[38] can be a facilitator (De Marchi et al., 2016; Aryal et al., 2021). This research found that the environment sector organisation (e.g. environment ministry) is the lead institution that creates a network of limited policy actors, reinforces relations among policy actors, and delegates' responsibilities to the local level government organisations for climate mitigation mainstreaming. While facilitation by a lead institution is supposed to enhance the collaborative practice between policy actors, availability and equitable distribution of resources (e.g. financial resources) may determine whether or not the collaborative practice can materialise in climate mitigation mainstreaming in Nepal. This is because of the limited access to financial resources and declining ODA per capita for Nepal as shown by the results presented in Chapter 4.

A struggle for institutional resources is also a driver of paradigmatic change in policies (Wood, 2015). For Nepal, financial resources such as the ones generated by the ODA and other specific climate financing mechanisms have contributed to collaborative practices between government organisations, between international development organisations and government organisations (both central and local), and between the private sector and international development organisations. While the

[38] Lead institution refers to the government organisation that lead the policymaking process.

government's sectoral policies have incorporated climate mitigation actions, international development organisations have funded projects active on the ground and are aiming to deliver climate mitigation-related policy goals via partnering with local government organisations and the private sector. Amidst limited financial resources and the entailing institutional competition, which is a common feature of the layering effect in terms of paradigmatic change, institutional interaction for accessing financial resources has twofold benefits. First, it enhances collaborative practice in both policymaking and implementation. Second, it helps mainstreaming of climate mitigation actions in the priority sectors, where institutions are powerful enough to access a major share of limited financial resources.

Thus it can be inferred that collaborative practice is a part of normative policymaking in Nepal, whereas mainstreaming, which also emphasises collaboration across policy actors' institutions, is constrained by financial resources. Mainstreaming is constrained by limited financial resources because the conceptualisation of mainstreaming adopted by this research (Chapter 5) focuses on delivering climate mitigation actions, which is unlikely if financial resources are limited. Although climate mitigation mainstreaming can occur via all sectors, institutions that can access sufficient financial resources in terms of developing on-ground projects are more likely to mainstream climate mitigation actions. For effective mainstreaming, two factors—powerful institutions and sufficient financial resources—are necessary. In the context of climate mitigation mainstreaming in Nepal, the environment ministry is reported as being a powerful institution and has relatively better access to financial resources according to the respondents. The environment ministry is the lead agency not only in terms of climate mitigation mainstreaming but also in terms of directly interacting with the international development organisations that provide financial assistance in the form of an ODA.

8.2.3. Climate change adaptation versus mitigation in Nepal: the local benefits narrative and the related discourses

The empirical evidence as shown in the supplementary materials for Chapter 4 and Chapter 4 confirms the findings of Vij et al. (2018) and Chapter 4 regarding the co-existence of climate change adaptation-and mitigation-based policy paradigms in Nepal, as there are signs of progress in both adaptation and mitigation fronts. However, despite the progress on both fronts, two sub-indices—victims to natural disasters (VIC) and absolute GHG emissions (GHGE)—have exacerbated in the last two decades (UNCDP, 2021; World Bank, 2021). The local adaptation measures in Nepal are planned based on the following: community knowledge without sufficient consideration of future climate scenarios and extreme disaster event forecasting; and consideration of development activities, such as building low-cost infrastructure that does not consider long-term resilience to extreme events (NCCSP, 2016; Vij et al., 2019). With mitigation, improved carbon productivity and decreased GHG emissions per capita, which are favourable outcomes, were achieved from unintentional changes in the structure of an economy from agro-based to services-based (Chapter 7). Consequently, the lack of sufficient intentional climate actions in government policies and the NDCs, and their weak delivery on the ground means the absolute GHG emissions rose in the last two decades.

Climate change adaptation and mitigation actions have been framed into government policies in Nepal due to international commitments to deliver the Paris Climate Agreements, the SDGs and the entailing ODA mechanism (Laudari et al., 2021; Aryal et al., 2021), which Chapter 5 confirmed. These are drivers of the formation of climate change adaptation- and mitigation-based policy paradigms in Nepal. However, delivering climate adaptation actions is challenging because they attract relatively less financial support from sources other than the government's funding, as stated by the respondents. This is despite creating the least developed countries fund (LDCF)—the world's largest climate change adaptation fund—that intends to help the poorest countries implement their National Adaptation Plan of Action (Sovacool et al., 2017). Currently, the grant under the LDCF managed via the Global Environmental Facility (GEF) values US$1.6 billion (Global Environmental Facility, 2021). Although the GEF website mentions Nepal as taking advantage of the LDCF project (e.g. green agriculture technologies for low-till crop planting), the respondents mentioned climate adaptation projects receiving less attention from the international development agencies that provide ODA for Nepal. During the Copenhagen Climate Accord (2009) and the Cancun Agreements (2010), developed countries had promised to deliver US$30 billion initially by 2012 and US$100 billion by 2020 for climate adaptation in developing countries. However, they fell short in delivering the promise (Khan et al., 2019). On the other hand, as mentioned by the semi-structured interviews' respondents, climate change mitigation is responsive to climate finance needs and that the policy actors recognise the co-benefits of climate mitigation actions in Nepal. However, most respondents believe they may not generate local benefits and are less compatible with the development objectives than adaptation actions. Therefore, climate mitigation actions are ignored in favour of climate adaptation actions at the policy implementation level despite their inclusion in government policies at the policy formulation stage. Many respondents confirmed that framing climate mitigation actions into government policies has a short history. This implies less experience of policy actors in engaging international development agencies and that the discursive way of formulating policies included internal policy actors. The recent addition of external actors may have foregrounded climate mitigation in a context where local policy actors were less ready to assimilate external actors and the informational and knowledge resource they instilled in the climate policy landscape of Nepal. At the implementation level, sectoral policies have taken initial steps to align their goals with climate goals and is explained in the following sections.

8.3. Linking climate mitigation actions with sectoral policy goals

As identified by the research on climate mitigation mainstreaming via sectoral policies in Nepal (Chapter 5 and Section 8.2), policy alignment was an important step for linking climate-specific action plans such as NDCs with the sectoral policies. The NDCs are a country-specific overall plan of climate actions that are designed to achieve the goals of the Paris Climate Agreement, which is a part of the global environment-related initiative. An NDC is an overarching plan of climate actions, meaning the focus should be on climate mitigation at economy-wide scale. However, recently, many countries have strengthened the sectoral foci of NDCs to help mainstream climate change issues into sectoral policies (Röser et al., 2020). This is usually done in the NDC preparatory process (Röser et al., 2020) when the intended climate actions are aligned with sectoral policy goals. In the case of Nepal, the first NDC and its contents and an approach to climate change, in general, are criticised for making climate change a sectoral agenda and not sufficiently highlighting climate change as political and development issues

(Regmi and Bhandari, 2013; Ojha et al., 2016). Nonetheless, Shrestha and Dhakal (2019) state that Nepal has mainstreamed climate change into development policies, although the focus is more on climate adaptation than climate mitigation, which is largely directed towards energy and forest sectors. Climate adaptation, on the other hand, is addressed by other sectoral policies.

The findings of the research on changing policy paradigms (Chapter 4 and Section 8.1) and climate mitigation mainstreaming (Chapter 5 and Section 8.2) suggest that the majority of sectoral policies have a climate mitigation focus ranging from low to high, and their goals align with the NDC's plan for climate actions. However, the policy paradigm and majority of conceptualisations about climate mitigation mainstreaming pertain to policy formulation. Including ambitious climate mitigation actions in policies does not necessarily mean that they can be achieved (Pauw et al., 2018). Instead, the way sectoral policies and NDCs can deliver climate mitigation actions in tandem depend on nationally appropriate climate actions (Laudari et al., 2021). This research analysed the delivery of climate mitigation actions via implementation of sectoral policies and NDCs (Chapter 6) to find that there exists a weak coherence between sectoral policies and NDCs despite the previous studies suggesting that NDCs have been strengthening the sectoral foci. This finding expands our limited understanding about the following: 1) policy alignment between NDCs and other sectoral policies in Nepal, excluding energy and forest sector policies; 2) the NDC preparatory process during which climate mitigation targets are determined; 3) the notion of sectoral foci that has been a topic of debate, and 4) coherence between sectoral policies and NDCs in Nepal.

The notable gap in the knowledge about policy alignment for climate mitigation mainstreaming in Nepal pertains to the fact that policy alignment is relatively stronger between NDCs and the energy and forest sector policies than between NDCs and other sector policies. Climate mitigation efforts are largely directed towards energy policies and REDD+ in Nepal (Shrestha and Dhakal, 2019). The first NDC of Nepal submitted to the UNFCCC in 2016 and the second NDC submitted in 2020 have also largely focused on climate mitigation in energy and forest sectors, including the transport sector. These sectors contribute about half of the nation's GHG emissions. Based on the findings from the research on climate mitigation mainstreaming in Nepal (Chapter 5), we understand that these are priority sectors for the Government of Nepal and these sectors have more potential to reduce GHG emissions. However, both policy alignment and the NDC preparatory process that determines climate mitigation targets across sectors are policy formulation-oriented. It means the prospect for implementing climate goals via sectoral policies and NDCs is either insufficiently considered or analysed for only priority sectors. This leaves out other sectors that contribute to half of the nation's GHG emissions (e.g. agriculture sector). The policymaking process-related problems such as aligning policies and setting unambitious or overambitious targets in the NDC preparatory process may lead to implementation problems (Röser et al., 2020). Laudari et al. (2021) state that Nepal's first NDC could not achieve most of its stipulated targets, mainly because of institutional constraints and the involvement of insufficient policy actors. This research, and particularly Chapter 6, has found that Nepal's first NDC will not be able to achieve the stipulated targets because of two main reasons. First, although previous studies (Shrestha and Dhakal, 2019; Laudari et al., 2021) found that Nepal's plan of action for climate mitigation focuses extensively on the energy sector, both NDCs submitted to UNFCCC in 2016 and 2020 have excluded energy efficiency measures and targets. This has weakened the prospect for achieving climate goals within the energy sector. Second, the agriculture sector contributes to about half of the nation's GHG emissions but neither NDC has included any specific and quantitative mitigation targets from this important sector in Nepal.

The notion of an NDC's sectoral foci and the related debate stems from studies that criticise the portrayal of climate change as a sectoral agenda in Nepal, which limits the potential for politicisation of climate change issues (Ojha et al., 2016; Laudari et al., 2021). While the criticism of technocratic hegemony is justified, given that the coordination between line ministries (sectors) in the NDC preparatory process is not a huge concern for most countries (Röser et al., 2020), this research identifies three key factors that are not socio-political yet may determine the effectiveness of NDCs: technical, structural, and material. Although the respondents mentioned using a technocratic approach to determining climate mitigation targets, this research did not identify a strong techno-bureaucratic influence whilst linking NDCs' climate mitigation actions with the sectoral policy goals. A projection of GHG emissions up to 2030 under the NDC scenario (38.5 MtCO2e) and other policies scenario (47 MtCO2e) revealed that the GHG emissions for other policies scenarios in 2030 will reduce with respect to the business as usual scenario in 2030 (54.3 MtCO2e), but will increase with respect to the 2015 (39.4 MtCO2e) value. In the NDC scenario, the GHG emissions will be marginally lower in 2030 than in 2015. This is despite the gaps in the NDCs, such as not including energy efficiency measures and excluding the GHG emissions reduction targets from the most significant agriculture sector. In the beyond NDC (BNDC) scenario that aims to address the gaps in NDCs, the GHG emissions in 2030 will be 34.4 MtCO2e, which is almost a 10% reduction with respect to the 2015 value and almost a 37% reduction with respect to a business-as-usual scenario in 2030. This is purely a technical issue that the policy alignment and the subsequent NDC preparatory process have ignored, despite the respondents from government organisations stating that the discursive policymaking is complemented by a technocratic approach and that the energy sector is the prioritised sector for climate mitigation mainstreaming.

The structural factor pertains to the structural feature of an economy and the associated GHG emissions (Wood, 2009). While the agriculture sector contribution to GDP has been in decline for the last 15 years in Nepal, a projection of GHG emissions from this sector shows that the agriculture sector will account for more than half of the nation's GHG emissions in 2030 for all scenarios: business as usual, NDC, BNDC, and other policies scenarios (Chapter 6). Ignoring this structural feature of GHG emissions will present challenges for Nepal in terms of implementing the NDC's climate goals and thereby achieving mainstreaming of climate mitigation actions. Finally, the material factor, which refers to the human and financial resource, is another critical aspect to linking climate mitigation actions to the sector policy goals. Institutional constraints such as the limited human and financial resources have often weakened the prospect for achieving policy alignment and mainstreaming of climate mitigation actions into sectoral policies, particularly in developing countries (Atteridge et al., 2019). Many low-income and developing countries are already struggling to access technical and financial support for the implementation of their NDC (Pauw et al., 2019). This is corroborated from the findings of the research on climate mitigation mainstreaming (Chapter 5), where respondents talked about the competition between government institutions for access to limited financial resources, and there are limited active on-ground projects that are supporting the implementation of the NDC in Nepal.

This research found that the policy alignment, NDC preparatory process, and the sectoral focus appeared to be inclined more towards energy and forest sectors in Nepal. Further, the NDC's technical issue within the energy sector and the structural issue that ignored climate mitigation actions for the agriculture sector highlights a need to overcome policy silos. In circumstances like this, when there is a need to reinforce synergies between goals of sector policies, policy coherence is found to be useful, not only to overcome silo thinking but also to integrate issues from one policy domain into another (Nillson et al., 2012; ICS, 2017; Weitz et al., 2017). In the context of climate mitigation mainstreaming and the new climate mitigation-based policy paradigm, improving coherence between NDCs and sectoral policies appears to be necessary because, when we move forward from policy formulation to implementation, delivery of insufficient climate mitigation actions within energy and forest sectors, and delivery of very few climate mitigation actions within the agriculture sector, will likely undermine the effectiveness of NDCs. The results from the quantitative modelling (predictive) of GHG emissions for NDCs and sectoral policies implementation are discussed in the following sections.

8.3.1. Insufficient climate mitigation targets in Nepal's NDC

The NDC implementation scenario analysis showed that the implementation of Nepal's NDCs would be able to reduce GHG emissions in the energy sector (16.5 MtCO2e to 5 MtCO2e) in 2030 and significantly increase the carbon sink potential of the nation's forests (-4.3 MtCO2e to 9.7 MtCO2e) in 2030 with reference to the business-as-usual (BAU) scenario in 2030. However, GHG emissions from the agriculture sector appear to remain the same (33.5 MtCO2e) in the NDC scenario in 2030 with reference to the BAU scenario in 2030. The agriculture sector is the primary GHG emissions source in Nepal and it contributes to about half of total national GHG emissions as of 2020, which means that the existing NDCs of Nepal may not result in GHG emissions reductions at economy-wide scale. The research found that the potential to reduce GHG emissions from the agriculture sector was limited, apart from reducing the burning of agriculture residues that contributes to GHG emissions. The reduction of non-energy GHG emissions by using other options such as no-till farming and the supply chain management of agricultural products could potentially further reduce GHG emissions from the agriculture sector (Wollenberg et al., 2016). However, they are not a part of Nepal's NDCs. Therefore, the limited opportunities in the agriculture sector of Nepal (MoSTE, 2014), coupled with insufficient agriculture-specific climate mitigation actions in the NDC, mean that other policy areas may have to offset GHG emissions from the agriculture sector. Therefore, a strong linkage between climate mitigation-related objectives in the NDC and sectoral policy goals is necessary for an economy-wide GHG emissions reduction in Nepal. Kok and de Coninck (2007) state that strengthening the linkages between sectoral policies and climate action plan (e.g. NDCs) via policy coherence is critical for improving the effectiveness of climate actions across different policy areas (and sectors)—for example, agriculture, forestry, energy and other industry.

With regard to the energy sector, the scenario analysis found that total energy demand will decrease significantly in the NDC scenario in comparison to the BAU scenario by 2030 (663 million GJ to 545 million GJ). However, the implementation of NDCs will put stress on energy supply because of the significant amount of transmission and distribution loss in the energy sector (21 % of the energy supply). The energy loss is primarily due to the planned shift in the energy system from biomass-based energy to hydroelectricity-based energy, which is mentioned by the NDC document of Nepal. The energy loss may reach up to USD 4.3 billion per annum in 2030 if the current level of electricity transmission and distribution loss persists. In case the country fails to maintain the transmission and distribution loss of about 10%, which is a South Asian regional average, a loss of USD 1.3 billion per annum is likely to result in the NDC scenario in 2030. The estimated economic loss due to energy loss will range from 3 to 10% of GDP in 2030, if the current value of GDP growth rate is considered to project the 2030 GDP value. Therefore, the study finds that the NDCs should not be a standalone plan of climate actions for reducing GHG emissions. Instead, an economic growth approach, such as green growth that emphasises both economic imperatives and environmental imperatives, should be used as part of improving policy coherence between NDCs and sectoral policies.

8.3.2. Improving the policy coherence via green growth

This research analysed the role of green growth to align climate mitigation-related goals and sectoral policy goals, thus improving policy coherence. The GHG emissions from the agriculture sector, and the energy transition from a biomass-based primary energy source to hydroelectricity, were found to be critical for the delivery of climate mitigation actions in the NDC of Nepal. These findings are consistent with the results from the research on climate mitigation mainstreaming in Nepal (Chapter 5), which identified the level of climate mitigation mainstreaming in the agriculture sector to be one of ‘coordination’. The ‘coordination’ level of mainstreaming implies that the climate mitigation-related policy goals are add-on policy objectives, and there exist potential synergies with other policy areas such as energy and forestry, for which the mainstreaming level is ‘prioritisation’. Therefore, the research identifies the agriculture, energy and forest sectors of Nepal as three key areas where policy coherence can be improved to deliver GHG emissions reduction goals of NDCs while minimising economic loss. Policy coherence not only promotes synergies between different policy areas but also provides non-conflicting signals to policy actors regarding deliberation on the desired actions across different policy areas (Mickwitz et al., 2009; Nilsson et al., 2012). While achieving absolute policy coherence may be difficult because of policy actors’ conflicting priorities and institutional and technocratic hegemony prevalent in Nepal, policy coherence via green growth showed there was potential to contribute to low GHG emissions. This potential exists for two reasons. First, the study on policy coherence between climate and sectoral policies identified the synergy between the agriculture and forest sectors to offset the GHG emissions from the agriculture sector. The agriculture sector of Nepal has limited potential to reduce GHG emissions despite being a major contributor to the national GHG emissions (MoSTE, 2014). Therefore, enhancing carbon sink capacity by maintaining the forest area at 40% of the total land area is found to offset about 9.7 MtCO2e per annum by 2030, while GHG emissions from the agriculture sector are likely to increase by 8.5 MtCO2e in 2030 in comparison to 2015.

Second, policy coherence focussed on green growth is likely to show improvements in economy-wide energy and carbon productivity values, mainly resulting from moving from biomass-based primary energy to hydroelectricity-based energy while addressing the transmission and distribution losses. The transition requires synergies and collective decisions from distinct policy areas (energy and forest) for which the climate mitigation mainstreaming is of 'prioritisation' level. Other policy scenarios that operationalise the climate mitigation-related policy goals of sectoral policies showed that GHG emissions reduction corresponding to the 'NDC scenario' level is achievable. However, the energy system will still be biomass-based, meaning an absolute increase in energy use. Therefore, the research finds that prioritisation of climate mitigation actions in the policies alone may not be sufficient if there exists a weak policy coherence between two policy areas that are related to a common motif—for example, energy resources. The policies in this area have a 'prioritisation' level of mainstreaming. However, insufficient actions aimed at reducing transmission and distribution losses and inadequate efforts to transition from biomass energy use to renewable energy have weakened the prospects for mainstreaming. Policy coherence at the policy impact end is therefore weak.

8.4. Greening of growth in Nepal and Bangladesh

In light of the Paris Climate Agreement and the SDGs, this research investigated the greening of growth in Nepal and Bangladesh by using six green growth indicators: energy productivity; material productivity; carbon productivity; share of forest in total land area; share of renewable energy in the energy mix; and GDP from services. The research found that the absolute reduction of resource use and the associated GHG emissions, and an increased share of renewable energy in the energy mix, are unlikely to be achieved by 2030. The climate mitigation goals of the NDCs and the SDGs are therefore unlikely to be delivered, as both countries aim to achieve LDC graduation by increasing their economic growth. While further greening of growth will be necessary for both countries, empirical evidence suggests that both countries made significant progress in improving their energy, material, and carbon productivity values between 1985 and 2016. However, the analysis of empirical evidence by using historical data about the six green growth indicators revealed that the current levels of progress regarding energy and material productivity values are not compatible with the requirements of the Paris Climate Agreement for either country. Therefore, the empirical evidence on the greening of growth in Nepal and Bangladesh contradicts the notion that new climate mitigation-based policy paradigms are emerging in both countries, particularly post-2005. The contradiction is largely to do with the policy paradigm being a policy formulation model that in both countries started to emphasise climate mitigation actions in government policies after 2005. However, at the implementation level, we are yet to see policy outcomes such as the reduction in GHG emissions and non-renewable resources. This points to the limitation of the concept of policy paradigm in environmental studies that rarely takes into account the quantitative empirical evidence and policy outcomes, which are non-ideational elements requiring a positivist perspective. In a general sense, policy paradigms rely on a constructivist perspective to explain policy changes.

While the framing of climate mitigation actions in the countries' policies implies a positive step towards delivering reductions in non-renewable resource use and GHG emissions, the predicted values of resource use for both countries indicate that framing climate mitigation into government policies does not mean an ultimate delivery. Therefore, even the operationalisation of the new climate mitigation-based policy paradigms in both countries is unlikely to deliver reductions in resource use and the associated GHG emissions that are in line with the requirements of global environment-related initiatives, particularly the Paris Climate Agreement. The increase in total primary energy consumption will range 8-15% for Nepal and 46-68% for Bangladesh between 2016 and 2030. Similarly, the increase in domestic material consumption will range 26-40% for Nepal and 56-61% for Bangladesh between 2016 and 2030. An increase in the use of these resources—especially forest biomass and fossil fuels—will not only increase GHG emissions but will likely reduce the carbon sink potential in both countries.

As most developing countries, including low-income countries, have started to incorporate climate mitigation actions into their policies, a policy paradigm that can deliver on the goals of global environment-related initiatives while being compatible with growth aspirations is therefore desirable.

The problems that policies are meant to address, and the focuses of the policies, which are key considerations of policy paradigms, may explain how the new climate mitigation-based policy paradigms can also focus on the delivery of reductions in non-renewable resource use and GHG emissions. While one key factor, economic growth, is considered to be an obstacle to climate mitigation because it will drive resource use and GHG emissions in Nepal and Bangladesh, population growth is rarely considered a problem when policy actors debate environmental imperatives versus economic imperatives. However, it is the population factor that will have more impact on energy and material consumption for Nepal, and material consumption in Bangladesh. Therefore, absolute energy and material consumption will still increase, even under low-growth scenarios for both countries. Resource consumption per capita is likely to increase as income increases, as per recent and projected trends in both countries (Chapter 7, Figure 7.6 and Figure 7.7), and hence absolute resource consumption will also increase (Chapter 7, Figure 7.4 and Figure 7.5). This may be a problem that sectoral policies will want to address via including policy goals to reduce absolute resource consumption. The new climate mitigation-based policy paradigms currently appear to be reactive, prompted by the influence of external drivers (e.g. global environment-related initiatives and green growth narrative). The consideration of absolute resource consumption by the new climate mitigation-based policy paradigm via leveraging a positivist perspective will likely make it more focused on delivering the objectives of global environment-related initiatives and green growth.

A normalised index value of the green growth indicator, measured as the ratio of the value of the indicator in a given year to the indicator value in the base year (1985), revealed that there is a positive correlation between improvements in the value of productivity indicators and increases in the share of GDP from services in both countries. The positive correlation implies that the energy, material and carbon productivity improvements are due to shifts from a resource-intensive agriculture-based economy to a service-based economy that is less resource-intensive. The share of renewable energy in the energy mix decreased for both countries between 1985 and 2016, meaning that renewable energy has contributed insignificantly to the improvements in carbon and energy productivity values. For Nepal, the correlation between the share of renewable energy and the productivity indicators is on the positive side, with correlation values being marginally above '0'. For Bangladesh, the correlation values are mostly negative. The unsatisfactory progress of both countries regarding the share of renewable energy in the energy mix and the increases in both absolute resource use and absolute GHG emissions mean that the greening of growth was far from being achieved, despite improvements shown by the productivity indicators.

The energy and material consumption models, and the projected values for energy and material productivity in 2030 for different growth scenarios, showed that absolute energy and material consumption will increase significantly for both countries. Energy productivity and material productivity are also likely to increase. However, unlike during the period between 1985 and 2016, when the structural effect was the primary driver of improvements in the values of the productivity indicators, these improvements are likely to tail off in the near future. The evident roles of the structural effect and the inflation effect that will probably persist shed light on the need for the following technological changes: 1) the substitution of the resource-intensive biomass by a secondary energy source such as hydroelectricity and 2) efficiency of resource use. These two technological changes are the identified ways to potentially decouple resource use and GDP growth in an absolute sense, as the income elasticity of resource consumption is likely to rise in future based on the current trends for both countries. While achieving green growth via efficiency improvements alone is not likely to meet the requirements of the Paris Agreement at a global level (Hickel and Kallis, 2019), increased efficiency of resource use in Nepal and Bangladesh can compensate for any loss in the values of the productivity indicators resulting from the weakening structural effect. The inflation effect is likely to persist in both countries given the above world average inflation (measured as annual deflator rate in %) in the last two decades (World Bank, 2021)

While both countries appear to be struggling to achieve their climate mitigation-related goals under the Paris Agreement, the LDC graduation in future will pose more challenges for greening growth. On the one hand, a transition to a renewable energy-based energy system and efficiency of resource use appears to be critical for the absolute reduction of resource use and GHG emissions. On the other hand, the income elasticity of resource use will potentially drive the consumption of resources. While the former is largely related to the energy and forest sectors and are production-based, the latter is consumption-based and is therefore related to almost all sectors. Therefore, the research proposes a policy coherence framework as a means of addressing the issues associated with climate mitigation goals while both countries aim for LDC graduation. A policy coherence framework is better suited in the context of greening the growth in Nepal and Bangladesh because a transition to a renewable energy-based energy system will involve a strong coherence between energy and forest sector policies, given the majority of existing resource use involves biomass and fossil fuels. The research does not recommend the policy coherence framework as a universal solution to achieving the greening of growth in Nepal and Bangladesh, while meeting the climate mitigation goals of the NDCs and the SDGs. Instead, the introduction of a policy coherence framework has been presented as a strategic action to create linkages between different sectors and policy areas that will bring about absolute reductions in resource use and the associated GHG emissions.

While the prospect for green growth appears to be challenging for both Nepal and Bangladesh, moving forward they can still embrace the concept of green growth. There are two main reasons for this: first, this research found that green growth can help improve coherence between sectoral policies, thus reconciling the tension between economic and GHG emissions issues (Chapter 6); second, Nepal and Bangladesh made significant progress on the resource productivity front, due mostly to the structural and inflation effect and rather less to technological changes (Chapter 7). Therefore, in light of reducing structural effect and technical efficiency improvement opportunities that have been underutilised up till now, embracing green growth via improving technical efficiency of resource use can help continue progress in resource productivity. However, the present environment-focus of the green growth narrative that these low-income countries will embrace may have to re-orient focus towards overall economic productivity, at least in the shorter term, until 2026 when both Nepal and Bangladesh will officially graduate from the LDC status. Both countries are already recommended for graduation in early 2021 (UNCDP, 2021).

Low-income countries face a structural impediment to growth that has become a pressing issue in need of resolution, particularly after COVID-19 that has created more socio-economic chaos in low-income countries than in the rest of the world (UNCDP, 2021). Structural impediment leads to an insufficient diversification of economic sectors and a dependency on low-productive economic activities prevalent in low-income countries, including Nepal and Bangladesh (UNCTAD, 2020). In light of these structural features that limit the effectiveness of green growth in low-income countries, Dercon (2012) suggested that green growth may have to give up some possible environmental benefits to keep the growth-poverty elasticity high, thus calling for a different shade of green in low-income countries. This suggestion was made keeping in mind that poverty reduction is the top agenda for low-income countries, and has now become more important than anything else because of the economic fallout from COVID-19, which has reduced the per capita income of low-income countries (by 2.5% in 2020), increased the number of people living below the poverty line, changed the structure of economies, and resulted in the contraction of economic output (Valensisi, 2020; UNCTAD, 2020). The natural resource category levels of the productive capacity index of Nepal and Bangladesh are 36 and 41, respectively. On average, it is 40 for developing countries and 37 for developed countries (UNCTAD, 2020). The wealthy natural asset base in Nepal and Bangladesh generates subsistence for most of the rural population and will continue to do so after the COVID-19 pandemic, as both countries rebound economically. Therefore, at the present time, overall economic productivity, which is key to overcoming the structural impediment (UNCDP, 2021), appears to be the priority for both Nepal and Bangladesh. Nonetheless, the reoriented green growth narrative will still have a strong natural resource element because natural resources will likely continue to become the most productive resource capable of enhancing the overall economic productivity in the future (UNCTAD, 2020). In the longer term, the green growth narrative in Nepal and Bangladesh may converge to that in developing and developed countries, and focus specifically on absolute reductions in GHG emissions and use of non-renewable resources.

8.5. Conceptual contributions: Extending the knowledge on climate mitigation policy paradigm and mainstreaming.

8.5.1. Drivers, motivation, and implications of climate change policy paradigms

Although the literature on climate policy paradigms—a policy formulation model—is well-developed, understanding how and when the paradigmatic change occurs is vague mainly because the change process focus extensively on policy formulation. As a result, the implications of climate and cognate policies' changes in their delivery and the qualifiers for paradigmatic change are still unclear to policymakers and researchers. This research attempted to shed light on the paradigmatic change process, drivers and motivation, and its qualifiers using the policy delivery and implementation perspective. This research found that the international climate agreements, the international development mechanism[39], and the entailing foreign aid (e.g. ODA) can create paradigmatic change in climate change and cognate policies. However, when it comes to delivering climate change policy paradigms, policy actors emphasise the local benefits, communities' resilience building and compatibility of climate policy goals with the nation's development objectives (e.g. LDC graduation). The respondents reported that the climate mitigation actions are relatively less compatible with the nation's development objectives for their global benefits than local benefits, which policy actors prioritise. Therefore, despite the emergence of the climate change mitigation-based policy paradigm, they may not be delivered on the ground, meaning framing climate mitigation actions into government policies does not mean an automatic delivery. Further, this research found that paradigmatic changes in policies do not occur in a punctuated equilibrium style. Instead, they are observed over time, depending on qualifiers and pre-requisites for paradigmatic change based on policy actors' diverse understanding of policy paradigms notion.

Climate change mitigation is viewed more as a strategic action by the majority of respondents. They talk about the vague nature of climate mitigation actions when it comes to delivering them via on-ground projects and programs, whereas climate adaptation actions are more specific that address local

[39] In the context of this thesis, International development mechanism refers to international development organisations, agendas they advocate (e.g. green growth narrative) and their interaction with local policy actors.

development gaps. Climate mitigation is strategic even at the policy implementation stage at the local level. They are mostly institutional, meaning the project and program owners, including the funding institutions (e.g. international development organisations), embed the concept of climate mitigation into their project implementation strategy. The information from the respondents working for the local governmental and international development organisations validates the statement that climate mitigation is strategically incorporated into their programs. They cite the relatively short history of Nepal in incorporating climate mitigation actions into government policies. Nepal is in an early stage in terms of framing and operationalising climate mitigation actions. Therefore, although climate mitigation is strategic for now, it will eventually get more attention in policy implementation, as mentioned by the respondents.

With the policy implementation, most respondents concur that policy changes (e.g. the addition of climate mitigation actions to climate adaptation actions) are far from being reflected fully onto existing on-ground programs and projects. However, attempts have been made to deliver the climate mitigation-based policy paradigms alongside development objectives, only to be hindered by limited technical, institutional, and financial capacity. While these are frequently cited limitations to delivering climate actions in many LDCs, including Nepal, another notable aspect that respondents identified is that there is a lack of coherence between climate change-oriented policies' objectives and development objectives. This was identified as a policy formulation issue but had implications on policy implementation and development objectives. The non-government respondents validated this claim by stating that existing government policies are sector focused, and there is weak coordination between levels of governments when it comes to operationalising climate change-related policy paradigms. Most respondents highlighted the need for coherence between climate and cognate policies' objectives and development objectives to avoid fragmentation in delivering both. Collaborative governance was also presented as a way forward to avoid fragmentation. The interactions between policy actors who form partnerships for collaborative decision-making and the implementation of climate change-oriented policies highlight the importance of collaborative practice in the context of climate policy discourse in Nepal.

A new international climate policy paradigm that appeared post-2015 presents climate change as a transformative challenge and emphasises broader socio-economic objectives (Hermwille, 2016). This research found that Nepal's climate change adaptation-based policy paradigm corresponds to the international climate policy paradigm. It emphasises development objectives and aims to address socio-economic issues at the local level (e.g. the criteria for the DC graduation). Therefore, its operationalisation via actual on-ground actions is relatively strong compared to the climate mitigation-based policy paradigm. Nonetheless, co-benefits of climate mitigation is the motivation for many policy actors. Moreover, non-climate and local benefits can be more significant in developing countries than developed ones (Pittel and Rübbelke, 2008). Therefore, despite the relatively weak operationalisation of the climate mitigation-based policy paradigm, we can expect it to be prioritised for implementation in future, particularly considering its framing in government policies (as identified by Chapter 4) and the attention it receives from international development agencies. Figure 8.2 shows the drivers, motivation, and implications of climate change policy paradigms in Nepal. It also shows the adjustments, such as the institutional changes and new policy instruments and financial mechanisms developed to enable the policy paradigms. The local versus global implications are key considerations for deciding on the actual on-ground actions. These findings from Chapter 4 and Chapter 6 improve our understanding of how and why climate change adaptation and mitigation are emphasised in government policies of a low-income country.

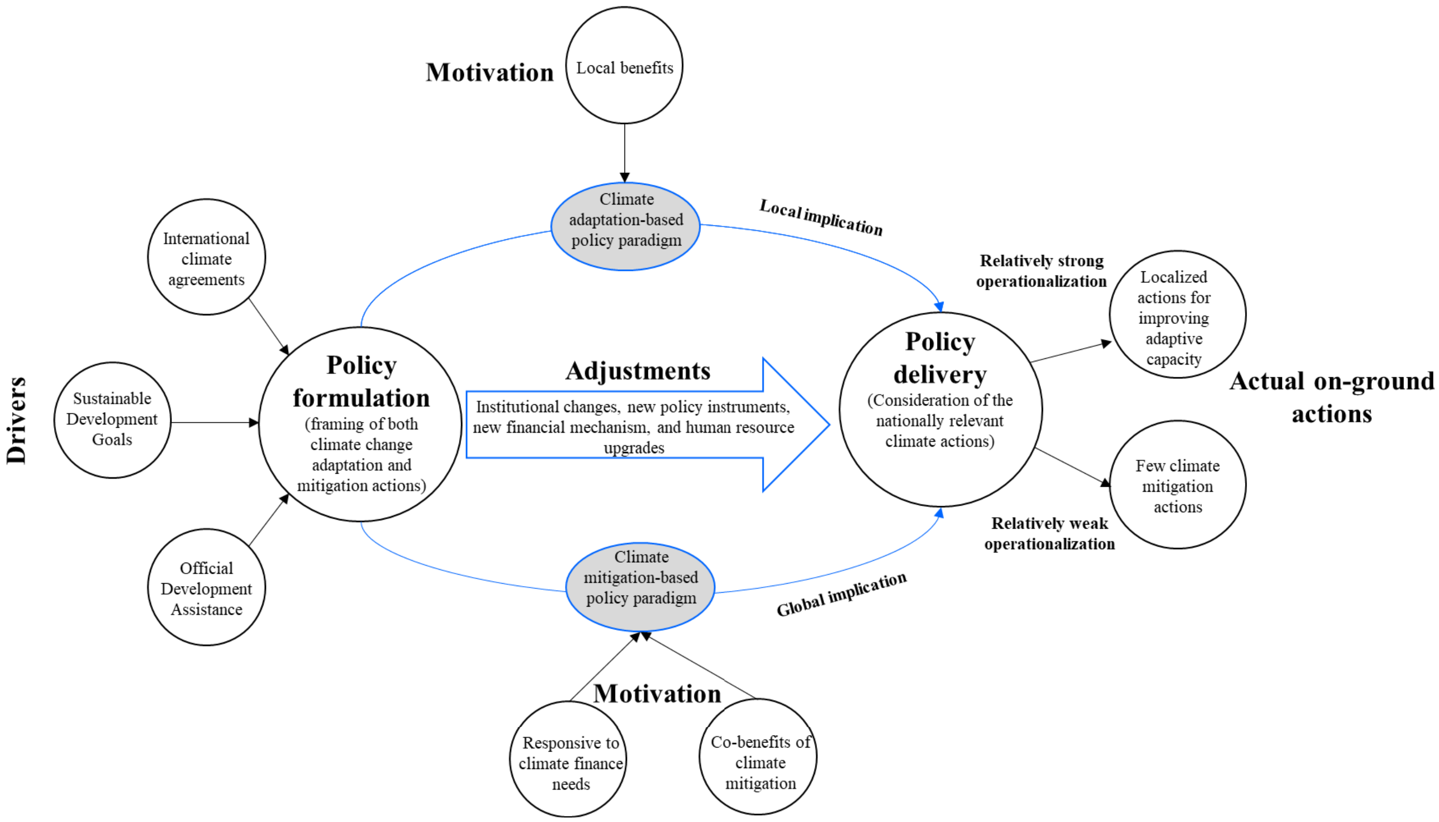

Figure 8.2. Climate change policy paradigms, their drivers, motivation and implications.

8.5.2. Climate mitigation mainstreaming and the contextual factor

Semi-structured interviews and a review of chosen government policies (see Chapter 5) found that climate mitigation actions are framed into government policies in Nepal. However, the social context in which framing is done during policy formulation and the priority for implementation vary across policies. The contextual factor (social) identified by this research is that global environmental discourse influences the contents of policies, including policy instruments (information, market, and economic instruments). External events (e.g. signing of international climate agreements) can change the policymaking context (Moat et al., 2013). External forces, such as global environmental discourse and the associated international development mechanism, can affect the policymaking process, including policy formulation, by influencing policy actors' knowledge, ideas, and interests (Lovri et al., 2018). This research found that this diversity-focused policy milieu is the social process that created a preliminary climate mitigation-related knowledge structure, which is a part of the cognitive influence

(Biermann et al., 2009) of the global environmental discourse. Consequently, the fledgling knowledge structure is reflected in government policies, which we understand as framing climate mitigation actions.

The ideas and interests of different policy actors and their institutions compete in the discursive policymaking realm to identify the nationally relevant climate change mitigation actions. In doing so, the central and local government organisations respondents mentioned that institutional change might occur to adjust to the need for new or reformed policies. However, institutional change is more common for nationally relevant climate change actions. For example, the creation and upgrade of an Alternative Energy Promotion Centre to deliver Nepal's Rural Energy Policy (2006). Nonetheless, a few respondents from government and private sector organisations mentioned that some climate mitigation actions in existing government policies are not nationally relevant. They mentioned that some climate mitigation actions in government policies are included solely because of pressure groups' influence and the need to communicate those actions to international communities (via UNFCCC) as per the requirements of the Paris Climate Agreement and the SDGs. Most respondents, mostly from government organisations, identified international climate agreements and the SDGs, together with the corresponding official development assistance and international climate finance mechanisms, as drivers to causing a paradigmatic change in climate change-oriented policies. Climate change mitigation is responsive to climate finance needs, and that the policy actors recognise the co-benefits of climate mitigation actions in Nepal. However, most respondents believe that they may not generate local benefits and are less compatible with the development objectives than adaptation actions. Therefore, climate mitigation actions are ignored in favour of climate adaptation actions at the policy delivery level despite their inclusion in government policies at the policy formulation stage.

The framing of the climate mitigation actions into the policies via changes in the policy actors' knowledge and ideas and the institutional changes reflect the underlying change in the national level discourse. For example, the policy alignment process that utilized both discursive policymaking and quantitative policy modelling considered issues such as the nationally relevant climate mitigation actions, potential sectors for interventions, the scale of commitments to be included in the NDCs, and financial need assessment for the implementation. It is not only the mere framing of the climate mitigation actions but the diversity in the subject of the national-level discourse that appears to be an important impact of the policy discourse on global environment-related initiatives and green growth. Further, the change in policy actors' ideas and knowledge changed the national discourse and reflected the discourse into sectoral policies and had an executive influence across sectoral and multi-level governance. Discourse is tied closely with ideas and institutions under discursive institutionalism, and that the discourse results from the change in ideas (Schmidt, 2008). This seems to be the case for Nepal. This finding expands the conceptualisation of change in policy actors' ideas, causing direct changes in policies. It is rather the discourse that changes first and then the policy changes.

Chapter 9: Conclusion

This thesis built on the assumption that policy discourse on global environment-related initiatives and green growth influence policymaking in the case countries, Nepal and Bangladesh. The purpose of this research was to investigate the policy formulation process and implementation related to the objectives of global environment-related initiatives and green growth by conducting country-specific studies. While global environment-related initiatives are international climate agreements and the environment-related SDGs, and green growth is an economic growth model, climate mitigation actions and related policy discourse bundles their objectives of reducing GHG emissions. The literature review could not identify the presence of a theory that bundled the objectives of environment and climate-related international agreements and green growth for low-income countries. However, there exists previous work on global environment-related initiatives and international development organisations being drivers for increased policy actions, particularly for climate adaptation in the two case countries. Regarding climate mitigation, Nepal and Bangladesh are not obligated to prepare and communicate actions for GHG emissions reductions (Article 4.6 of the Paris Climate Agreement) because of their LDC status and their special circumstances. However, despite their LDC status and low mitigative capacity, the increasing interest of both countries' governments towards framing climate mitigation actions into government policies motivated this research. Therefore, the research investigated the influence, and causal effects that global environment-related initiatives and green growth create in these countries at both policy formulation and implementation levels. Key questions for investigation were: *How* does the paradigmatic change occur in climate change policies of low-income countries, such as Nepal and Bangladesh? *How* are the *objectives* of global environment-related initiatives and green growth integrated into non-environmental policies (sectoral policies)? *Will* the case countries be able to achieve their global environment-related initiatives and green growth-related policy goals with graduation from the LDC status of the UN.

In the course of answering these questions, the research investigated the policy formulation aspect of environment- and climate-specific and sectoral policies by utilising literature on policy paradigms, policy integration, and mainstreaming concepts. For studying the implementation aspect, the thesis focused on methodological and data contributions by using empirical analysis and predictive modelling while referring to the literature on green growth and global environment-related initiatives. This thesis included two chapters (4 and 5) that studied the policy formulation aspect and another two chapters (6 and 7) that studied the implementation aspect. The discussion chapter (8) discussed several crucial points from Chapter 4 to Chapter 7, which are the basis for the conclusion. I divide the overall conclusion into four categories, and they are discussed in the following paragraphs.

First, this research created an analytical framework comprising four aspects: 1) Problems policies are meant to address and the focus of the policies; 2) Contents of the policies; 3) Institutions and strategic interactions; and 4) Global environment-related initiatives. I used this analytical framework to find that new climate mitigation-based policy paradigms emerged in Nepal and Bangladesh after 2005. The new climate mitigation-based policy paradigm co-exists with the previous climate-based policy paradigm, depends increasingly on internal funding in both countries, and is more transparent in communicating the intended climate actions to the global community (e.g. UNFCCC). Another notable feature of the new climate mitigation-based policy paradigms in both countries is the emphasis on issues other than reducing GHG emissions—for example, increasing access to clean energy, sustainable transportation, and sustainable agriculture. The focus on other benefits of climate mitigation clarifies why countries with low mitigative capacity are interested in framing climate mitigation actions into government policies. The climate adaptation-based policy paradigm utilised official development aid (ODA) to finance the implementation of the climate adaptation actions. A shift from ODA-based funding to internal funding means that there could be competition amongst formal institutions (government institutions) to access limited funds and to decide whether mitigation actions should be funded or adaptation actions. Competition between formal institutions to access financial resources is common when two policy paradigms co-exist. However, most respondents to semi-structured interviews talked about leveraging collaborative practice between government institutions to reduce conflict and enhance synergies between sectoral policies while using the limited funding opportunities. A continuous decline in the ODA per capita for both countries means the recent progress made in the deployment of economic and market-based policy instruments in both countries will play a critical role in enabling the new climate mitigation-based policy paradigms in future.

Further, despite second-order changes in three aspects—focuses of the policies, policy contents (financial resources), and global environment-related initiatives—the fourth aspect, the institutional aspect, has gone through first-order changes via dialectic change mechanisms in both countries. While changes have been incremental, the non-crisis driven change (an attribute of the dialectic mechanism) in the institutional arrangements means that the policy discourse relating to climate mitigation actions and their integration into government policies by formal institutions is reactive. Therefore, this research concludes that the inclusion of climate mitigation actions as policy goals is a response to the requirements of global environment-related initiatives. The new climate mitigation-based policy paradigm appeared after 2005. However, climate mitigation actions became more prominent in policies formulated after 2009 in both countries. This followed the Bali Action Plan in 2007 and the Copenhagen Climate Accord in 2009. It implies that these two climate conferences encouraged even low-income countries with low mitigative capacity to respond to a global call for climate mitigation. The research concludes that the reactive nature of the new climate mitigation-based policy paradigm originates from the obligation to communicate international climate commitments. Subsequently, the climate commitments (e.g. climate mitigation actions) are reflected in sectoral policies.

Second, this research found that the global environment-related initiatives that encourage signatory countries to reduce non-renewable resource use and GHG emissions and the deliberation of green growth as a potential economic growth model influence Nepal's policy discourse. This finding not only validated the initial presumption of this thesis but also clarified why low-income countries like Nepal with low mitigative capacity are interested in framing climate mitigation actions into government policies. The areas of influence are the improvement in the policy actors' knowledge and change in policy actors' ideas; the way policy actors and their institutions interact about different policy topics, the exchange of policy actors' ideas and their institutional interests; collaborative practice between policy actors, discourse in environmental policymaking and governance, policymaking processes (discursive and quantitative policy modelling), and discourse in environmental policymaking and governance,. This all results in various levels of integration of climate mitigation actions across sectoral policies. The way sectoral policies integrate climate mitigation actions is usually explained by using concepts such as 'policy integration' and 'mainstreaming', and these are used interchangeably in environmental policy studies. However, this research found that the interchangeable use of the two concepts is problematic and therefore identified the conceptual difference between policy integration and mainstreaming by creating a conceptual framework for climate mitigation mainstreaming. It is problematic because policy integration is primarily policy formulation-oriented, whereas mainstreaming has some focus on policy implementation.

The conceptual framework includes four criteria to distinguish mainstreaming from policy integration: 1) policy objectives and impacts; 2) sector and multi-level governance; 3) financial and human resources; and 4) institutional change. This research used the conceptual framework to find that mainstreaming is an extreme form of policy integration. While policy integration does not explain the scale of integration, mainstreaming explains the different levels of integration of climate mitigation actions into policies. This research identified the *prioritisation* of climate mitigation actions in Nepal's energy and forest sector policies, *harmonisation* for Nepal's transport sector policies, and *coordination* for Nepal's agriculture and industry sector policies. The research concludes that although sector policies integrate the climate mitigation actions, the 'harmonisation' and 'coordination' levels of integration that include climate mitigation actions as add-on policy objectives may not be sufficient from a policy implementation point of view. A 'prioritisation' level of integration—that is, mainstreaming by adding climate mitigation actions as the primary goals of sectoral policies—is policy implementation-oriented because it focuses on delivering climate mitigation actions via on-ground projects.

Most of the respondents to the semi-structured interviews validated the notion of on-ground projects. They emphasise the need to translate climate mitigation actions in sectoral policies into on-ground actions. Thus this research concludes that mainstreaming climate mitigation implies delivering climate mitigation actions via on-ground projects because, unlike policy integration that focuses mainly on framing climate mitigation into policies, the concept of mainstreaming extends its focus on the impact/outcome of policies. This preliminary insight is significant because it adds another dimension to understanding the difference between policy integration and mainstreaming. However, further research could critically analyse the notion of on-ground projects linked to climate mitigation mainstreaming. This research suggests that the implicit understanding of mainstreaming as having on-ground projects may be problematic for many low-income countries reflecting on their weak financial, technical, and institutional capacity. Therefore, this research underscores the notion of on-ground projects as the caveat of the concept of mainstreaming. Policymakers may be willing to move beyond policy formulation towards implementation, only to be hindered by resource constraints. Lack of climate mitigation mainstreaming across government policies can occur even if there is an aspiration to deliver climate mitigation actions via policy implementation.

Third, an empirical analysis of data for indicators of green growth and the projected data of energy and material consumption up to 2030 shows that achieving green growth while meeting the Paris Climate Agreement's objectives and the SDGs will be challenging for both countries. While the prospects for greening growth remain elusive in an absolute sense for both countries, the research found that both countries made significant progress in energy productivity, material productivity, and carbon productivity. However, despite a significant increase in productivity values, the share of renewable energy in the energy mix decreased for both countries between 1985 and 2016, and this trend is likely to continue as absolute resource consumption and the associated GHG emissions are likely to increase. The increase in productivity values was mainly because of structural changes in the economies of both countries that shifted from being agriculture-based to services-based, and because of the inflation effect. While the inflation effect may continue to contribute to increased productivity values, hard structural changes are starting to tail off in both countries. The structural effect and the inflation effect correspond to the dynamics of economic production. Any improvements in productivity values from these cannot be considered a part of climate mitigation mainstreaming because these unintentional efficiency gains are not explicitly stated as climate mitigation actions, neither are they included in sectoral policies as policy goals. A decline in the share of renewable energy in the energy mix indicates that the policy implementation aspect is weak and is likely to worsen further as absolute resource use and the associated GHG emissions increases even for low economic growth scenarios for both countries. Therefore, this research concludes that technological changes aiming to increase the share of renewable energy in the energy mix, and to reduce absolute resource consumption and GHG emissions, are key to achieving green growth in future for both countries. Reductions in the use of low-intensity forest biomass and utilising the untapped potential to improve the technical efficiency of resource use are technological changes seen by this research as climate mitigation actions that aim to deliver on the goals of both global environment-related initiatives and green growth in Nepal and Bangladesh.

Moreover, this research concludes that green growth is relevant for low-income countries, particularly in the context of LDC graduation and for effectively enabling the new climate mitigation-based policy paradigms. While it remains unknown whether policymakers will adopt green growth in low-income countries, they would want to address both climate mitigation objectives and economic goals (e.g. LDC graduation). The green growth model (as defined in this research) operates at the intersection of climate mitigation objectives and economic goals, and therefore efficiency gains are weighted more than absolute reductions in resource use and the associated GHG emissions. Although the new climate mitigation-based policy paradigms in Nepal and Bangladesh emphasise the reduction of non-renewable resource use and the associated GHG emissions, they do not seem to explicitly address absolute reductions, and this remains an issue that needs rethinking in future by policymakers. Therefore, in addition to the limited access to funding, addressing absolute reduction of non-renewable resource use and the associated GHG emissions will be key to effectively enabling the new climate mitigation-based policy paradigms in both countries. These findings correspond to the limitation of green growth that intends to achieve climate mitigation objectives via efficiency gains, thus ignoring the ecological limits. While this research identified the problems with the new climate mitigation-based policy paradigms and the downside to greening the growth in both Nepal and Bangladesh, the research recommended a transition from biomass-based to a renewable energy-based energy system. This renewable energy transition is likely to help both countries reduce their resource use and the associated GHG emissions in an absolute sense because biomass contributes to more than half of the total primary energy consumption and domestic material consumption in both countries. This research concludes that, if the renewable energy transition condition is met, then the international development organisations' push to adopt a green growth model will make more sense given its limitation, and the new climate mitigation-based policy paradigms can be enabled effectively in both countries.

Finally, the research concludes that a policy coherence framework that foreshadows strategies to minimise the negative impacts of the diminishing structural effect on a pursuit to achieve an absolute reduction of resource use and the associated GHG emissions can help better deliver climate mitigation objectives. The policy coherence framework will also link the policy implementation and delivery aspects of government policies as the policy coherence is delivery-oriented. The policy coherence framework includes three key strategies as proposed by the research. The first is efficient economic growth that builds on the notion of green growth to reconcile tensions between increasing resource use and decreasing GHG emissions across economic sectors. While the NDC of Nepal intends to shift from a biomass-based energy system to a hydroelectricity-based energy system, the transmission and distribution (T & D) loss that accounted for up to 10% of GDP in 2030 appears to be overlooked in efforts to reduce GHG emissions. Ignoring the T & D loss is not economically viable. Similarly, the GHG emissions from the most significant sectors—agriculture, forest, other land-use (AFOLU)—that contributed up to 48% of GHG emissions in Nepal (2020) have been seen as less important than the energy sector. This research also finds that the climate mitigation mainstreaming in the agriculture sector of Nepal is of 'coordination' level, but should have been a priority given its major contribution to national GHG emissions.

The second strategy is implementing technological change across biomass-using sectors (e.g. residential and manufacturing) by focusing on a renewable energy transition that would also improve the share of renewable energy in the energy mix for both countries. The share of renewable energy in the energy mix has been in decline for the last two decades for both countries. The third strategy is to maintain constant income elasticity of demand for resource consumption by introducing policies that subsidise the use of renewable energy resources while reducing the subsidies on fossil fuels which are prevalent in many low-income countries. However, understanding the economic implications of reducing subsidies on fossil fuels in low-income countries needs detailed investigation and policy analysis because of the potential impact on energy use for subsistence. Nevertheless, a declining cost of energy production from renewable energy sources in the South Asian region is an encouraging sign for policymakers.

Future recommendations

Although the literature on policy paradigms is rapidly evolving, there is a lack of (i) country-specific studies focusing on climate mitigation actions in low-income countries; (ii) consideration of non-ideational elements (e.g. knowledge and institutions) of policy paradigms; and (iii) sufficient consideration of quantitative empirical evidence related to a policy topic.

This research has made an effort to build on the literature on policy paradigms by undertaking country-specific studies of Nepal and Bangladesh, and it has also discussed the non-ideational elements of policy paradigms, such as the institutional aspects (institutional interactions, institutional interest, and institutional change) and policy actors' knowledge. The initial conceptualisation of the policy paradigm was based on the ideational element of the policymaking. Later the public policy and comparative politics scholars expanded the notion of policy paradigm by exploring policy actors' ideas-institution nexus, but the role of policy actors' knowledge is still thinly explored by researchers. This research discussed the role of policy actors' knowledge and institutions as exogenous factors to changes in policy paradigms in a case country (Nepal) that has relatively less technical and institutional capacities required to develop and deliver climate mitigation-oriented actions. Future research can conduct more climate policy paradigm-related country-specific studies focusing on non-ideational elements.

This research has also tried to take account of the quantitative empirical evidence related to a policy topic. The analytical framework created and applied to identify the new policy paradigms builds on the premise that non-ideational elements, including the influence of global environment-related policy discourse, determine the characteristics of any new policy paradigms in countries such as Nepal and Bangladesh where environmental policymaking has external influence. The analytical framework created to study the climate policy paradigms in Nepal and Bangladesh by Vij et al. (2018) builds on a similar premise. However, the framework does not provide enough explanation about the role of the policy discourse on global environment-related initiatives, such as the Paris Climate Agreement and the environment-related SDGs, mainly because the analytical framework is climate adaptation-focused. Further, although the new policy paradigms in both countries are climate mitigation-based, achieving climate mitigation goals in an absolute sense is far from being addressed via sectoral policies. This is particularly true for Nepal as chapter 6 showed that without creating coherence between climate-specific policies (e.g. NDCs) and sectoral policies, the climate mitigation goals might not be delivered. Therefore, the research recommends that any future studies of climate mitigation-based policy paradigms, particularly in countries who experience external influences (e.g. international development mechanism and the corresponding ODA), should explore if climate mitigation actions are considered only during policy formulation. Further, the research recommends that the climate policy paradigms analytical framework (developed and presented in chapter 4) needs further testing to find out whether it should add other essential elements of climate mitigation-based policy paradigms.

The conceptualisation of the mainstreaming of climate mitigation-oriented actions applied in this research in the context of Nepal emphasises four factors: (i) entry-points, (ii) policy actors, (iii) external drivers, and (iv) policy processes. These factors combine with various levels of climate mitigation mainstreaming in the sector policies to create a conceptual framework. Based on this framework, the study concluded that mainstreaming is also policy implementation-oriented and hence is a better alternative to policy integration. The conceptual framework is also a basis for this research to discuss the difference between the mainstreaming and policy integration concepts which are often used interchangeably, most notably in the climate adaptation-related literature. The framework is applied in the context of climate mitigation in a single country, meaning that the evidence generated may be insufficient for global literature. Therefore, the research recommends that future work aiming to clarify the conceptual difference between the two concepts should add more evidence to this debated topic amongst climate and environmental policy scholars.

The empirical analysis of green growth in low-income countries in this study attempts to contextualise the relevance of economic and climate mitigation goals at both the policy formulation and policy implementation stages. This was done by bundling global environment-related initiatives and green growth based on their common aim of reducing non-renewable resource use and GHG emissions. While the research intended to justify the bundling of two completely different approaches to achieving climate mitigation goals, the research has added a new perspective to look at the climate mitigation and economic challenges with which many low-income countries are unfamiliar. Future studies relating to this particular research domain will be able to add more empirical evidence, as the practical application of green growth has been limited to date.

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