

# Managing CoDesign in Dynamic Alliance Networks

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# Declaration

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I, Abdussalam Ali, declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references given.

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# Abstract

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The research described in this thesis develops ways to support creativity in dynamic business networks. Businesses in a business network are organized to bring their knowledge and assets together to develop new services and products. Traditionally business networks were stable. However, the changing nature of the business environment calls for new knowledge, which is increasingly met by bringing in new businesses with the new knowledge into the network and often changing the network structure. At the same time greater creativity and innovation are needed to address the emerging problems. Consequently, networks must create the environment that supports members from businesses working together to combine their knowledge to create innovative solutions. The design process is thus becoming increasingly collaborative as product design emerges as new ideas emerge. There is more emphasis on supporting collaborative design (CoDesign) where individuals and teams from different disciplines, including customers, consumers and users work together in the design process.

Although CoDesign itself is now well-understood, how to manage it within a dynamic networking environment given greater emphasis on privacy and knowledge is still not well understood. The research described in this thesis will contribute to knowledge of how to integrate business networking arrangements with CoDesign while maintaining knowledge sharing and privacy. To do this we have developed a model that will contribute to knowledge of how to integrate business networking arrangements with CoDesign and enable knowledge sharing and privacy.

To develop the model we have analysed existing business network structures, classified them by a set of concepts and developed a model that covers existing practices, integrates structure with CoDesign and supports dynamic change to networking arrangements. The model is made up of two levels – the business networking level and the design level. The business networking level defines the responsibilities of businesses and the privacy

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constraints. In the model, teams are created across the businesses and organisations. The design level is where these teams carry out CoDesign. The model describes ways for such networks to change as people in businesses join and resign over the time and the governance structures to preserve privacy.

The design level is facilitated by providing people in businesses with an environment to create and share knowledge for CoDesign. Knowledge management related research has been investigated as the CoDesign process is considered knowledge management intensive. In the networking level the model defines spaces where people in businesses join and agree on collaborative activities. In the creativity level those people are provided with tools where they can create and share knowledge. In the thesis we show how Design Thinking tools are introduced to support creativity in the CoDesign process. However, the model can support any tools needed for some special problem. Maintaining privacy is considered where rules and policies are defined to control accessing the knowledge and other components.

The model has been defined and a prototype has been implemented to evaluate the model by following the qualitative method. The model has been evaluated by conducting semi-structured interviews with experts. The experts agree that the model supports creativity in the dynamic business networks. However, their advice for future work and development should be considered.

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# List of Publications

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## Book Chapters

Ali, A. and I. Hawryszkiewicz (2015). Chapter 12 - Cloud as infrastructure for managing complex scalable business networks, privacy perspective A2 - Ko, Ryan. The Cloud Security Ecosystem. K.-K. R. Choo. Boston, Syngress: 249-267.

## Conference Proceedings

Ali, A. and I. Hawryszkiewicz (2015). Supporting Co-Design using Design Thinking Business Networks. 24th International Conference on Information Systems Development. Harbin, China.

Ali, A. and I. Hawryszkiewicz (2014). Services to Support Knowledge Sharing in Complex Business Networks, Big Data as the Source. 11th International Conference on Intellectual Capital, Knowledge Management & Organisational Learning. Sydney.

Ali, A., et al. (2014). Services for Knowledge Sharing in Dynamic Business Networks. 23rd Australasian Software Engineering Conference. Sydney.

Ali, A. and I. Hawryszkiewicz (2012). A Modelling Approach for Knowledge Management in Complex Business Systems. IADIS International Conference WWW/Internet, Madrid.

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# List of Abbreviations

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<b>SECI:</b>	Socialisation, Externalisation, Combination and Internalisation. The model of knowledge transfer mechanisms developed by Nonaka.
<b>KM:</b>	Knowledge Management
<b>DAN:</b>	Dynamic Alliance Network
<b>CoDAN:</b>	The acronym of our research model
<b>CoDesign:</b>	Collaborative Design
<b>WWW:</b>	World Wide Web
<b>CAD:</b>	Computer Aided Design
<b>DT:</b>	Design Thinking



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# Glossary

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## **Alliance Network**

In business context alliance network is where businesses of common interests build relationships to collaborate. Participants in alliance networks create and share knowledge for innovative outcomes and competitive advantages (Chen and Chen, 2002).

## **Brainstorming**

Brainstorming is where teams collect as many ideas as possible in a short time. The main purpose is to get ideas rather than discussing them (Tschimmel, 2012).

## **Business**

In this thesis we refer to an organisation, a company and firm as a business. According to the business dictionary (2018a) business provides goods or services, either privately owned or not-for-profit.

## **CoDAN**

CoDAN is the acronym for our research model, the model for supporting CoDesign in Dynamic Alliance Networks (DANs).

## **CoDesign**

CoDesign is the process where two or more businesses in a business network collaborate to create a product or service. People from different disciplines, including users and customers, participate in the CoDesign process ( (Du et al., 2012) and (Kankainen, 2012)).

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## **CoDesign Outcomes**

CoDesign outcomes are goals and business objectives to be achieved through the CoDesign process such as developing new products and services.

## **CoDesign Process**

CoDesign process is a number of activities, which are carried out to achieve the CoDesign outcomes and are performed collaboratively.

## **CoDesign Space (CoDesign-Space)**

CoDesign space in CoDAN is where business members in the network create the outcome of CoDesign Activities. CoDesign-Space is created in the DAN-Space. The person who creates CoDesign-Space becomes CoDesign-Space-Owner.

## **CoDesign Activity**

CoDesign Activity in CoDAN is what a group of people do and perform to achieve one or more of CoDesign outcomes in DAN. CoDesign Activities are the breakdowns of CoDesign process.

## **CoDesign Activity to CoDesign Activity knowledge transfer mode**

In this mode the knowledge is transferred from one CoDesign Activity to another within the same CoDesign-Space.

## **CoDesign-Space to CoDesign-Space knowledge transfer mode**

In this mode the knowledge is transferred from one CoDesign-Space to another within the same DAN-Space.

## **CoDesign-Space-Owner**

A role defined by CoDAN assigned to a person who creates CoDesign-Space to manage it. In Governed DAN-Space this role is assigned to DAN-Space-Coordinator. In Not-Governed DAN-Space it is assigned to DAN-Space-Contributor.

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### **CoDesign-Space-Participant**

A role defined by CoDAN assigned to a person who is assigned to CoDesign-Space to participate in CoDesign. This role is assigned to the person from a business in DAN or from outside of DAN.

### **Collaboration**

Collaboration is a process of joint decision making for a defined problem key issue. This process is a joint activity performed by people and teams across the business units or between businesses themselves ((Qureshi, 2006), (Scariot et al., 2012) and (Elliott, 2011) ).

### **Complexity (in business context)**

Complex systems are those systems with large numbers of elements. These elements are interrelated and connected. The change of one element may cause big changes to all of the system. Usually complex systems are adaptive to these changes. In business context complexity results from relationships between businesses which share the same environment of operation. As a result, these businesses should respond to emergence and changes to adapt to this complex environment (Bar-Yam, 2004).

### **Components Privacy**

Maintaining privacy in the research model is to control accessing the components defined in CoDAN. These components are; DAN spaces, CoDesign spaces, CoDesign Activities and Creativity Tools. People access these components based on their roles' policies.

### **Conceptual Framework**

Conceptual framework in this research represents a number of concepts which are used to categorise DAN types. These concepts are domination, governance, collaboration modes, knowledge management domination and privacy concern levels.

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## **Contributed DAN**

Based on the conceptual framework, the DAN is considered contributed when a number of businesses participate in the DAN. One of the reasons which motivates businesses to participate is to benefit from the opportunities provided by the network.

## **DAN Space (DAN-Space)**

DAN Space in CoDAN is a virtual space where businesses in DAN can join to network for CoDesign. In the model, DAN Space represents the level of supporting networking between businesses in Dynamic Alliance Network (DAN).

## **DAN-Space-Contributor**

A role defined by CoDAN assigned to a person from the contributing business in DAN. In Governed DAN-Space, the person with this role can only be assigned to CoDesign-Space to participate in CoDesign. In Not-Governed DAN-Space, in addition, DAN-Space-Contributor can create CoDesign-Spaces and manage them.

## **DAN-Space-Coordinator**

A role defined by CoDAN assigned to a person from the governing business in DAN to govern the Governed DAN-Space.

## **DAN-Space-Dominant**

A role defined by CoDAN assigned to a person from the dominant business in DAN to have full access to the Governed DAN-Space.

## **DAN-Space-Participant**

A role defined by CoDAN assigned to a person from outside of DAN in DAN-Space. The person with this role can be assigned to CoDesign-Space(s) to participate in CoDesign.

## **Design Process**

Design in the business context often means the development of processes that lead to the creation of products or services.

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### **Design Thinking**

Design Thinking (DT) is a human-centred approach of solving problems through a set of creativity tools that support CoDesign to achieve innovative outcomes. In our research DANs utilise Design Thinking tools for CoDesign ((Tschimmel, 2012) and (Du et al., 2012)).

### **Dominant Business**

Dominant business is the business that dominates DAN when it, for example, owns all or most of the assets and/or shareholdings in the network. Also, the domination is gained when the dominant business has an experience and expertise over the other member businesses in the network.

### **Dominated DAN**

Based on our conceptual framework, the DAN is considered dominated if it is dominated by at least one business. The DAN can be dominated by more than one business. A business which dominates the DAN is called the *dominant business*.

### **Dominated Knowledge Management (KM)**

Based on our conceptual framework, KM is considered dominated in DAN when at least one business controls the *KM processes* in the DAN.

### **Dynamic Alliance Network (DAN)**

In our research, Dynamic Alliance Network (DAN) is a business networking environment created by businesses for collaboration in CoDesign. Businesses in DAN join and leave at any time. Business networks are known as business alliance networks, and because of their dynamic feature we call such networks in this thesis Dynamic Alliance Networks (DANs).

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### **Flat Governance**

Flat governance, based on our conceptual framework, is when the members of the network share the responsibility of governing and coordinating the network. The flat governance usually encourages sharing the costs, risks and challenges between the members in the DAN (Pisano and Verganti, 2008).

### **Governed DAN-Space**

Governed DAN-Space is a type of DAN-Space that is governed at least by one business from DAN. The person who governs the Governed DAN-Space is assigned DAN-Space-Coordinator role.

### **Governing Business**

Governing business is the business that governs DAN in terms of coordination and management. Governing business governs the DAN-Space created for DAN. Also, the governing business can be assigned for a single project in DAN.

### **Hierarchical Governance**

In our model, the hierarchical governance is when a specific business has the authority to coordinate and manage the process in the DAN or in the DAN-Space.

### **High Level of Privacy Concern**

Based on our conceptual framework, DAN is considered with a high level of privacy concern when there is a design and production processes performed among the members of the DAN.

### **Human-Centered Design**

Human-Centered design is when users and consumers are involved in the design process for developing a product or service ((Tschimmel, 2012), and (Mootee, 2011)).

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## **Knowledge Management Processes**

Knowledge management processes are those processes involved in managing the knowledge. These processes include knowledge discovery, capturing, filtering and sharing ((Awad and Ghaziri, 2004) and (Becerra-Fernandez and Sabherwal, 2010) and (Dakilir, 2011b)).

## **Knowledge Ownership**

Knowledge ownership defines who owns the knowledge. Knowledge owners can be individuals and/or businesses. When maintaining privacy in CoDesign, knowledge ownership should be considered. The owned knowledge is only accessed by those who are authorised.

## **Knowledge Sharing**

It is the process when tacit and explicit knowledge is exchanged between individuals and groups ((Awad and Ghaziri, 2004) and (Becerra-Fernandez and Sabherwal, 2010)).

## **Knowledge Transfer**

In our model knowledge transfer is moving a specific knowledge from one CoDesign-Activity to another or from one CoDesign-Space to another. Knowledge transfer is a KM process which supports knowledge sharing.

## **Low Level of Privacy Concern**

Based on our conceptual framework, the DAN is considered with a low level of privacy concern when there are no design and development processes performed among the members of DAN.

## **Maintaining Privacy**

Maintaining privacy is the implementation of the procedures and methods to be applied to protect the private assets. These procedures include the ways of how to authorise people to access these assets when needed.

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### **Not-Governed DAN-Space**

The Not-Governed DAN-Space is the DAN-Space type that is not governed by a governing business in DAN. The person who creates this DAN-Space is assigned DAN-Space-Contributor role.

### **Open Mode Collaboration**

Based on our conceptual framework, the network is in open mode collaboration if the problem and knowledge domain are not defined (Pisano and Verganti, 2008).

### **Persona-map**

Persona-map is a Design Thinking tool used to record the knowledge in relation to people's needs ((Tschimmel, 2012) and Crandall (Crandall, 2010)).

### **Privacy**

Privacy is keeping something protected and secured unless authorised. That includes the knowledge and personal information and actions (Muniraman et al., 2007).

### **Research Framework**

Research framework in this thesis shows the guidelines towards designing and implementing a model to manage CoDesign in DANs. In this framework CoDesign management is based on five themes; knowledge sharing, self-organising, business networking, maintaining privacy and enabling creativity. A number of enablers are defined in this research for each theme which are supported by the research model, CoDAN.

### **Role**

Role as defined in the model, CoDAN, is a number of responsibilities assigned to the person when joining DAN-Space and CoDesign-Space.



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## **Shared Knowledge Management (KM)**

Based on our conceptual framework, KM is considered shared, not dominated, when there is no a specific business dominates the KM processes. The sharing of the knowledge management does not involve a specific business as a central point of management.

## **Stakeholders**

Stakeholders are the individuals, groups and businesses who benefit from the developed product or service.

## **Storyboarding**

Storyboarding is a Design Thinking tool used to create stories. Stories in the storyboard form the focus for new ideas (Tschimmel, 2012).

## ***System as such strategy***

It is a strategy when the users are not involved in the system evaluation process. In this case only the evaluator refers to the system and the documentation provided for evaluation ((Cronholm and Goldkuhl, 2003) and (Chen et al., 2011)).

## ***System in use strategy***

It is a strategy when the users are involved in the system evaluation process. ((Cronholm and Goldkuhl, 2003) and (Chen et al., 2011)) .

## **Wicked Problem**

Wicked problem is a kind of problem that has no specific definition or formulation. Every wicked problem can be described in more than one way. This kind of problems has no specific solution. Solutions for wicked problems cannot be described as right or wrong, instead, they are either better or worse. The way to reach this solution is iterative ((Rylander, 2009) and (Buchanan, 1992) ).

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# Chapter 1

## Ch1: Introduction

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### 1.1. Overview

The emerging business environment is one that has a large number and variety of stakeholders whose needs are continually changing. These needs are met by new products and services. Increasingly providing such services needs expertise and knowledge from many areas. It requires the ability to identify the emergent needs of stakeholders, the way such needs can be met, and the skills and materials needed to create any new products and services to meet their needs. To provide such solutions, it is necessary to bring together designers with the knowledge and expertise to create such products and services. Most solutions now require the combination of knowledge from many areas and hence designers with expertise in these areas.

Over time, the design process that includes many participants is increasingly called collaborative design or CoDesign. CoDesign is where individuals and teams, including customers, consumers and users all bring their knowledge to work together to design new products and services. Involving the users and consumers in the CoDesign process is found to be increasingly crucial. Other terms used in the literature to describe design include human-centered design, user-centered design or designing with the customer. Human-centered design approach provides designers and developers with a clearer idea about the customer needs and requirements.

CoDesign often starts by generating new ideas for new products and services. This calls for ways to support creativity to generate new ideas, as well as the ability to put these ideas into practice. CoDesign requires collaboration between people with the right knowledge.

These networks and teams are created across the business units as well as across businesses and organisations. These networks and teams, including people in businesses, stakeholders such as owners, investors, and consumers and users can be involved.

Knowledge is thus increasingly the key requirement of any collaborative design. One kind of knowledge is finding out what stakeholders need. This is sometimes in itself difficult to determine the increasingly specialised nature of most work. Accordingly, any design process is developed in a way where stakeholders are involved in the design process. Other stakeholders, including investors, are involved as well. At the same time solutions are required quickly. Often such expertise may not be available in a business and it becomes necessary to bring in knowledge in the form of experts from outside.

CoDesign process is thus a knowledge intensive process. Knowledge is considered as a property owned by individuals and businesses. The competitive nature of businesses results means that they do not like to expose their expertise and knowledge to everyone because of competitiveness. Hence privacy issue must also be considered when designing models that support such kind of collaboration, privacy should be considered and maintained to control knowledge access and sharing. Such transfer of knowledge now takes place not only in local teams in a business but also between businesses resulting in the creation of business networks.

Business networks can be quite complex and include several CoDesign activities which must be coordinated to reach an outcome agreed by all business partners. For example, two or more businesses may collaborate to create a new product or service. This may include CoDesign activities to define what the product or service should do. Then each business can develop part of the product. One business may outsource some of its work, or it may hire contractors. Or they may jointly contract to carry out a task for yet another business. One of the advantages of collaboration between businesses is developing and enhancing the innovation by reaching more professionals and skilled people. That of course provides businesses with new sources of information and knowledge where intellectual capital is developed. The other advantage here is reducing the implementation life cycle as well.

## 1.2. Dynamic Business Networks

It is becoming increasingly difficult for any business to quickly develop the knowledge needed to design services and products in today's business environment. Increasingly business networks are emerging to develop solutions. Participants in CoDesign often come from different businesses. Furthermore such design teams often change as stakeholders requirements emerge, which in turn calls for new knowledge. Business networks collaboration in CoDesign thus becomes dynamic. These networks are changing, and businesses join and resign over the time. One of causes of this dynamic change is the emergence and change in the business environment. Furr et al. (2016) is one of the papers that presents a scenario of such kind of collaboration in CoDesign.

Accordingly, dynamics and features of the business networks needs to be investigated and defined to develop the best way to support such networks for CoDesign. CoDesign, as mentioned previously, is performed through business networks and these networks become dynamic. Models supporting such networks should facilitate ways where these networks can be flexibly configured and modified. They should support any number of CoDesign activities and coordinate them to achieve an agreed upon outcome. Participants of these networks can easily join and resign. Teams can be created and modified as well. In addition, creativity tools should be provided to utilise by these teams to create and share knowledge in CoDesign.

We analysed literature and found several business network structures. These were often problem specific and provided little guidance for setting up a new network. In our analysis through literature and observation we found that there is a lack of research in developing models and support systems for CoDesign in a networked environment. The systems and models investigated are dedicated to a specific industry and are complicated. There is no framework to help people to create a business network. We found that there is a large variety of networks in practice. Our research question then is:

***How to organise business networks to create knowledge needed to deliver business solutions in today's complex environment.***

To do this we developed a conceptual model that provides a theoretical framework, which can be used to configure business networks identified in our study. We found that business networks are dynamic in nature in that they arrange their activities in flexible ways. We thus identified the concept of Dynamic Alliance Network (DAN) and that businesses in DAN can in a variety of ways organise themselves to carry out activities needed to support the business network goal. We called these DAN spaces that support design activities. CoDesign is then initiated through the DAN spaces.

### 1.3. Key Issues and Research Goals

Changing the market can be when a new product or service emerges. That means the needs of the changing market are preserved, the idea of new product is created, product is designed, manufactured and delivered. Each of these stages leads to the next one.

- Each design activity often requires different expertise.
- Product specifications often emerge. The design process now emerges to create the innovation by bringing people together to design the product before it is manufactured and delivered.
- Knowledge and expertise are increasingly specialised.

Design in the business network often means the creation of CoDesign activities that lead to the creation of products. These products are usually innovations and meet emerging market needs and business requirements. CoDesign activities must include tools that support creativity and innovation. It must also be possible to create new CoDesign activities and integrate them into the network.

#### **Emerging Tools**

CoDesign increasingly requires creativity tools to stimulate new ideas. There are tools now emerging in processes such as Design Thinking. Creativity tools are utilised to implement solutions for what are commonly wicked problems. Literature describes wicked problems

as problems with no precise solution. Examples of these tools are brainstorming tools such as storyboarding and persona-maps and solutions development tools such as lotus blossom.

## 1.4. Research Model

Key issues mentioned previously motivate us to think about a new model to support business networks, DANs, collaborate in CoDesign.

Our research is to develop a generic model to enable creativity for DANs. The model allows businesses in DAN to decide what to do and assign the task to a subset of businesses in the network. This subset of businesses can then create CoDesign spaces to carry out any necessary activities. In the CoDesign level participants are provided with creativity tools to perform CoDesign activities. A prototype of the model has also been implemented as web services. Implementing the model this way supports businesses and participants to join CoDesign regardless of their geographical locations. That facilitates participants with distant barriers to be involved in CoDesign. The model is to be generic where it can be utilised for any design process and can be used with any DAN regardless of its structure.

In our model the privacy is to be considered as well. The privacy is to be maintained by implementing rules and policies to control accessing the knowledge and other components.

The ideas behind these innovations are due to the emergence of needs and social requirements. Accordingly, businesses in DAN need to have what is called the self-organising feature to respond to these changes in an effective way.

The model allows creating of CoDesign process to match product design needs. The model allows CoDesign to emerge as needs emerge.

The model should support businesses, so they can respond to these changes by creating their creativity environments and CoDesign teams and facilitating knowledge sharing.

**We call our research model “CoDAN”. We also occasionally use alternative terms “the model”, “our model” and “research model” in this thesis.**

Our methodology to develop the research model is to define our model and implementing a prototype. The prototype is to be accessed as a collection of web services. The model has been evaluated through experts throughout semi-structured interviews. These experts are to

be provided with model documentation and access to the online prototype to have a proper idea about the model. The outcome of these interviews is to be analysed qualitatively by conducting content and thematic analysis.

## 1.5. Research Contribution

Our contribution throughout this research is to develop a model to support Dynamic Alliance Networks (DANs) and ways to organise CoDesign in complex environments. The model provides ways to configure business networks CoDesign activities by flexibly combining creativity tools and knowledge management processes to address an emergent problem. There is a lack of research to bring these different disciplines together according to the literature. Knowledge management processes are involved in CoDesign. How to bring in people with new knowledge to address existing problems in innovative ways or to define new directions. Participants in CoDesign create knowledge, filter knowledge and share it among them to create new knowledge. Creativity tools such as Design Thinking tools are utilised to process the knowledge and put knowledge management processes in practice.

The knowledge created and shared in CoDesign includes the tacit and explicit knowledge. Our model should support creating and sharing the two types of knowledge. As per the literature, systems support knowledge management and CoDesign mostly support the explicit type of knowledge.

Our model supports businesses to collaborate in CoDesign where privacy is maintained and controlled. Also, businesses are supported to be self-organised to adapt to changes emerging in their environments.

## 1.6. Research Methodology and Development

We start developing our research by defining the key issues through investigating a broad collection of literature and research work. This included CoDesign, business network, knowledge management and tools that encourage creativity such as in Design Thinking. Accordingly, we develop what is called the research framework where the enablers of managing CoDesign are defined. The model is then defined, and a prototype of the model



is implemented. The evaluation is to be performed through a qualitative methodology. The model is to be evaluated by experts through the model definition and its prototype.

## 1.7. Thesis Outline

### ***Chapter 1: Introduction***

This chapter.

### ***Chapter 2: Literature Review.***

In this chapter we explore the current research to define the research key issues. We start by introducing creativity in developing innovation. CoDesign is carried out through business networks where participants in these networks create and share knowledge. Accordingly, collaborative business networks have been presented as well as knowledge management principles. Also, we have presented knowledge management from the aspect of CoDesign. One way to absorb and present the research key issues is to investigate systems that support CoDesign. Systems which support CoDesign have been explored to show if they are adequate to support CoDesign. In addition, knowledge management systems have been investigated for the same purpose. As one of our research goals is to define and implement creativity tools to support CoDesign, Design Thinking concepts and tools have been presented. In our research we see maintaining privacy is necessary when implementing systems that support collaboration. Because of that, privacy in relation to CoDesign has been reviewed and investigated. Lastly, we have listed the research key issues based on the literature reviewed. A framework for our research has been illustrated and presented to be referred to as a guide to design and implement our research model.

### ***Chapter 3: Research Plan and Methodology.***

In this chapter we explain how the model of our research is to be developed and evaluated. This chapter is the first step towards designing and implementing our model. The research framework illustrated at the end of Chapter 2, Literature Review, is presented again in this

chapter and explained in more details. The plan steps of how to design, develop and evaluate the model have been explained as well. We have explained our methodology and strategy of how to evaluate the model based on the related literature. An idea about qualitative research has been given as the qualitative method is adopted for the evaluation process. Then we have explained our constructs and stated our research hypotheses to be tested. The research hypotheses have been developed based on our research framework and constructs.

#### ***Chapter 4: Types of Dynamic Alliance Networks.***

Our aim in this research is to develop a model to support dynamic business networks for CoDesign. To do this we first analysed business networks to identify common characteristics. In this chapter we carried out a more in-depth analysis of literature has been reviewed to investigate DANs and their common features in practice. The types of alliance networks have been presented according to different research and criteria. 15 types of dynamic alliance networks have been defined as a result. Based on the literature, we have developed our conceptual framework for the general features of alliance networks. The 15 types of network have been categorised against the conceptual framework defined features. Categorising the types of network in this way helps to develop a model in the best way to support these networks for CoDesign. We then approached the classification from a scientific perspective.

***Chapter 5: Research Model Definition.***

In this chapter we present our research model design. The model has been defined to support the features defined through the conceptual framework in Chapter 4. In this chapter we present our idea of spaces to support the dynamic alliance networks for CoDesign. These spaces have been defined as two types, DAN spaces and CoDesign spaces. To develop the best approaches for maintaining privacy DAN spaces also have been defined as two types, Governed and Not Governed. Then we show how these two types of DAN spaces can be utilised to support the different categories of network defined. The other components of research model have been defined as well. These components include the roles, CoDesign activities and creativity tools. Privacy modeling then has been presented based on the roles defined and their responsibilities in the spaces. That is including how these roles are utilised to support the different categories of alliance networks as well. One of the aims to develop the research model is to define creativity tools for business networks to collaborate in CoDesign. Accordingly, enabling creativity in the model has been presented. Enabling creativity includes defining the creativity tools and CoDesign activities. CoDesign activities are performed by utilising the creativity tools.

***Chapter 6: Model Prototype, Design and Implementation.***

In this chapter we show how the prototype is designed and implemented. We present how we utilise Object Oriented Modeling method to design the prototype. Accordingly, we present the modules to manage and access the database. Also, the user interface is presented including the images of the main screens.

***Chapter 7: Model Evaluation.***

This chapter shows how the evaluation process has been conducted and how the findings are extracted and presented. In this part the qualitative evaluation of the model by the expert participants to evaluate the model is explained. Also, we have explained our procedure of how the semi-structured interview has been conducted with the participants.

We have presented the evaluation findings according to themes and hypotheses defined. Discussion of these findings has been conducted at the end of the chapter.

***Chapter 8: Conclusion and Future Work.***

The conclusion of this research has been presented in this chapter. Summary of the evaluation findings has been presented here. Then we have explained the contribution of this research according to three aspects. These three aspects are; contribution to academic research and theory, contribution to practice and contribution to teaching and learning. At the end of the chapter our directions for future work are explained.



# Chapter 2

## Ch2: Literature Review

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### 2.1. Introduction

In this chapter we investigate the literature in relation to our research. The purpose is to explore the work has been done and to address the research key issues relating to the research question. At the end of the literature review we illustrate our research framework. The research framework is considered as guidance to define the research model later in this thesis.

In this introduction we start with some concepts of innovation and creativity, then we explain our plan of exploring the literature according to that.

In fact businesses compete, respond to market emergences and fulfill business requirements by creativity and innovation development.

Innovation is a driver for businesses to gain competitive advantages. Involving stakeholders in the innovation allows them to share their experience and knowledge to achieve innovative outcomes (Herrera, 2016).

Amabile et al. (1996) have defined creativity and innovation. Amabile et al. (1996) define creativity “as the production of novel and useful ideas in any domain”. In contrast Amabile et al. (1996) have defined innovation “as the successful implementation of creative ideas within an organisation”. Creativity is to create new ideas while innovation is implementing these ideas.

Amabile (1998) has presented her model of creativity by including three components as shown in Figure 2.1.

These components can be summarised as follows:

1. **Expertise:** the knowledge and experience known by the person. It includes skills the person can demonstrate in the business domain.
2. **Creative Thinking Skills:** skills of people on how they approach problems and create solutions in a flexible way.
3. **Motivation:** motivation is the factors which encourage people to be creative and innovative.

Amabile (1998) reports that these three components are supported by knowledge sharing and collaboration.

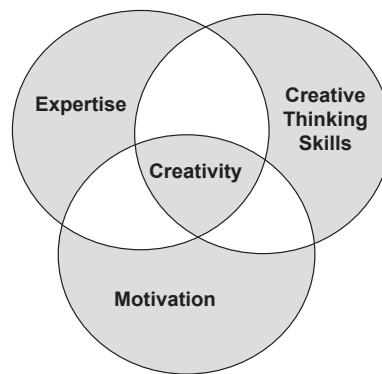


Figure 2.1: The three components of creativity according to Amabile et al. (1996)

Bjerke and Johansson (2015) in their study conclude that collaboration between businesses results in positive innovative impacts for these businesses.

Based on the three components of creativity presented by Amabile (1998) we describe our research work as illustrated in Figure 2.2.

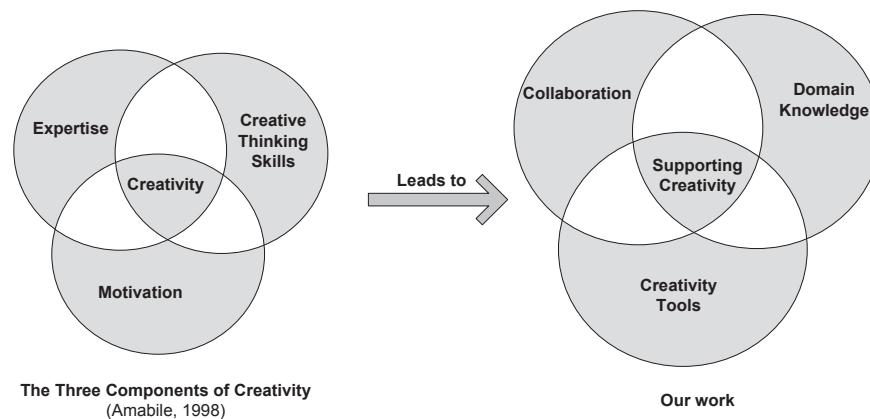


Figure 2.2: Our work according to the three components of creativity.

Our research is to develop a model of a set of tools to support creativity in Dynamic Alliance Networks (DANs) for CoDesign. We refer to the model of creativity components presented in Amabile (1998) as a fundamental for our work. According to the illustration in Figure 2.2 our focus is developing creativity tools that support knowledge and collaboration within DANs to perform CoDesign. Our model is to help businesses in creating new knowledge, new collaborations and provides new way to use the creativity tools.

According to Figure 2.2 we define the themes in Figure 2.3. These themes represent our guidance to define the literature domain to be investigated. According to Figure 2.3 these themes can be described as following:

- Businesses compete to respond to market emergences by creativity and innovation.
- Creativity and innovation are achieved by collaboration in design (CoDesign).
- CoDesign is performed through business networks.
- Business networks create and share knowledge out of their collaboration in CoDesign.
- Creating and sharing knowledge is achieved by utilising creativity tools such as Design Thinking tools.
- CoDesign is a process of bringing together individuals and teams to share knowledge. That brings up the privacy issue where “who accesses what and does what” should be managed and maintained.



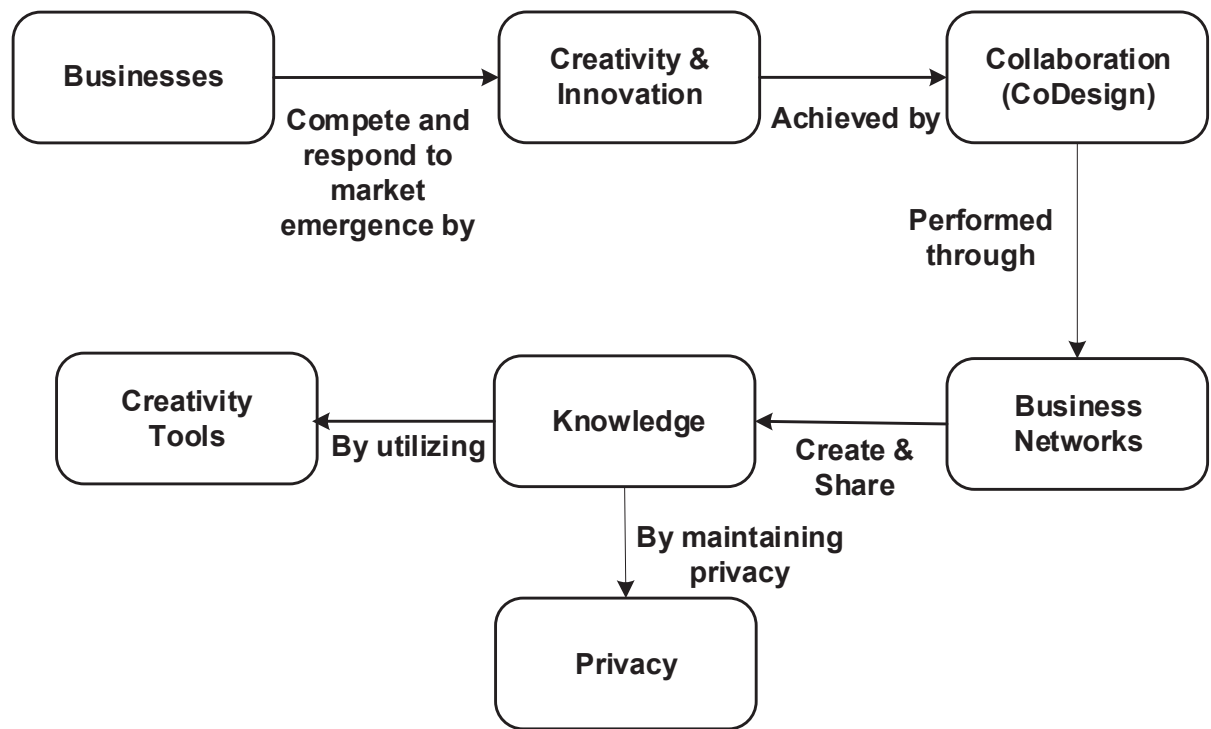


Figure 2.3: Literature Review Domain Themes

According to these themes we define the topics of the literature domain to be reviewed as following:

1. **Dynamic business networks (Section 2.2):** Collaboration between businesses is performed through the business networks. Accordingly, businesses can adapt to changes and emergence in their environment. This kind of adaptation is related to what is called self-organisation. Businesses are to be self-organised to adapt to these changing environments.
2. **Knowledge and knowledge management (Section 2.3):** Knowledge is needed for creativity and innovation to gain competitive advantages. Knowledge management is the way to discover, acquire, create, and share the knowledge and applying it. In this section we present the concepts of knowledge and knowledge management.
3. **CoDesign and knowledge management (Section 2.4):** Business networks are setup to perform CoDesign for new products or services. In this section we present CoDesign concepts and principles according to the literature. Also, in this section we show how knowledge management processes are included in the CoDesign process.

4. **Systems support CoDesign (Section 2.5):** In this section we present our investigation of systems that support CoDesign. The purpose is to see how these systems are adequate in supporting CoDesign with its new dimensions. In addition, the knowledge management systems are to be investigated for the same purpose as well.
5. **Privacy in CoDesign (Section 2.6):** Privacy becomes a concern as CoDesign is a collaborative process that involves knowledge sharing. This collaboration can be either within the business itself or between businesses. Knowledge is seen as a competitive advantage and private property due to many literatures. In this section we present privacy concepts and investigate privacy in relation to CoDesign.
6. **Creativity Tools (Section 2.7):** Creativity tools are utilised by people in business networks to design creative products and services. In this section we investigate Design Thinking and its tools as Design Thinking tools are utilised in CoDesign.

In summary, our investigation of literature domain includes collaboration and collaborative business networks, knowledge and knowledge management, CoDesign and supporting systems, creativity tools and privacy in CoDesign. At the end of literature investigation, in section 2.7, we discuss the findings of our literature reviews and address the research key issues. The research framework is presented at the end of the chapter.

## 2.2. Dynamic Business Networks

Collaboration has been defined by many authors. Scariot et al. (2012) define collaboration “as the ability to gather active contribution from several actors during a creative process”.

Wood and Gray (1991) derive a number of definitions of collaboration from different papers.

According to Wood and Gray (1991) collaboration can be characterised as a process of decision making for a defined problem or key issue. This process is a joint activity between groups of people who are defined as the stakeholders.

One advantage of collaboration is bringing people of multidiscipline together for making decisions and finding proper solutions. In collaboration people share their knowledge and experience. The value of business outcomes are positively affected by the knowledge and experience shared through people in collaboration (Elliott, 2011).

Businesses and organisations in the era of globalisation become more dependent on each other. This is interpreted into collaboration where exchange of knowledge is a key factor to participate and collaborate. Business collaboration is an interaction between individuals and groups either within the business itself or between businesses. This interaction happens through what is called the business networks (Qureshi, 2006).

Business networks are a way of performing collaboration between businesses. Participants in business networks create and share knowledge for innovative outcomes and competitive advantages.

A study has been done by Hasgall (2012) to understand how business networks are effective in supporting organisations to adapt and respond to changes in their environments. The study findings show that business networks support employees by providing them with knowledge. This knowledge can be integrated into the firm and can increase the sensitivity of the workers to the environmental changes, according to Hasgall (2012).

Business networks support the organisation to access new resources, new technologies and new markets. (Chatti, 2012). Interactions within these networks should be supported in these environments as stated by Fischer and Ostwald (2001).

Networking between businesses is referred as alliance networking according to Chen and Chen (2002), Sroka and Hittmar (2013), Reza et al. (2016), Pitt et al. (2006) and Tallman and Chacar (2011).

Alliance networking is the way where businesses join together to learn from each other. This develops the knowledge domain as they access knowledge sources not available within the owned business itself. Alliance in terms of business collaboration is where two or more businesses come together to share benefits and outcomes based on their business goals. As a result this leads to enhance the competitive advantage of the business. Also, it results in reaching new valuable knowledge through the participated businesses (Chen and Chen, 2002). These networks are dynamic in nature as the number of participants varies with time which results in change of the network size. The size of alliance network varies depending on the goals and outcomes aimed for. In some cases these goals are achieved

more easily by involving a large number of businesses. In other cases the situation is quite the opposite where goals can be achieved better by a small number of businesses (Sroka and Hittmar, 2013).

An example of business networks is presented in Ali et al. (2014) shown in Figure 2.4. The scenario shows a number of business units and interactions between them. It shows how knowledge flow takes place between departments A and B and the outsourcing department C. These units collaborate to create a new design. Roles in this model are shown as black dots and responsibilities are assigned to some roles to act as boundary roles in the collaboration. For example, design leader and contract facilitator are boundary roles. These boundary roles identify both the knowledge that they must provide in the collaboration and the knowledge that they need to carry out the responsibilities of their business unit.

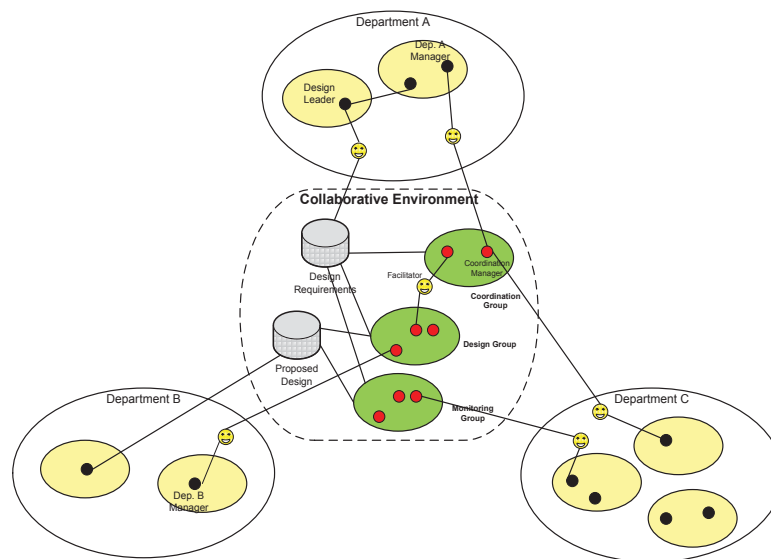


Figure 2.4: Business networks and interaction between them

These departments need to be facilitated to manage their collaborative environment in the context of knowledge creating and sharing. This support can be by providing the business with a set of tools to create such environment and process the knowledge among the participants in flexible way. Also, these tools allow the business to modify the collaborative environment when required.

The other scenario is shown in Figure 2.5 where three businesses come together to collaborate. The two businesses A and B establish collaboration team where negotiation and knowledge sharing take place. Collaboration team interacts through a collaboration activity. When a number of businesses, especially if they are competitive, join the same collaboration activity, privacy becomes an issue. In this scenario the knowledge shared between the two businesses (A and B) is not to be accessed by anyone. There should be a privacy policy between the businesses to build the trust in order to achieve the business goals at the end.

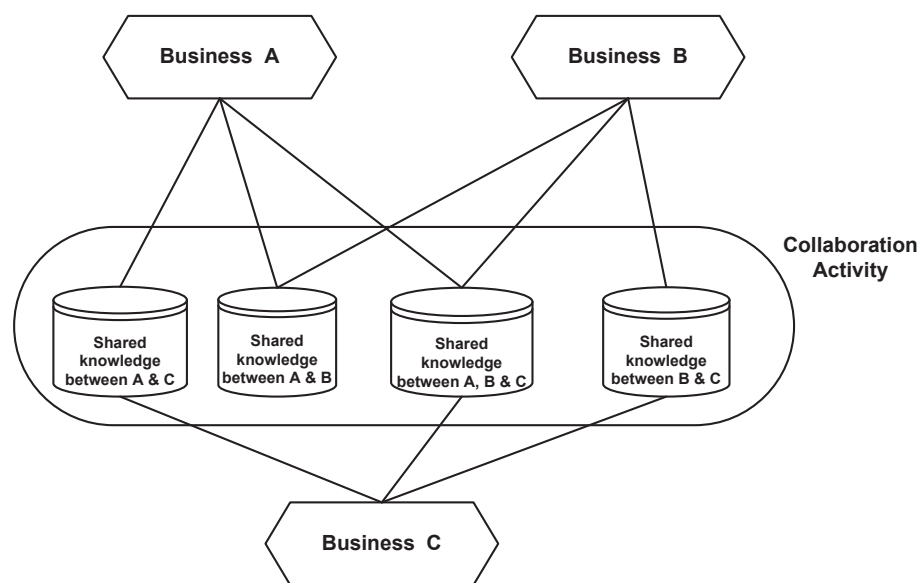


Figure 2.5: Businesses Collaboration Scenario

The situation becomes more complicated when the business C joins the collaboration activity. Suppose, for example, business B does not agree that business C accesses specific knowledge mainly that is created by B itself. The privacy policies and rules should be defined to manage such cases when multiple businesses join the same collaboration activity.

According to the scenario illustrated, knowledge created through the collaboration activity can be categorised as following:

1. Knowledge shared between the three businesses.
2. Knowledge shared between businesses A and B only.
3. Knowledge shared between businesses B and C only.

4. Knowledge shared between businesses A and C only.

Such issue is considered crucial in our research when thinking to develop models for supporting the collaboration process. That of course encourages businesses to collaborate when such issue is taken in consideration.

CoDesign is a process where businesses collaborate, create and share knowledge to develop a new product, service or business process. Performing the CoDesign process depends on multidisciplinary participation. This means, different individuals and groups such as experts, professionals, customers and users may contribute in the design process.

Knowledge sharing through these networks is a predominantly socio-technical issue. This kind of issue needs to be supported by mechanisms and technology instead of being replaced, as that the case when designing information systems (Ali et al., 2014).

Consequently a flexible approach is needed where knowledge flows and responsibilities can be easily changed without the need to reprogram systems.

### **2.2.1. Business Networks and Self-Organising**

One advantage of business networks is to support businesses responding to the changes and emergences as by the study of Hasgall (2012). This feature is called self-organisation where the business can re-organise itself according to the changes which emerge in the environment where it operates. We refer to work such as that by Bar-Yam (1997) who states that the only way for businesses to manage the complexity is to be complex themselves. Businesses must adapt to change and should be self-organised to satisfy the requirements of complex adaptive systems. Self-organisation is the property of complex adaptive systems where the system re-organises its structure and behavior due to the nonlinearity and changes of its environment (Stewart, 2007).

Zhongwei and Bingsheng (2009) state that the organisation with high knowledge management adaptability can quickly respond to the changes of the environment.

In the context of innovation these business networks are referred to by Wang (2012) as innovation networks. Due to Wang (2012) innovation networks are the way for businesses and firms to collaborate to achieve their common innovation goals. These networks are formed to create and share knowledge and they are self-organised as reported by Wang (2012).

In our research we are not addressing the complexity phenomena of business environments. However, we address the self-organisation as a feature of the complex business environment. We see this feature should be supported and gained by businesses these days as they operate in complex changing environments.

In complex environments knowledge requirements are open and affected by the changes that happen in the environment. For example, the organisation could be affected by changes in any other organisation within the environment. Such changes often lead to new information arising and a quick response in processing this information. In such environments information flow is not controlled and predictable but requires continuous adaption to process emerging information flows. As a result, ways are needed to support business networks to manage changing knowledge flows within complex environments (Ali et al., 2014).

Such change can be managed by developing new software business processes as each change emerges. The other alternative is to develop services that can be used by network stakeholders themselves to change the knowledge processing arrangements. The question then becomes what are the needed services.

In our research we aim to develop a model that supports businesses to re-organise their business models and networks to adapt to changes and innovation requirements quickly. These networks are created either within the business itself or between multiple businesses. As a result, privacy is to be considered and maintained to control who can access what while these networks collaborate. The aim is to provide businesses with a generic model to manage this type of network in terms of self-organisation and taking privacy in mind. This kind of support (Ali et al., 2014) should flexibly provide business networks with the ability to quickly share and analyse knowledge to address emerging business needs in their environment.

### **2.2.2. Features of Dynamic Business Networks (DANs)**

Increasingly business networks are dynamic and continuously change over time. Thus we refer to them in this research as Dynamic Alliance Networks (DANs). The main goal of this research is to develop a model to support DANs for managing CoDesign. These DANs change in their sizes and structures. Collaborative teams in DANs must be modified as a

DAN changes. In this research we investigate these networks to develop a model to show how CoDesign changes as a DAN changes. In Chapter 4 we present our investigation of more literature to identify the various DAN types based on their practical features. Also, in Chapter 4, we present our conceptual framework for simplifying the categories of DAN types based on the concepts of conceptual framework. Then in Chapter 5 we define our research model, CoDAN, to support these different DAN categories based on their conceptual features.

## 2.3. Knowledge and Knowledge Management

As mentioned previously, business networks in their collaboration activities rely on creating and sharing the knowledge. In this section we present knowledge and knowledge management concepts and principles.

### 2.3.1. Knowledge and Knowledge Types

Knowledge has been defined by many literature and researchers. Because knowledge is an intangible object there are different definitions stated by different researchers and intellectuals.

Jasimuddin (2012) derives different definitions of knowledge according to different literatures and authors. By summarising these definitions knowledge can be characterised as a driving tool for supporting decision making and creating solutions for businesses. Knowledge is created and shared through interaction between professionals, individuals and teams.

Knowledge is a human action produced by thinking through a community of individuals and groups. The knowledge is considered as aggregate where the new knowledge is produced based on the previously created and shared knowledge (McDermott, 1999).

Becerra-Fernandez and Sabherwal (2010) present three classifications of knowledge. First, the knowledge is classified as procedural or declarative. Second, the knowledge is considered as tacit or explicit. Third, knowledge is considered as general or specific.



The common classification of knowledge is that of tacit and explicit. The majority of the related research and literature rely on this classification. This classification has been defined by Nonaka and Takeuchi (1995) in their SECI (Socialisation, Externalisation, Combination and Internalisation) model.

**Explicit knowledge** refers to the knowledge that is expressed in words. This knowledge can be found and stored in different format such as printed manuals, audio and video. Example of this kind of knowledge is the catalogue of stock analysis used by investors to decide their stock sales and purchases (Becerra-Fernandez and Sabherwal, 2010).

**Tacit knowledge** is more likely personal and resides in people's brains. It is based on the person's experience and skills. Example of that is the knowledge of a marketing manager that supports the investor to make a decision based on his experience about the market trends and changes rather than depending on the catalogue itself (Becerra-Fernandez and Sabherwal, 2010).

Tacit and explicit knowledge types are transferrable to each other. Figure 2.6 simply shows this process. When a person reads a book, for example, he transfers the explicit knowledge (in the book) into his/her brain as a tacit type. The opposite is when he/she writes what is in his/her mind into the paper (explicit to tacit).

Tacit knowledge is transferred and shared between people through socialisation according to the SECI model (Nonaka and Takeuchi, 1995). This can be expressed as social interaction between individuals.

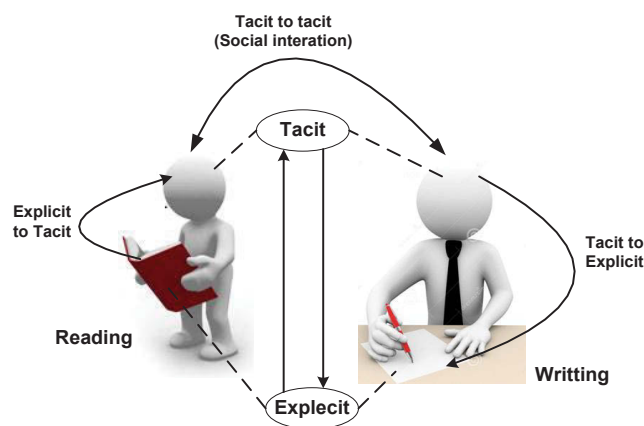


Figure 2.6: Transferring between tacit and explicit knowledge

Referring to Becerra-Fernandez and Sabherwal (2010) knowledge can be classified as procedural or declarative. *Procedural knowledge* is referred to as “know how”. It is considered as the steps and actions towards achieving a specific outcome. *Declarative knowledge* can be referred to as “know what”. It is more about knowing the definitions and facts and describing the relationships between things and variables.

Authors also consider knowledge as general or specific. *General knowledge* can be easily transferred among a large number of people. *Specific knowledge* is only transferred among a limited number of people.

Usually the specific knowledge is private for the business or organisation. Models developed to support collaboration between businesses should provide mechanisms to control transferring this kind of knowledge. Only authorised people can access this type of knowledge.

The above defined types of knowledge can be combined together as stated by Becerra-Fernandez and Sabherwal (2010). Tacit or explicit knowledge can be declarative or procedural and general or specific according to Becerra-Fernandez and Sabherwal (2010).

### **2.3.2. Knowledge Management (KM)**

Knowledge management (KM) also is defined in different ways. The different definitions of KM have been reported by Jasimuddin (2012). Jasimuddin (2012) has investigated 36 literatures in order to define KM. He reports that there is a difficulty of coming up with a concrete definition for KM because of many reasons. One of these is that the study field of KM is newly emerged. The other reason is the multidisciplinary nature of KM definitions. Each author defines KM from a different discipline and industry according to Jasimuddin (2012).

Despite what is argued by Jasimuddin (2012) regarding KM definitions, KM is considered as a collective of processes and activities for organising the knowledge creation and sharing. These processes and activities are applied to the knowledge with both of its kinds, tacit and explicit. These processes are socially oriented as they are performed through interaction among expertise, employees, individuals and groups. These processes include

discovering, creating, acquiring, capturing, sharing and re-using of the knowledge ((Kaner and Karni, 2004), (Small and Sage, 2006), (Kumar and Thondikulam, 2006), (Riera et al., 2009), (Yeşil and Hırlak, 2013), (Muniz Jr et al., 2010), (Anirban et al., 2011), (Lewrick et al., 2010), (Kannabiran, 2009), (Oluikpe et al., 2010), (Amo, 2006), (Birkinshaw, 2001), (Rechberg and Syed, 2013), (Cardoso et al., 2012) and (Dakilir, 2011a)).

### 2.3.3. Knowledge Management Processes

According to the Nonaka's SECI model (Chatti, 2012), knowledge is transferred through four mechanisms which are:

1. Socialisation: transferring tacit to tacit.
2. Externalisation: transferring tacit to explicit.
3. Combination: transferring explicit to explicit.
4. Internalisation: transferring explicit to tacit.

These mechanisms are implemented through what are called KM processes which have been presented by extensive literature such as Fernandez and Sabherwal (2010b), Awad and Ghaziri (2004) and Dakilir (2011b). Based on these literature the main KM processes as shown in Figure 2.7 include:

- **Discovering:** The process of finding where the knowledge resides.
- **Gathering:** knowledge gathering is alternatively used to explain the knowledge capturing. Fernandez and Sabherwal (2010b) define capturing as the process of obtaining knowledge from the tacit (individuals) and explicit (such as manuals) sources.
- **Filtering:** It is the process of minimising the knowledge gathered by rejecting the redundancy. That can be done by individuals or by utilising software applications (Dakilir, 2011b).
- **Organising:** The process of re-arranging and composing the knowledge so that it can be easily retrieved and used to take decisions (Awad and Ghaziri, 2004).
- **Sharing:** It is the way of transferring knowledge between individuals and groups (Awad and Ghaziri, 2004). Fernandez and Sabherwal (2010b) define knowledge

sharing as “the process through which explicit or tacit knowledge is communicated to other individuals”.



Figure 2.7: Knowledge Management Processes

In CoDesign people from businesses in DAN join teams to share their knowledge for developing new products or services. Accordingly, CoDesign process is based on tacit knowledge in major. Mechanisms, due to SECI model, that are emphasised in CoDesign are socialisation (transferring tacit to tacit) and externalisation (transferring tacit to explicit). That means participants communicate to share the knowledge among themselves. Also, they record this knowledge in different formats such as computer files, sketches, audio and video for transfer and share.

Knowledge management processes are involved in CoDesign. While performing CoDesign process, individuals within teams discover, capture, filter and share knowledge.

In our research we see supporting KM processes of managing both types of knowledge in CoDesign is required. That can be achieved by providing collaborative teams with tools to facilitate sharing their ideas, skills and experiences in a flexible way. Accordingly, KM processes are considered when we develop our research model, CoDAN.

## 2.4. CoDesign and Knowledge Management

In this section we present CoDesign in relation to knowledge management and knowledge management processes. First we investigate and explain CoDesign concepts and principles. Then we present CoDesign as a process that involves knowledge management processes.

### 2.4.1. CoDesign Overview

Design has been developed from just dealing with products to include designing services and processes. Design becomes involved with the users and consumers by understanding their requirements, needs and behaviors. Design became a collaborative oriented process

(Mahmoud-Jouini et al., 2016). By involving individuals and groups including users and consumers, design has gained the new title “CoDesign”.

The word CoDesign is an abbreviation that refers to “Collaborative Design” which linguistically means “to design jointly” according to Collins Dictionary (2018b).

CoDesign has been defined through many literatures where there is a contrast between these definitions. This contrast is due to the context of the literature and the research discipline and industry.

Du et al. (2012) define CoDesign as “the process in which participants from different disciplines share their knowledge about both the design process and design content”. Kankainen (2012) derives a more comprehensive definition for CoDesign by involving customers and users in the design process. Kankainen (2012) states that CoDesign “refers to an activity in which potential users are empowered to bring their ideas into the design of new solutions”.

Participants in CoDesign play different roles from active participants to those who are facilitators, supporters and coordinators. Tools and services to support CoDesign depend on these roles and responsibilities (Kankainen, 2012).

By the beginning of the twenty first century the social and economic challenges became more and more complex. Businesses, by the beginning of the last decade, started to innovate by involving users, consumers and stakeholders in the design process and that is the CoDesign process by definition (Hillgren et al., 2011).

In CoDesign process individuals of different generations can be included as presented by Xie et al. (2012). Xie et al. (2012) present different scenarios in their study where children and adult groups participate in the CoDesign process.

Tian et al. (2007) highlights key advantages of CoDesign. One of these is performing distributed design process where participants can establish discussions, participate in checking and modifications and resolve conflicts. That results in a short innovation life cycle and low development costs. CoDesign in modern industry and production firms (Li et al., 2004) brings multidisciplinary individuals and groups together to perform complex design activities through communication and collaboration.

In fact businesses in DANs perform CoDesign process. Businesses join DANs to contribute in designing and developing products and services, as explained in Chapter 4 later. Teams are created within DAN to carry out variety of CoDesign processes.

According to the overview presented we can summarise the following in relation to CoDesign:

1. CoDesign is a multidisciplinary process for innovation and creativity.
2. Stakeholders including professionals, users and consumers can be involved in CoDesign process.
3. Performing CoDesign results in a short innovation development cycle and low cost.
4. CoDesign is performed among businesses in DANs.

In our research we see supporting CoDesign through technology is crucial. This support should consider CoDesign by its new definitions and characteristics. Supporting CoDesign process by technology should be considered through three aspects.

- First, supporting CoDesign in dynamic business networks (DANs) should be facilitated as businesses start to perform CoDesign through these kinds of networks.
- Second, supporting participants and stakeholders for CoDesign in terms of coordinating and managing their networks and teams.
- Third, providing the participants of CoDesign with creativity tools to manage the knowledge they create and share. The different levels of skills and professionalism among the participants and stakeholders should be considered in implementing such CoDesign supporting systems.
- Fourth, as the creativity environment is joined by different businesses and stakeholders, here, privacy should be maintained. There should be a kind of control for who can access and do what.

### **2.4.2. Participatory Design**

As mentioned previously that consumers and users can participate in the design process. Accordingly, CoDesign is referred to as participatory design according to many literatures.

Scariot et al. (2012) mentions three types of consumer involvement in CoDesign as they have been developed over time:

- **First**, *design for customer* where this kind of design is based on the data and theories related to the customer's behaviour.
- **Second**, *design with customers* which is based on the needs and preferences of the customer when testing different options of solutions by the customer.
- **Third**, *design by customers* where the customer is practically involved and takes a part in the design and development.

*Participatory design* refers to the third type, *design by customer*, mentioned by Scariot et al. (2012). In practice the collaborative design is affected by social changes (Scariot et al., 2012) which leads to the inclusion of the end-users in the design process. This approach is also referred to as *user-centred design*.

Customer participation in CoDesign (Heidenreich and Handrich, 2015) has been considered widely by academics, designers and professionals involved in the design process.

Leavy (2012) considers participatory design as one of competitive advantages if it is well adopted and supported by the organisation or business. By involving users and consumers in design process (Steen, 2013) users and customers are considered as designers rather than just users of the service or product where the usability tests take place.

Although users and consumers are not expert designers they can be effective actors in the CoDesign process. They can participate by sharing their ideas and solutions rather than being just end users and consumers (Manzini and Rizzo, 2011).

Gebauer et al. (2013) refer to this kind of participation by what is called "innovation communities". These communities play a role in CoDesign by sharing the ideas and concepts and end with designing prototypes for evaluation and testing. Gebauer et al. (2013) categorise these communities as "business-to-consumer" and "business-to-business". Gebauer et al. (2013) in their study consider the "online communities" as an approach to enhance the relationship and social interaction between the participants.

Systems and models which support CoDesign should consider consumers and users as they take on a key role in CoDesign. These systems should be easy to learn and utilise to support such type of individuals and to encourage them to participate in CoDesign by utilising these systems. Maintaining privacy in these systems should be considered as well. Consumers and users of service or product are considered as external beneficiaries. When the business utilises such systems and joins these external users the access must be

controlled. Although users and consumers are considered as stakeholders in the CoDesign process, their access to knowledge should be controlled. Knowledge accessed and functions performed should be decided based on the person's role in the creativity environment.

### **2.4.3. CoDesign and the Final Deliverables**

The final deliverables of CoDesign can be products, services or new processes. Products are tangible items and are mainly produced by manufacturers. Services are intangible benefits and can be either produced by private businesses or government organisations.

There is a lack of literature which deal with CoDesign in developing services compared to those which deal with products design.

Hillgren et al. (2011) mention what is called "social design". They refer to social design according to The Young Foundation as "new ideas (products, services and models) that simultaneously meet social needs and create new social relationships or collaboration. In other words, they are innovations that are both good for society and enhance society's capacity to act". Design is socially useful when it is derived due to social changes and needs (Thorpe and Gamman, 2011).

Although social innovation is not a new idea (Hillgren et al., 2011) it has started to attract attention in the governments in many countries. Many government foundations and organisations have been established for social innovation. Examples of that are: the Office of Social Innovation and Civic Participation in USA and the British Design Council in Britain. These foundations have been established to respond to social challenges and needs by providing collaborative projects.

Also, many Australian government organisations and authorities have started to involve CoDesign into their business processes. Examples of these are the Department of Human Services (Bridge, 2012) and the Australian Taxation Office (ATO, 2013).

Social services are usually created due to social issues and problems. Wicked problems according to Rylander (2009) and Buchanan (1992) are described as those problems with no precise solutions, their solutions are either better or worse. The way to reach these solutions is iterative.



New business innovation models should be implemented to support the design of such solutions and services. That provides new vision to the CoDesign process. Dedicated and special purpose systems cannot support CoDesign for creating social solutions and services. Designing and creating the services and business processes in addition to the products encourages finding new innovative ways of implementing models and systems to support CoDesign.

Due to the social dimension of CoDesign, businesses and organisations need to interact with the different communities and groups in the society. These communities and groups present the target audience of the services to be designed and implemented. Accordingly, models supporting CoDesign should consider these groups and dimensions. These models should have features such as availability, accessibility and usability so the different society groups can be involved in CoDesign process. Also, privacy policies and rules should be maintained in a way to manage access control. That provides safety and security to businesses when these groups join design environments created by utilising these systems.

#### **2.4.4. CoDesign and Types of Knowledge**

We have previously defined the classifications of knowledge. According to these classifications, knowledge can be tacit or explicit, declarative or procedural and general or specific.

CoDesign as a knowledge intensive process includes all these classifications of knowledge. However, tacit knowledge presents the major type in CoDesign process. That is because CoDesign relies on people networking and team interaction. People in these teams and networks share their ideas and experience. Also, CoDesign includes both declarative and procedural knowledge. Declarative knowledge is the main form when declaring and defining problems, issues and solutions. Procedural knowledge is the main form when designing and implementing solutions. Knowledge in CoDesign can be general or specific depending on the type of people participating in CoDesign. Specific knowledge is more related to professionals and consultants while the general knowledge is more related to consumers and users.

According to literature, models and systems which support CoDesign and knowledge management are explicit oriented. There is limitation in supporting tacit knowledge. Also, these systems are specific oriented. Only professional people with specific knowledge use these systems. These systems are not available for people with general knowledge to utilise. Systems supporting CoDesign are investigated later in this chapter.

The specific knowledge is considered more private than the general one. Accordingly the sensitive and specific knowledge in design environment should be access controlled.

In developing our research model we see both types of knowledge, tacit and explicit, should be supported. Tacit knowledge presents 90% of knowledge as stated by Wah (2000). Tacit knowledge should be converted to explicit to be organised and transferred. Technology should provide tools to support business networks and teams to exchange both types of knowledge.

#### **2.4.5. CoDesign and Knowledge Management Processes**

Individuals and teams which participate in CoDesign create and share knowledge. CoDesign is a knowledge discovery, creation and sharing process. Participants in CoDesign process play the role of sharing and exchanging their experiences, skills and ideas to reach a proper problem solution ((Kankainen, 2012) and (Wang et al., 2009)). Knowledge creating and sharing is one of the key features of CoDesign process. By knowledge sharing people learn and exchange knowledge to define solutions to achieve the goal (Steen, 2013). Design team accepts or rejects this knowledge after frequent communications and interactions (Du et al., 2012).

That means knowledge management processes are involved in CoDesign process. These processes have been mentioned previously and include knowledge discovery, creation and capturing, filtering and sharing. In CoDesign, knowledge passes through these processes as following:

- Participants discover knowledge from different sources.
- Participants create and capture knowledge.
- This knowledge is filtered such as in the case of selecting potential ideas or solution options.

- Participants share the knowledge in CoDesign process by different methods of knowledge transfer.

Models and systems which support CoDesign should consider the knowledge management processes. Processes such as knowledge creating, filtering and sharing need to be facilitated. That is of course to be done while keeping privacy maintenance in mind. As per literature related to knowledge management there are varieties of systems that support knowledge management processes. The question here is, are these systems adequate to support CoDesign.

To address this question we investigate the systems supporting CoDesign in the next section.

## 2.5. Systems Support CoDesign

In this section we investigate systems supporting CoDesign. We investigate these systems based on two types, those dedicated for CoDesign and those implemented for knowledge management supporting. We investigate knowledge management systems in supporting CoDesign based on the fact that CoDesign is a knowledge management intensive process as mentioned earlier. Before we present the two types of systems we start with an overview of technology and its role in supporting CoDesign.

### 2.5.1. Supporting CoDesign through Technology

Technology tools are replacing the face-to-face approaches in collaboration. This has resulted in what is called virtual enterprises, virtual organisations, virtual teams (Germani et al., 2012) and virtual co-creation environments (Harwood and Garry, 2010). Virtual teams defined by Dulebohn and Hoch (2017) as “work arrangements where team members are geographically dispersed, have limited face-to-face contact, and work interdependently through the use of electronic communication media to achieve common goals”

Yoshimura (2012) reports that the issue of the poor performance in collaboration is due to the lack and shortage of the systems that support collaboration process.

Design process is considered as a knowledge-intensive process. Accordingly, technology takes on a key role in supporting the design process which provides the businesses with a competitive advantage in designing and creating products (Zha and Du, 2006a).

Zha and Du (2006a) mention the reasons for why they choose internet technology for their systems. These reasons are: 1) The internet browser advantages. 2) The hypertext transfer protocol (HTTP) advantages. 3) The diversity advantage as using different hardware and software resources. The role played by internet technology (Andreadis, 2015) is bringing teams and individuals together for interaction.

Andreadis (2015) presents his framework for collaboration through social media. The paper considers social media is an effective platform for interaction between individuals and teams to share knowledge and co-create products. Andreadis (2015) suggests that businesses today should consider advantages of Internet and social media and implement them to strengthen their competitiveness by including individuals and other communities such as consumers and users in CoDesign.

Social media in practice brings together those stakeholders that have never met or cannot meet for interaction and to share in the CoDesign process (Vallaster and von Wallpach, 2013).

By developing of Internet and communication technology virtual teams (Pinjani and Palvia, 2013) and virtual prototyping have emerged. Pinjani and Palvia (2013) define virtual teams as the groups formed by their firms for decision making; these groups utilise technology for communication and are separated by geographic distances and different time zones. Virtual prototyping is referred to by Wang and Zhang (2010) where individuals and teams share the engineering designs for development. Virtual prototyping is supported by computer aided engineering applications through the Internet.

Virtuality has emerged and developed to make it easier and more effective for teams to participate in the design process. One advantage of virtuality is to facilitate the communication and interaction between geographically dispersed participants in CoDesign.

Wang et al. (2009) report that most design software and applications are individual and standalone based applications. Applications which support collaboration are needed as design becomes collaboratively oriented. Wang et al. (2009) mention three categories of systems that support collaborative design. They are the web-based systems, client-server based systems and agent-based systems.

When designing systems that support CoDesign the proper technology and infrastructure should be well selected and adopted. Technology is seen as an important enabler that provides new capabilities and facilities to those performing the CoDesign process.

As we mentioned earlier, virtual teams are emerging due to utilising and adopting technology and Internet in collaboration activities.

Virtual collaboration (Kan et al., 2001) has been developed to overcome the limits of traditional collaboration due to geographical barriers.

Members of the team need to operate quickly therefore technology becomes an important factor to enable and support these teams to exchange information and knowledge in effective ways to improve productivity. Trust and conflict are issues in virtual teams. Accordingly, the effective technology can support building trust between distant individuals and can reduce conflict (Pinjani and Palvia, 2013). The ability to develop two-way communication and information systems is considered as a central factor for successful CoDesign as stated by Leavy (2012).

This research does not focus on virtual teams. However, in this research the technology is considered as a main enabler for the research model. The research model provides an advantage to these virtual teams and organisations by providing them with tools when they perform the CoDesign process. Also, stakeholders including consumers, customers and users can be involved in CoDesign process regardless of their locations as well. That indeed leads to effective collaboration outcomes by involving an unlimited number of individuals. People can quickly share ideas and contributions in CoDesign. By choosing the proper technology tools collaborative teams contribute effectively in CoDesign and achieve business goals.

### **2.5.2. Dedicated CoDesign Supporting Systems**

Literatures have been explored to investigate systems that support CoDesign. It is found that most research and papers present systems and models that support engineering products. There is a lack of research in implementing systems and models that support CoDesign with its new dimensions as explained previously.

Table 2.1 below presents the systems and models presented in different literature and the features of each.

Table 2.1: CoDesign Supporting Systems in the previous Research

No.	Publication	Work/Research	Features/Remarks
1.	(Andreadis et al., 2015)	Implementing an architecture to support manufacturing design	<ul style="list-style-type: none"> <li>- Web-based.</li> <li>- Engineering design support</li> <li>- Using cloud computing as infrastructure.</li> <li>- Transferring CAD services to cloud.</li> </ul>
2.	(Andreadis, 2015)	Proposing a framework by combining social media and live streaming for collaborative manufacturing	<ul style="list-style-type: none"> <li>- Web-based.</li> <li>- Engineering design support</li> <li>- This approach is to support both consumers and technicians in CoDesign.</li> <li>- It depends on CAD for the design process.</li> </ul>
3.	(Chiang et al., 2006)	The paper presents general integrated framework in presenting design knowledge.	<ul style="list-style-type: none"> <li>- Web-based.</li> <li>- Engineering design support</li> <li>- CAD technology.</li> </ul>
4.	(Zha and Du, 2006a, Zha and Du, 2006b)	Implementing web-based knowledge intensive collaborative design (WebKIDSS)	<ul style="list-style-type: none"> <li>- Web-based.</li> <li>- Engineering design support</li> </ul>
5.	(Germani et al., 2012)	Illustrating a platform to support CoDesign within dynamic design processes.	<ul style="list-style-type: none"> <li>- Engineering design support</li> <li>- The system supports engineering/mechanical products.</li> <li>- It depends on CAD as information source</li> </ul>
6.	(William Xu and Liu, 2003)	Proposing web-based product data management (PDM) for CoDesign.	<ul style="list-style-type: none"> <li>- Web-based.</li> <li>- Engineering design support</li> <li>- Allowing users to access the related product information and data.</li> </ul>
7.	(Liang, 2010)	Developing agent-based model to support design knowledge producing and sharing	<ul style="list-style-type: none"> <li>- Agent-based.</li> <li>- Engineering design support</li> <li>- Sharing design knowledge among designers</li> </ul>
8.	(Kan et al., 2001)	Implementing virtual reality CoDesign environment	<ul style="list-style-type: none"> <li>- Web-based.</li> <li>- Engineering design support</li> <li>- Supporting small and medium size industries.</li> <li>- Addressing the issue of long design process.</li> </ul>
9.	(Wang and Zhang, 2010)	Implementing a system to allow designers and experts to create and run design simulations	<ul style="list-style-type: none"> <li>- Web-based.</li> <li>- Engineering design support</li> </ul>

10.	(Wang et al., 2009)	Framework for representation of knowledge produced in knowledge design process	<ul style="list-style-type: none"> <li>- Agent-based.</li> <li>- Engineering design support</li> </ul>
11.	(Tian et al., 2007)	CoDesign Space	<ul style="list-style-type: none"> <li>- Net-based system to support collaborative design.</li> <li>- The system supports engineering/mechanical products.</li> <li>- It depends on CAD as information source</li> </ul>

Table 2.1 shows different models and systems according to the literature explored. The common features of these systems and models are:

1. Utilising the World Wide Web technology as infrastructure of implementation.
2. These systems and models focus on CoDesign of engineering products.
3. These systems usually are integrated to the Computer Aided Design (CAD) applications.

Papers and research developed in relation to CoDesign supporting systems are considered as one step towards supporting CoDesign. One of the advantages of these systems is utilising WWW as the infrastructure to implement such systems. Also, these systems are integrated to CAD applications. That allows benefiting from the capabilities of CAD systems as well as the knowledge existing in CAD systems.

However, there are concerns and limitations in supporting CoDesign through these systems with its new dimensions and features. Limitations of these systems can be listed as following:

1. Lack of supporting CoDesign in DANs. These systems do not support CoDesign between businesses. Supporting collaboration between businesses becomes necessary in today's economy and market, especially when taking into consideration the emergence of dynamic business networks.
2. Non-expert users such as the normal users, consumers and society members cannot use and operate these systems. These systems are implemented to be utilised by

experts and professional. According to literature users and consumers are strongly considered in CoDesign process these days.

3. Most of these systems are based on CAD applications which are considered expensive packages. That makes it hard to be adopted by small and medium businesses, and makes it hard to be utilised by un-professional people as well.
4. Upgrading these systems requires high costs. In the turbulent and changed markets these days business requirements are changing quickly. A new innovative way is needed where tools and services can be added as required without re-developing the whole system
5. As these applications are dedicated for engineering design, they cannot be used for other aspects of CoDesign such as the social services and solutions that are wicked problem related.
6. There is no clear explanation in papers which present these systems in relation to addressing privacy issue. These systems are implemented on WWW and shared by different users regardless of their locations. Privacy should be addressed and maintained, as WWW technology is a shared environment, to control accessing the resources and information.

Because of such limitations it can be concluded that these systems are not adequate to support CoDesign with its new features. Businesses and enterprises should adopt new innovative ways in supporting CoDesign. These ways should consider the shortcomings of the implemented systems and the emerging requirements of CoDesign. In our research we overcome these issues by developing a generic model to support CoDesign in Dynamic Alliance Networks (DANs). The model either can be utilised for design products or services. Tools in the model should be easily utilised by different people of different levels of skills and experience. That allows professional and non-professional people to participate in CoDesign. The model tools can be implemented as web-services so the model can be adopted by different businesses of different sizes according to their budget. New tools and services can be added when required without changing the whole system.



### 2.5.3. Knowledge Management Systems and CoDesign Support

Fernandez and Sabherwal (2010a) describe the knowledge management systems as “the integration of technologies and methods that are developed to support the KM processes”. Fernandez and Sabherwal (2010a) have classified KM systems into four categories:

- **Knowledge Discovery Systems:** these systems help to develop new tacit and explicit knowledge through information and data or from previously created knowledge.
- **Knowledge Capturing Systems:** knowledge capturing systems facilitate the process of retrieving the knowledge either from tacit or explicit sources.
- **Knowledge Sharing Systems:** these systems facilitate exchanging and transferring knowledge between individuals and groups.
- **Knowledge Application Systems:** these systems facilitate the utilisation of knowledge created.

Fernandez and Sabherwal (2010a) have mentioned the limitations and shortcomings of these systems as following:

1. These systems are considered as task-specific and dedicated KM systems.
2. These systems usually are not integrated with the firm’s enterprise systems.
3. Scalability issue, where continuous growth of the system’s case library may result in decrease of its speed.
4. These systems are complicated and not easy to implement.

Many papers have been explored to investigate the KM systems and technology as a supporting driver for KM. These papers include Wong (2005), Moffett et al. (2003), Luo and Lee (2013), Alazmi and Zairi (2003), Davenport et al.(1998) and Rasmussen and Nielsen (2011).

Moffett, McAdam and Parkinson (2003) develop their study about the factors for successful KM based on their model “MeCTIP”. 1000 British companies, including small-medium and large companies have been included in this study. One of the findings due to this study is that most of firms see KM as a factor to support and raise the market share. Also, technology is considered as a main component to support KM processes in the firm.

Another study by Alazmi and Zairi (2003) concludes that technology infrastructure is considered as a factor for successful KM.

Wong (2005) made his study based on the small-medium enterprises (SMEs) as most studies focus on large firms. That is because SMEs have different structures and conditions compared to large companies. The author states that pretty-implemented technology is one of the main factors that support the success of KM although some literatures consider it as a sub-factor. The author imputes the importance of IT as an enabler to KM due to IT capabilities of storage, fast search and retrieval of information and supporting the communication and collaboration between people. Applications with such features should be easy to operate, providing the needs, simple and related to knowledge structure. Regarding to KM processes, including knowledge creation and sharing, technology should provide tools of networking and interaction between individuals and groups.

Luo and Lee (2013) state that many researchers consider IT as an important KM driver. However, they overlook the social interaction factor according to Luo and Lee (2013).

Most of the enterprises with different sizes try to support their knowledge processes and activities by introducing technology. The technology here includes IT applications and infrastructure. However many authors and researchers consider Information and Communications Technology (ICT) is not adequate and enough to support KM because of its limitations. Also, KM systems are different from the known information systems.

The study by Nunes et al. (2006) show that ICT presence and implementation does not mean that knowledge is shared effectively throughout the firm. This argument has been made clear by Fischer and Ostwald (2001) who report that technology alone is not adequate to solve the issue of knowledge management.

According to different literatures explored, limitations of the technology and KM systems can be addressed as following:

1. ***Technology does not serve more than as a storage of information.*** This is because KM systems are designed with the same way of designing and implementing the information systems as mentioned by Currie and Maire (2004), Nunes et al. (2006) and Birkinshaw (2001). Currie and Maire (2004) state that “the Intranet, at best, would become of collective memory, rather than reshape the work organisation”.
2. ***Limitation to tacit knowledge type.*** IT systems operate as storages for explicit knowledge more than tacit type (Nunes et al., 2006). Nunes et al. (2006) relate to the

difficulty of gathering tacit knowledge. Birkinshaw (2001) refers to this limitation by considering information systems are mostly storing what is called “codified knowledge” which is explicit knowledge in nature. This type of knowledge is tapped when it is needed according to Birkinshaw (2001).

3. ***Overlooking the “social interaction” when introducing IT for KM:*** Social interaction is an important factor for creating and sharing knowledge among individuals and teams. Birkinshaw (2001) reports that IT is considered as a replacement of physical social interaction. Social interaction (Birkinshaw, 2001) is important for people to exchange information and knowledge. Most individuals prefer to contact their colleagues to seek help and advice rather than accessing databases and information repositories when they face problems and issues in the workplace.

Most of researches who present the critical success factors of KM did not consider the social factor as a major success factor. However, in their SECI model, Nonaka and Takeuchi (1995) have considered socialisation as the mechanism to transfer and share the tacit knowledge

McDermott (1999) in his study emphasises on the previous argument based on the knowledge definition itself. He reports that knowledge is different from information. As a result the KM systems cannot be designed and implemented based on information systems concepts.

Previously we mentioned that knowledge processes are inclusive in CoDesign process. The question is “can knowledge management systems be utilised to support CoDesign with its new features?”. In our opinion the answer is no for many reasons:

1. These systems are explicit oriented. CoDesign is more tacit oriented.
2. These systems overlook the social interaction support. CoDesign process is performed through social interaction.
3. Knowledge management systems usually are dedicated systems. Either they are dedicated to the knowledge management process or dedicated to the purpose and industry.
4. These systems are utilised by professional people only because of their dedication and complication.

A new way and approach should be developed to overcome those issues. In our research we aim to implement a model that considers the social interaction and support networks and teams in CoDesign process.

In the “Discussion” section, later in this chapter, we focus more on these key issues.

## 2.6. Privacy in CoDesign

CoDesign environment is considered as collaborative shared environment. Individuals and businesses join such environments and share knowledge. Controlling the access in CoDesign environment is crucial in this case. In fact, there is a lack of research relating to privacy in CoDesign. Maintaining privacy should be considered when implementing systems support knowledge sharing such as in the case of supporting CoDesign. Models supporting CoDesign should develop policies and rules to control accessing the knowledge and other objects in the creativity environment.

Due to the lack of research in relation to the privacy in CoDesign we investigate privacy through knowledge management literature. That provides a background in order to maintain privacy for CoDesign in our research model.

Privacy is considered as one of the human rights. Controlling of information owned by people is one type of privacy (Muniraman et al., 2007).

There is no specific definition for privacy. The definition of privacy is presented in the literature according to the discipline and the industry ranging from philosophy to information technology and information systems (Minkkinen, 2015). A range of literature deals with the customer information privacy and how it can be protected. Examples of these are Wang and Wu (2014), Conger et al. (2013) and Bansal et al. (2016). That is because of developing Internet and online transactions which encourage people to submit their personal information and details.

However, types of information that need to be protected as mentioned by Muniraman et al. (2007) include:

- **Personal identifiable information:** refers to the personal information used to identify people such as their names, addresses and birth dates.

- **Sensitive information:** any information which is considered as private. Example of that includes information about religion, race and surveillance camera videos and images.
- **Usage data:** the information about habits and devices used through the computer. That includes the information about habits and interests observed through the history of the Internet usage for example.

To explore privacy in context of knowledge management we refer to the paper by Dulipovici and Baskerville (2007). Authors report that knowledge is considered as a sort of objects and goods. That makes it subject to privacy laws and regulations. Dulipovici and Baskerville (2007) present questions in regard to the ownership of the knowledge. For example, is the shared knowledge owned by the recipient either an organisation or a person? Do we need to protect the knowledge by the ethics and laws of privacy? Authors in their study have mentioned many organisations that develop guidelines of building privacy legislations and regulations such as United Nations (UN) and the Council of Europe. They report that World Intellectual Property Organisation (WIPO) is the only organisation which deals with intellectual property rights in the world.

Dulipovici and Baskerville (2007) in their study conclude that which systems support knowledge creating, sharing and storing must support protecting this knowledge. Knowledge is a private property and owned by either an individual or organisation.

Organisational knowledge represents business secrets which should be highly protected from capturing by the other competitors. In this case the access control mechanisms should be implemented to provide this sort of protection (Bertino et al., 2006). These mechanisms are supposed to control the access to knowledge when sharing and transferring processes take place. Knowledge creator or owner specifies who should be permitted to access this knowledge ((Bertino et al., 2006) and (Muniraman et al., 2007)). Protecting knowledge is one of knowledge management success factors (Murray and Alexandra, 2014).

Access control procedures should be balanced, easy and user friendly. As mentioned by Muniraman et al. (2007) the system should not have much restrictions so users do not refuse to use the system. There should be a balance between privacy and accessibility. Knowledge is to be accessed only by authorised people who can access knowledge easily when they need it.

In the research we focus on maintaining privacy in CoDesign environment. The model we develop to support CoDesign in DANs should facilitate the privacy management for the people who utilise it. Who accesses what and perform what should be managed when teams and individuals are assigned to the creativity environment

Based on the literature reviewed there is a lack of research in relation to maintaining privacy even within knowledge management context. However, some authors try to open the doors of the topic and have developed some related research. Examples of that are the work done by Jennex and Zyngier (2007), Murray and Alexandra (2014) and Shuyuan Mary and Chingning (2009).

In fact, knowledge management systems support only the explicit knowledge. Tacit knowledge is overlooked when implementing knowledge management systems supposed to support collaboration processes such in CoDesign. Implementing security and privacy is treated the same way when implementing these systems. The focus of security and privacy is mainly on protecting and encrypting the stored information in these systems. In our research we see supporting tacit knowledge is important. When implementing systems which support collaboration between people and teams maintaining privacy should be treated in different way. These systems and models should provide tools to the people and businesses to have flexible options for accessing and sharing knowledge. Policies and rules must be implemented to control accessing knowledge expertise, and what knowledge is to be transferred and to whom.

In our research model we consider maintaining privacy as a main requirement to support CoDesign in DANs. Rules should be defined to support privacy aspects in CoDesign such as knowledge ownership, access authorisation and control. In Chapter 4, we present privacy as one of the concepts of our conceptual framework to identify the categories of DAN types. In Chapter 5, The Model Definition, we show our idea of privacy modeling to maintain privacy in the research model, CoDAN.

## 2.7. Creativity Tools

In this section we present the creativity tools based on Design Thinking related literature. The reason is because businesses perform CoDesign process become utilising Design Thinking tools in common. Design Thinking tools facilitate CoDesign with the new

features of CoDesign. The participatory feature of CoDesign encourages businesses to utilise Design Thinking tools. As reported previously, CoDesign process may involve different groups and audience from professionals to normal consumers and users, from older people and adults to kids. Design Thinking tools, as presented in this section, can be utilised by all these categories of people to perform CoDesign. The other aspect is the social aspect of CoDesign. CoDesign these days is employed to implement social services for society. These services in many cases are solutions due to the wicked problem. Design Thinking tools as referred by literatures is the most convenient approach to such problems.

### **2.7.1. Design Thinking Concepts and Features**

Design Thinking (DT) is increasingly becoming popular within businesses and organisations (Tschimmel, 2012). Its benefit has been shown through applying its procedures and strategies to enable creativity in design process.

Historically, Design Thinking started to take place as a clear discipline in the 1960s. However, there is no clear history for Design Thinking as each author looks to DT and its history from his/her discipline's point of view. These days Stanford University's d.school is one of the pioneer institutes where Design Thinking can be learned (MacFadyen, 2014).

Design Thinking nowadays is applied to a broader domain of challenges than previous design concerns which focus mainly on engineering products implementation. These domains include the human services and security and emergency plans (Leavy, 2012). Design Thinking becomes an effective tool to develop solutions for problems and issues that are characterised as complex, obscure and uncertain. Utilising Design Thinking tools and strategies closes the gaps between the different disciplines and creates a kind of diversity among different levels of skills and experiences. However, DT is becoming broadly known but not well understood and applied (Mootee, 2011).

Design Thinking is defined as (Tschimmel, 2012) "a way of thinking which leads to transformation, evolution and innovation, to new forms of living and to new ways of managing business". Most new products and services are designed collaboratively and implemented across different business units (Du et al., 2012). Such success requires sharing of knowledge in terms of creating ideas and exchanging the experiences and views. Du et al. (2012) report that there is a lack of software tools to support Design Thinking.

Design Thinking (Rylander, 2009) is one of the common approaches that have been adopted to tackle what are called wicked problems.

Wicked problem is described as “ill-defined”, it has no specific definition or formulation. Every wicked problem can be described in more than one way. This kind of problems has no specific solutions. Solutions for wicked problems cannot be described as right or wrong, instead they are either better or worse. The way to reach this solution is iterative. That means the design process is alternating between the problem definition and the defined solutions. Classical ways and mechanisms are linear and cannot be used to solve such problems ((Rylander, 2009) and (Buchanan, 1992) ).

Design Thinking is considered as a new mechanism and approach to support CoDesign. DT characteristics sometimes have an influence with CoDesign as per literature. Examples of that are the participatory design and multi-disciplinary features. Participatory design in some literature is described as customer-centric design or user-centric design.

To present DT features we have referred to Tschimmel (2012), Mootee (2011) and Young (2010). Features of DT as per these papers can be summarised as following:

1. *DT supports the human-centered approach of design.* In human-centered approach of design user’s experience such as emotions, feelings and needs are considered when designing an innovation. DT provides tools to empathise with people for such experience and knowledge related to the new innovation.
2. *DT is a research-based technique.* For understanding people properly qualitative research is considered as a main method for empathising users. In DT, observational techniques are used in such research. These techniques consider the users as central within the research context. These techniques are more focusing on tacit knowledge rather than explicit knowledge.
3. *DT is collaboration and multi-disciplinary based.* This feature is not applied to collaborative teams only but also including the stakeholders and end-users in the design process.
4. *DT is iterative delivery process supported by prototyping.* DT differs from the traditional linear practices in managing projects. In these techniques requirements and specifications are defined then forwarded to the design process as the next step. DT, on



the other hand, is considered as a non-linear approach where the design process in any stage is revised for improvement. Here prototyping plays the role of enabling testing and evaluation in an effective way. Observations and results obtained from these testing and evaluation procedures are used and applied to the previous stages for quality improvement of the deliverable.

Features of Design Thinking provide powerful capabilities to CoDesign. Human-Centered feature allow people in CoDesign, by utilising the proper Design Thinking tools, to target and capture the required knowledge according to types of participants involved. The iterative feature of Design Thinking allows it to reach the proper solution for the problem defined.

In our research model we are not limited by Design Thinking tools. Other kinds of tools can be investigated and developed in the model if required and achieve CoDesign outcomes.

### **2.7.2. Models of Design Thinking**

DT provides users with tools to support the design process where empathising with people and observing their needs is in the center of these tools. There are several models developed to present DT. However, these models are based on the same principles of DT.

Tschimmel (2012) describes five DT models which we present three of them, the IDEO's 3 I model, the Model of the Hasso-Plattner Institute and Double Diamond Model of the British Council.

#### **1. IDEO's 3 I Model:**

The "3 I" here refers to the three spaces of design, *Inspiration*, *Ideation* and *Implementation* as shown in Figure 2.8. It has been created by IDEO in 2001 to support social innovation. The three spaces can be described as following:

- *Inspiration*: the first space of design and it includes these activities:
  - Defining the design problem.

- Observing the behavior of the beneficiary groups and individuals.
- *Ideation*: after collecting the observations and defining the design problem in the ideation space the team synthesises these observations and knowledge in the context of the problem. That leads to interpretation of these observations to opportunities or suggested solutions.
- *Implementation*: in this space the best ideas are translated to actions where the prototyping plays the main role in this stage. Solutions and ideas are tested and evaluated through prototyping and iterated for improvement.

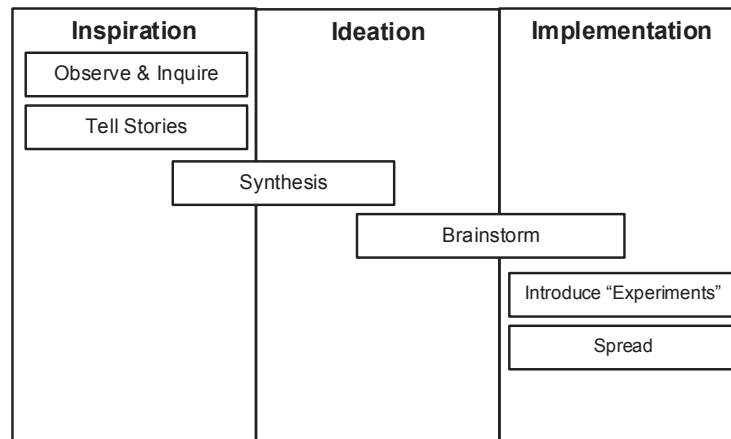


Figure 2.8: IDEO's 3 I Model

## 2. *The Model of the Hasso-Plattner Institute:*

This model, Figure 2.9, has been created by the d-school in the Hasso-Plattner Institute at the University of Potsdam in Germany. This institute is connected to Stanford University and IDEO. In this model DT is represented by six steps:

- *Understand*: gathering the knowledge about the topic.
- *Observe*: collecting information about the user by implementing qualitative research. Brainstorming tools such as storytelling are used in this step.
- *Point of View*: reflecting the user's perspective based on the observations gathered.
- *Ideation*: this step is the same as the ideation phase in I 3 model presented previously.
- *Prototype and Tests*: these two steps represent the implementation space in I 3 model.

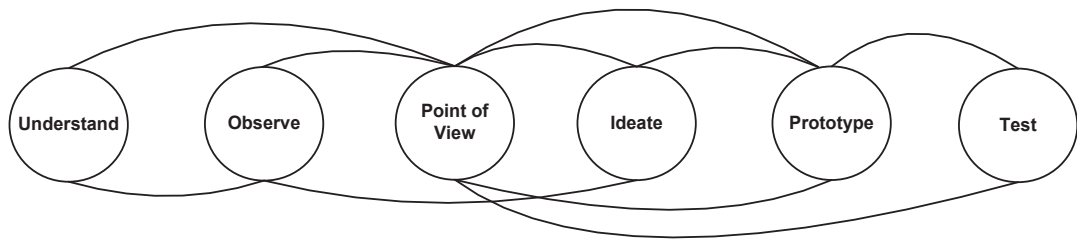


Figure 2.9: The Model of the Hasso-Plattner Institute

**3. The 4 D or Double Diamond Model of the British Council:**

This model, as shown in Figure 2.10, has been developed at British Design Council in 2005. As shown in the figure below the model can be described with divergent and convergent stages. 4 D refers to the names of the design phases which are *Discover*, *Define*, *Develop* and *Deliver*. These phases are briefly explained as:

- *Discover*: in this phase new markets, trends and opportunities are searched for and discovered. This phase represents the first stage of divergent.
- *Define*: here the information gathered through the first stage is filtered. Ideas are more focused. This phase represents the first stage of convergent.
- *Develop*: Based on the ideas defined in the previous phase, solutions are developed, tested and evaluated in this phase. This phase represents the second stage of divergent.
- *Deliver*: in this phase the proper developed solution is selected. This phase represents the second stage of convergent.

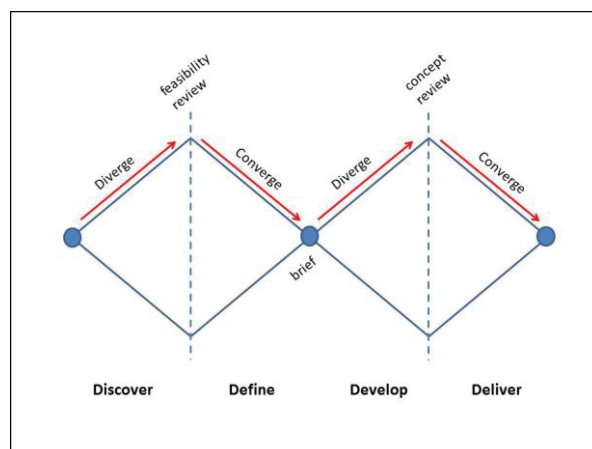


Figure 2.10: The 4 D or Double Diamond Model of the British Council

Although Tschimmel (2012) mentions the advantages and disadvantages of each model he states that there is no best DT model. Evaluation of the model depends on design context and even the users themselves.

Historically, the first model has been developed is the IDEO's 3 I. However, the double diamond model is seen as the basic model for the other models. In double diamond model the concept is to gather and create knowledge (divergent phase) and then filtering and utilising this knowledge (convergent phase). Divergent and convergent phases continue iteratively until the proper solution is reached or selected. Divergent and convergent phases happen through all steps and stages of design in the other models.

As CoDesign process is an iterative process Design Thinking tools support this feature. By utilising DT tools people share ideas and solutions to end up with the proper solution and outcome for the problem defined.

### **2.7.3. Design Thinking Creativity Tools**

Creativity tools defined in DT have been obtained from different fields of knowledge (Tschimmel, 2012) because of the multidisciplinary feature of DT. These tools are listed as following according to Tschimmel (2012):

#### ***1. Observation and register on place:***

Tools of observation are those which support designers to know and learn about users and situations. Photographing, voice and video recording are examples of register tools. One of the effective tools is what is called the "self-documentation" tool. This tool enables the user/consumer to describe himself, his needs and emotions guided by outlines.

#### ***2. Mind Maps:***

Mapping is to organise the complex knowledge and information in a systematic manner. It is to interpret the collected information in visual form where it can be communicated and understood. The idea of mind map is to find relationships between keywords and images and associate them with each other. This tool is good in the situation of complicated ideas and information.

#### ***3. Personas and Empathy Map:***

Personas and Empathy Maps are used to know and learn about the users in the context of the problem or issues they face. Simply, Personas is a tool to observe information about users and Empathy Maps is a tool to organise this information.

#### **4. *Brainstorming:***

Brainstorming is to collect as many ideas as possible in a short time. The aim is just to get ideas rather than discuss them. Based on the traditional brainstorming other tools have emerged such as Brainwriting and Brainsketching. One reason behind that is when some people have a concern to speak loudly in a group. For example, there are experts in the group and their ideas strongly influence others. The last two tools provide more independence and freedom.

#### **5. *Sketching:***

Converting ideas to drawings and images is an effective way in DT. Sketching is called the “mother of design tools” because it is there in every stage and phase of the design process. However, these sketches need to be simple as much as possible and present the idea in a clear manner.

#### **6. *Storyboard:***

Storyboard is a number of images and written labels and notes that are organised in a series manner to present a service, concept or event. Storyboarding enables the dialogue between individuals in the context of design objectives.

#### **7. *Rapid Prototyping:***

Rapid Prototyping is a quick tool to present the design in a materialised and tangible fashion. The purpose of rapid prototyping is to come up with early implementation to be tested by designers and users. This feedback is very important to improve the product or service in early stages which saves cost and time.

#### **8. *Storytelling:***

It is a tool where the user/customer tells his story and experience with the service or product. This tool can be used in conjunction with other tools such as Storyboard.

The other important tool which has not been mentioned by Tschimmel (2012) is what is called Lotus Blossom for developing solutions. Lotus Blossom has been developed by Yasui Matsumura as mentioned by Frey (2011).

The three tools; Lotus Blossom, Storyboarding and Persona-Map are to be presented again in Chapter 5 and Chapter 6. They are to be presented in Chapter 5 to demonstrate some scenarios and examples of how our model, CoDAN, supports DANs in CoDesign. In Chapter 6 we show how these three tools implemented in the model prototype to demonstrate creativity tools and CoDesign activities.

#### 2.7.4. Design Thinking and Knowledge Management

Design Thinking is intellectual and cognitive in its nature. One advantage of knowledge sharing mechanisms in DT is closing the knowledge gaps between the different disciplines ((Mootee, 2011) and (Du et al., 2012)).

While the traditional tools are used to extract the explicit knowledge (Young, 2010) DT observation tools such as storyboarding, brainstorming and mapping are used to extract tacit knowledge from the individuals and interpret it in explicit forms.

Tacit knowledge resides inside the brains of experts as skills and within customers as experiences. This kind of knowledge cannot be reached by exploring databases and websites (Davis, 2010), rather, DT techniques and tools are utilised for acquiring tacit knowledge.

The iteration feature of DT leads to creation of new knowledge from the previous created and captured knowledge to provide better solutions. However, according to the literature review there is no mention of the relationship between the iteration feature of DT and knowledge management processes.

Figure 2.11 shows the traditional sequential model as presented earlier, while Figure 2.12, modified from Figure 2.11, shows the iterative model in relation to Design Thinking.

Although these processes are presented as sequential in Figure 2.11 as in many related literature but practically this is not the case in Design Thinking. These processes are non-linear and iterative. For example, if a new knowledge is discovered and captured, new knowledge may be discovered from the captured knowledge. New knowledge could be discovered and captured from the filtered, organised or shared knowledge as well.



Figure 2.11: Traditional Model of Knowledge Management Processes

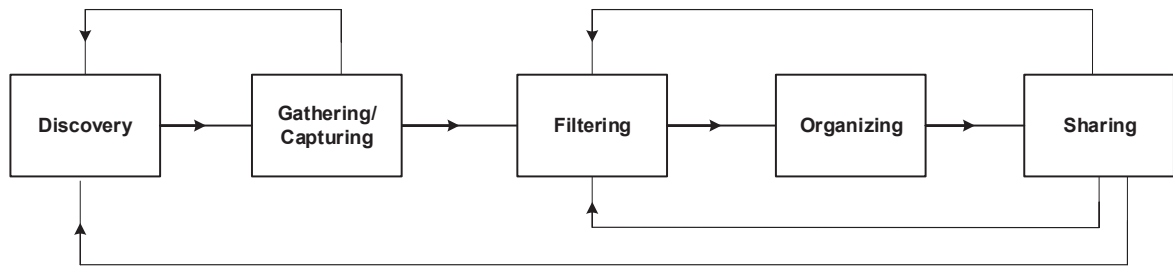


Figure 2.12: Iteration Feature of Knowledge Management Processes in Design Thinking

In DT knowledge discovery can be performed any time within any stage. The new sources of knowledge can be discovered from previously captured, filtered or shared knowledge. The new discovered knowledge is subject to capturing then filtering, organising and sharing. This iterative process continuous until a proper and satisfactory solution is reached for the defined problem.

To support CoDesign creativity tools, such as Design Thinking tools, should be implemented in a way where KM processes are considered. These tools should provide the capability to participants to create, filter and share knowledge easily and flexibly.

## 2.8. Discussion

In this section we discuss the findings of the literature review to highlight our research key issues.

One of the reasons that encourages collaboration between businesses is the agreement between these businesses to innovate. This innovation usually provides advantage and competitive values to these businesses. Turiera and Cros (2013) have presented 50 examples of innovations which can be implemented by collaboration between different businesses. As we presented previously collaboration between businesses these days is established through dynamic business networks (DANs). Systems and models which claim to support CoDesign do not facilitate DANs. Models which support CoDesign should consider the features of these networks. One of these important features is that these networks are dynamic and change over time. Also, these networks vary in their way of management structure and governance.

Usually KM and CoDesign supporting systems are installed as a dedicated property for the business itself. Also these systems are dedicated to a specific industry or a process. This makes these systems expensive and cannot be adopted by the small and medium businesses. Also, modifying these systems leads to reprogramming the whole of the system in most cases. In addition, these systems are only utilised by professional and expert people.

According to the literature published in the last two decades it can be argued that the current systems and models overlook the wicked problems phenomena. These systems support the linear and traditional design process. Design process in relation to wicked problems and complex environments are non-linear and iterative. Suggested solutions for wicked problems need to be evaluated more than one time, and design phases need to be revisited to reach the proper solution.

Current CoDesign supporting systems usually deal with the last phase of design, the implementation phase. These systems in the most cases are integrated to CAD software and applications, where the prototype is illustrated and then published through designers to have their feedback. These systems do not support the early stages of design where ideas are generated and shared, and users and consumers are empathised in order to properly defining the problem. These systems are also complicated where the non-professional users cannot utilise these systems. Non-professional users such as consumers and customers became main participants in CoDesign process.

There is a lack of research in supporting social design and services. Social services are deliverables in which their ideas are created by empathising the society individuals and groups. The outcomes of these services also are measured by these targeted individuals and groups within the society. Organisations, such as the government-based, start to integrate CoDesign with their business processes.

Based on the fact that CoDesign process depends critically on knowledge creating and sharing, knowledge management systems have been investigated as well. The investigation is addressing the question “are knowledge management systems capable to support CoDesign process?”.

As a result of this investigation it can be reported that KM systems also are not adequate to support CoDesign process. KM systems are more explicitly oriented. Traditional KM systems support explicit knowledge more than the tacit type. Extracting, transferring and



sharing tacit knowledge are social interaction-based processes. This social interaction is mostly overlooked when building such KM systems.

CoDesign process is based on collaboration and sharing knowledge between individuals, teams and businesses. Systems support CoDesign in dynamic business networks should maintain privacy to control who does what and access what. Traditional systems usually support the privacy and security of the stored explicit knowledge. There is a lack of research in supporting privacy in CoDesign with its new features.

Design Thinking related literature have been explored as well. The main reason is that DT tools and models now are utilised in CoDesign for creativity, especially when dealing with wicked problems and designing social services. There is a quite good research and literature to establish a background about DT in theory and practice. However, there is a lack of research in supporting creativity tools, such as in DT, through technology and systems in terms of knowledge sharing and social interaction between individuals and teams in design process.

According to the previous discussion we summarise the research key issues as following:

1. There is a lack of research in supporting CoDesign in DANs.
2. Current CoDesign and KM systems are dedicated and complicated. Only the professional and expert people utilise these systems. Also, these systems cannot support CoDesign with its new features.
3. There is a lack of research in supporting CoDesign for wicked problems where the solutions are created in an iterative way.
4. Current systems and models only support the last stages of design process. Early stages where the problem is defined are not supported.
5. There is a lack of supporting CoDesign in relation to social design and services.
6. Current systems are explicit oriented. These systems in the main are considered as storage for explicit knowledge. There is a lack in supporting tacit knowledge where social interaction should be considered.
7. Creativity tools, such as in Design Thinking, become utilised in supporting CoDesign. There is a lack in supporting these tools through technology and integrating them in the models supporting CoDesign.

8. There is a lack of research in maintaining privacy in CoDesign. As CoDesign process is performed in a collaborative environment maintaining privacy should be taken into consideration when developing models for supporting CoDesign.

Our aim is to develop a generic model, CoDAN, to support managing CoDesign in DANs. CoDAN should provide the following capabilities and features to overcome the research key issues:

1. CoDAN should support DANs by facilitating businesses to create their creativity environments and managing these environments.
2. CoDAN is a generic model. It means that CoDAN is not dedicated to a specific industry where all kinds of businesses can utilise it.
3. The research model, CoDAN should be utilised by different users of different skills and experience.
4. The model should support the CoDesign in finding solutions for wicked problems. That is achieved by integrating creativity tools such as those are provided by Design Thinking into the model.
5. By bringing people from businesses together into the collaborative environment and utilising the creativity tools that supports creating and sharing both types of knowledge, tacit and explicit.
6. By integrating the creativity tools then the KM processes such as knowledge filtering and transferring are supported.
7. Maintaining privacy is one of the facilities to be provided by CoDAN. That is to be achieved by defining rules and policies with the creativity environment.

These are the major features which should be provided by our research model CoDAN.

In the next section we present our research framework based on the literature review to develop our research model, CoDAN.

## 2.9. Research Framework

Based on the literature review we implement our research framework to be used as guidance for developing and evaluating our model.

Our aim in this research is to develop a model to support CoDseign management in DANs. According to the literature investigated we see supporting CoDesign management should consider the following main themes:

1. Business Networking.
2. Maintaining Privacy.
3. Self-Organising.
4. Knowledge Sharing.
5. Enabling Creativity.

These themes are considered as the major requirements for managing CoDesign. Each requirement should be enabled through one or more enablers. Accordingly, these enablers should be supported by our model CoDAN to support the CoDesign process in DANs at the end.

Table 2.2 presents each of these themes with the corresponding enablers as extracted from the literature.

Table 2.2: Enablers of Managing CoDesign in DANs

<b>Theme</b>	<b>Enabler (Enabled by)</b>	<b>Reference</b>	<b>Section (s) where presented</b>
<b>Business Networking</b>	Supporting Networking	Fischer and Ostwald (2001)	Section 2.2
	Supporting Collaboration	(Amabile, 1998) (Elliott, 2011) (Qureshi, 2006)	Section 2.1 & Section 2.2
	Facilitating Stakeholders Participation	(Hillgren et al., 2011) (Vallaster and von Wallpach, 2013)	Section 2.4
<b>Maintaining Privacy</b>	Knowledge Ownership	(Dulipovici and Baskerville, 2007)	Section 2.6

	Components Privacy	(Bertino et al., 2006) (Muniraman et al., 2007)	Section 2.6
	Access Control	(Bertino et al., 2006) (Muniraman et al., 2007)	Section 2.6
<b>Self-Organising</b>	Bringing in New Knowledge	Hasgall (2012)	Section 2.2
	Supporting Team Evolution	Zhongwei and Bingsheng (2009)	Section 2.2
	Modifying Teams	Zhongwei and Bingsheng (2009)	Section 2.2
<b>Knowledge Sharing</b>	Tacit & Explicit Knowledge Support	(Nunes et al., 2006) Birkinshaw (2001)	Section 2.5
	Knowledge Management Processes	(Fernandez and Sabherwal, 2010b), (Awad and Ghaziri, 2004), (Dakilir, 2011b)	Section 2.5
<b>Enabling Creativity</b>	Facilitating Creativity Tools	(Leavy, 2012) (Tschimmel, 2012) (Du et al., 2012) (Young, 2010)	Section 2.7
	Supporting Brainstorming	(Mootee, 2011) (Du et al., 2012) (Young, 2010)	Section 2.7
	Supporting Multidisciplinary	(Li et al., 2004) (Jasimuddin, 2012) (Tschimmel, 2012)	Section 2.7

We present these themes and related enablers in the Figure 2.13. Presenting the framework in this way makes it easy to be understood and reviewed. Also, it facilitates the future work on the research when expanding and modifying the framework.

The framework is presented by three circles as following:

Entire circle: represents the main theme of the research “Managing CoDesign in DANs”.

Medium Circle: represents the themes related to the main theme. These themes are considered as the major requirements of managing CoDesign in DANs.

Exterior Circle: represents the enablers in relation to each theme.

The framework is to be used as a guidance to develop and evaluate our research model, CoDAN.

This framework can be described by the following statement:

To support managing CoDesign in DANs; enabling creativity, knowledge sharing, self-organisation, business networking and maintaining privacy should be considered. These are referred to as the main themes for CoDesign supporting model. The related enabler of each of these themes should be supported by the developed model.

Our contribution in this research is focused on the first three themes; business networking, maintaining privacy and self-organising. Based on these three themes we study the types of DANs to develop the best way to support CoDesign in DANs. This study is in Chapter 4. Creativity tools and knowledge management processes are defined the literature.

In the next chapter, Chapter 3 “Research Plan and Methodology”, we explain in more details the enablers illustrated in the research framework. Accordingly, we show our plan of developing and evaluating our research model, CoDAN. Then we follow with Chapter 4 to investigate the various types of DANs and their features.

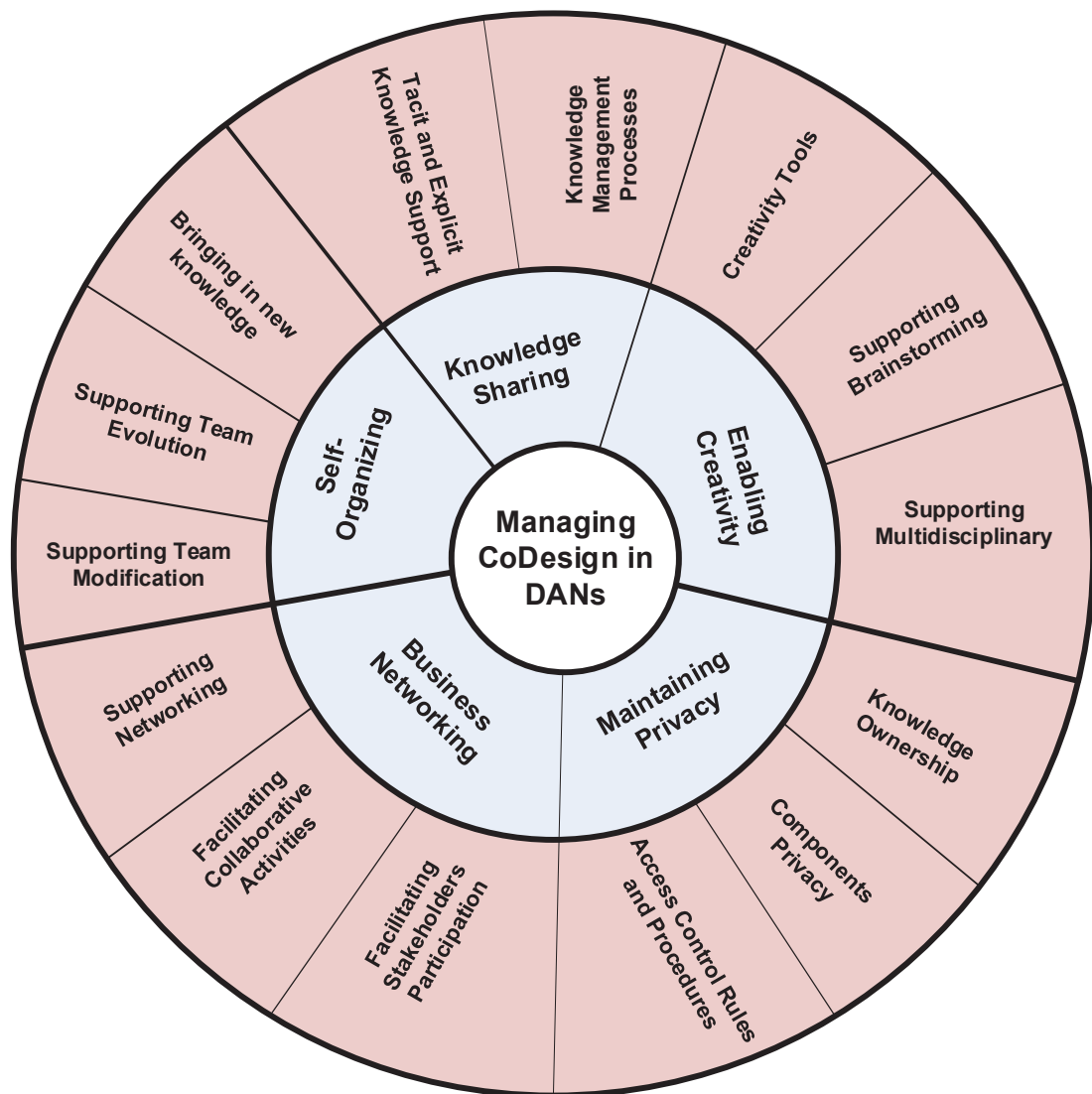


Figure 2.13: Research Framework

## 2.10. Chapter Summary

In this chapter we have explored and investigated the literature in relation to CoDesign management in DANs. The aim is to explore the previous work and address the research key issues. The literature has been explored according to a number of different aspects. These aspects include collaborative business networks, CoDesign concepts, Knowledge Management and Design Thinking. Also we have presented the privacy in relation to CoDesign. The findings of the literature review have been discussed and the research key issues have been addressed. Accordingly, we have developed the research framework. The

research framework is to be as a guidance to develop and evaluate the research model, the outcome of this research.





# Chapter 3

## Ch3: Research Plan and Methodology

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### 3.1. Introduction

In the previous chapter “Literature Review” we have explored the research work in relation to supporting CoDesign in dynamic business networks (DANs). The exploration was through different perspectives that include:

- Collaboration and collaborative business networks.
- CoDesign principles and CoDesign supporting systems.
- Knowledge management principles and supporting systems.
- Creativity tools and Design Thinking.
- Privacy in context of CoDesign and knowledge management.

Based on the literature review the research key issues and research framework have been presented. Research framework presents the main themes and their related enablers of managing CoDesign in DANs. These enablers should be supported by the research model to address overcome the research key issues.

The themes presented in the research framework are; knowledge sharing, supporting self-organising, facilitating business networking, enabling creativity and maintaining privacy. These themes are enabled by a number of enablers as presented in the framework (shown again in Figure 3.1 below). The research model supporting CoDesign in DANs should support these themes and their related enablers.

In this chapter, in section 3.2, we revisit the research framework. We explain in more details the main themes and their enablers.

In section 3.3 we derive our hypotheses and evaluation model based on the theoretical constructs.

The selection of the research model evaluation method is presented in section 3.4 based on the literature.

In section 3.5 we explain more about the qualitative research as the method adopted to evaluate our research model.

At the end of this chapter, section 3.6, we present our idea of research model development and evaluation plan which is presented in the next chapters.

In the next section we explain in more details the themes and enablers illustrated in the research framework.

## 3.2. Themes and Enablers of Managing CoDesign in DANs

The framework derived from the literature review is again shown in Figure 3.1 below. In the framework we have defined five themes in relation to managing CoDesign. These themes present the aspects to be considered when supporting CoDesign management. Each theme is enabled through a number of enablers. These enablers should be supported by our model, CoDAN, to support CoDesign within DAN. As we mentioned that our contribution in this research is mainly related to the themes; business networking, maintaining privacy and self-organising.

In this section we explain the five themes and their related enablers in more details.

### 3.2.1. Business Networking

Business networks play a crucial role in collaboration between businesses as presented in the literature review. In this research, we refer to the business networks as Dynamic Alliance Networks (DANs). These networks and related created teams will grow based on the size of collaboration and the number of businesses involved in the collaboration activity. In our research, business networking should be supported through the following enablers:

- **Supporting Networking:** As mentioned previously, businesses perform CoDesign through dynamic business networks. The model should facilitate these networks by allowing the businesses to network. Businesses in DANs should be provided with the facility of creating their environment where they join flexibly for networking and collaboration. The model should provide this facility for different structures and governance scenarios of DANs.
- **Facilitating Collaborative Activities:** by bringing businesses together, they should be provided with the facility of carrying out various collaborative design activities. Facilitating businesses in DANs to collaborate in CoDesign is by creating their teams and assigning them to collaborative activities for creativity. These teams should be provided with creativity tools such as the tools defined in Design Thinking to create and share knowledge.
- **Facilitating Stakeholders Participation:** It is important to involve the different stakeholders in CoDesign for quality outcomes. These stakeholders include business owners, investors, managers and consumers. The model should support deciding the role of each of these stakeholder types when joining CoDesign.

### 3.2.2. Maintaining Privacy

When supporting CoDesign in DANs privacy is an important aspect to be maintained. Maintaining privacy can be facilitated through the following enablers by our model:

- **Knowledge Ownership:** knowledge is considered as a private asset according to the literature. Methods should be developed where businesses and individuals who own this knowledge can control accessing it.
- **Components Privacy:** Other components such as CoDesign activities are owned by people who create them. Methods should be defined and implemented to control accessing these components.

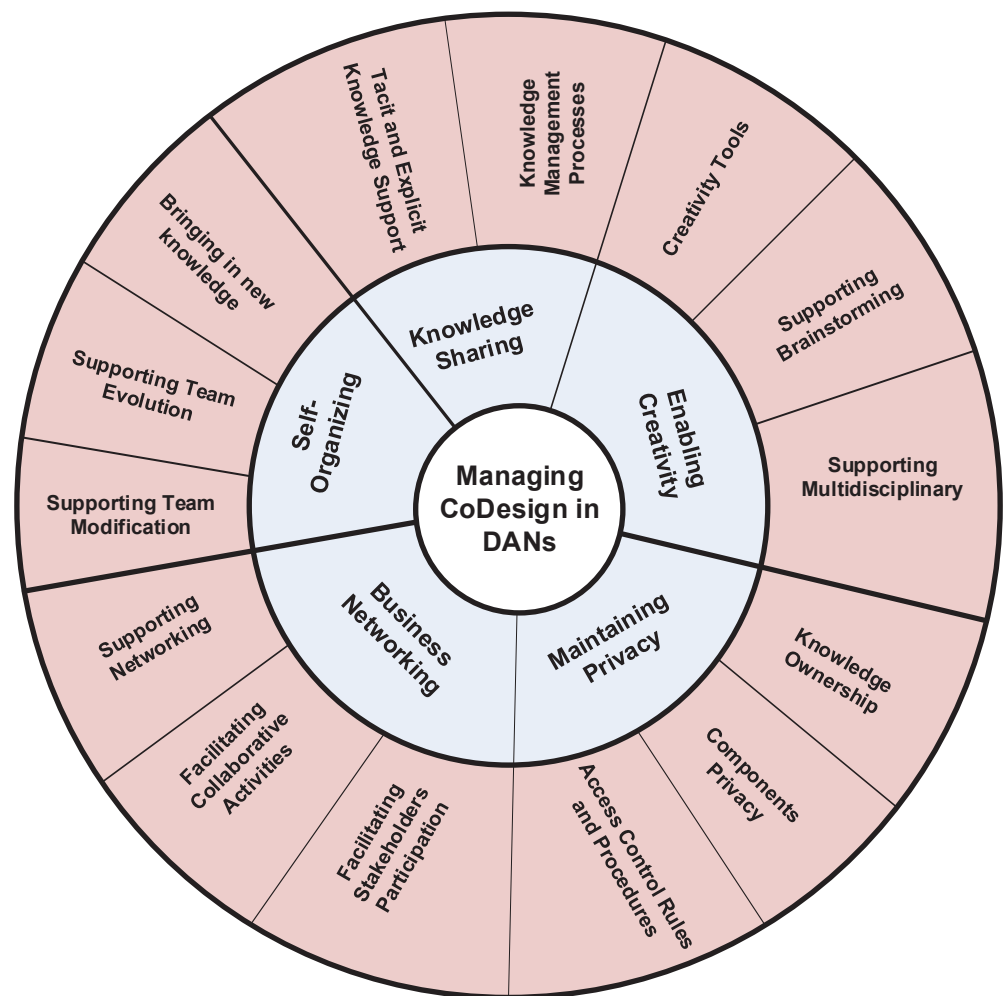


Figure 3.1: Research Framework

- Access Control Rules and Procedures:** In a business network we see access control from two perspectives. One is where in the network responsibility for privacy lies, and the other is to provide the necessary rules to maintain privacy and access to knowledge and other components. This is including authorising people to control accessing knowledge or other components when needed. Access control procedures should be well defined, logical and easy to practice by people involved in the business network.

### 3.2.3. Self-Organising

According to the literature review today's businesses operate in an emergent and a changing environment. Businesses need to be self-organised to respond to such changes and emergences. CoDesign process is established to design new products or services to respond to these changes. Accordingly, systems supporting CoDesign need to facilitate the self-organising feature for businesses. To enable self-organising the following enablers should be provided through the research model:

- **Bringing in New Knowledge:** One way to respond to emergence and change is to bring in new sources of knowledge. These sources can be experts, professionals and stakeholders for example. Our model should support businesses in DANs to manage people for participating into the creativity environment. These participants should be provided with tools to create and share knowledge for CoDesign.
- **Supporting Team Evolution:** one of the enablers that should be supported is facilitating team creation. Once people join the creativity environment facilitated by the model, they should have the capability to create teams for collaboration. The model should support businesses to create such teams when required in a flexible way.
- **Supporting Team Modification:** The existing created teams need to be modified according new emergences and changes. The model should provide the facility to flexibly modify these existing teams.

Supporting self-organising in our model is to allow businesses to create environments where people of different disciplines and skills join, create and share knowledge. The model provides people in businesses with tools where they can evolve teams when required. The model also facilitates these teams so that they can be modified when required.

### 3.2.4. Knowledge Sharing

CoDesign process relies on knowledge sharing between participants. Knowledge sharing process should be facilitated and supported in a way to achieve CoDesign outcomes.

According to the literature reviewed, the focus is on supporting knowledge sharing of explicit type. Knowledge in CoDesign is considered mainly as the tacit type. Tacit knowledge is required to be converted to explicit knowledge for easy sharing and application. According to Nonaka's SECI model, the focus should be on socialisation and externalisation mechanisms when supporting tacit knowledge. In the CoDesign process knowledge sharing is performed through socialisation when people meet and socialise to share their experience, ideas and thoughts. Also, externalisation takes place when the tacit knowledge is recorded as an explicit knowledge into artifacts. Tools should be provided to manage teams and support social interactions between teams and individuals who participate in CoDesign. In our research we aim to provide such tools to support this kind of knowledge sharing. These tools are to facilitate interaction between teams and stakeholders to create and share knowledge and achieve CoDesign process outcomes.

Our research model should facilitate and support the following enablers to enable the knowledge sharing theme :

- **Tacit and Explicit Knowledge Support.** The model should provide tools to support the two types of knowledge, tacit and explicit. Tacit knowledge is facilitated by allowing people to join in to the creativity environment. These people should be provided with tools so they can easily convert their experience and ideas (the tacit knowledge) to the explicit type for sharing and organising. Facilitating explicit knowledge includes filtering and organising this type of knowledge as well.
- **Knowledge Management Processes Support.** Knowledge management processes have to be facilitated in addition to knowledge creation and sharing. Filtering process, for example, should be supported as a specific knowledge is extracted from the existing knowledge. This extracted knowledge can be used to create a new knowledge as well. Considering knowledge management processes when supporting CoDesign results in more effective solutions and outcomes.

### 3.2.5. Enabling Creativity

CoDesign process is a creativity process. Tools should be provided to enable creativity.

Creativity is enabled through the following enablers in our model:

- **Creativity Tools.** Creativity tools are utilised to perform CoDesign as presented in the literature review. These tools play a significant role when they are considered and implemented within models that support CoDesign. Design Thinking (DT) tools, as an example of these tools, support knowledge management and can be utilised by people of different skills and expertise. Implementing creativity tools, such as those defined in DT, through technology provides new dimensions to these tools, where people can be involved in CoDesign any time anywhere.
- **Supporting Brainstorming:** Brainstorming is a way to create ideas and share them when performing the CoDesign process. Design Thinking tools, for example, are utilised to facilitate brainstorming. In our model these tools should be facilitated through technology. Taking advantage of technology in implementing these tools means brainstorming outcomes can be enhanced and developed in a better way.
- **Supporting Multidisciplinary:** CoDesign is a multidisciplinary process in its nature. Different people of different skills and experience including users and consumers are involved in the design process. The model should support all of these types of skills and expertise to be involved in CoDesign. Different tools should be defined and developed to facilitate different people of different skills and experience.

In the next section we explain how we develop our theoretical constructs.

## 3.3. Research Constructs

To develop our hypotheses we first present our research model constructs. These constructs represent the theoretical background of the research hypotheses.

In this section we show how the enablers explained in the research framework are related to the constructs and then the hypotheses

According to literature our hypotheses are based on three main constructs; properties of complexity, privacy and creativity. Based on their descriptors these constructs can be described as follows:

#### ***Complexity:***

In this research we do not address the theory of complexity in particular. However, we consider two properties of complexity, emergence and self-organisation in the context of our research. Emergence is described by Bar-Yam (2004). In the business environment emergence (Bar-Yam, 2004) can be explained by the way businesses respond to changes in the market. This emergence can be, for example, a new competitive innovation. Businesses in DANs need to be self-organised to respond to such changes as explained in the literature review.

#### ***Privacy:***

Maintaining privacy should be considered when designing models and systems to support CoDesign. Maintaining privacy is a requirement in the environments where people from different businesses collaborate and share knowledge. The privacy construct in our research model is described by two descriptors, access control and authorisation. Access control refers to the rules and methods of controlling the access of knowledge and other objects of creativity environment. Authorisation refers to the fact that no one has access to or has a control over an object unless authorised. Knowledge is considered as a type of the objects so that its access should be controlled and authorised.

#### ***Creativity:***

Creativity construct is described through a number of descriptors according to Amabile (1998). In the context of our research five creativity descriptors are considered based on Amabile (1998). These descriptors are expertise, creative thinking skills, developing domain knowledge, performing collaboration and enabling work-group feature.



Based on the research framework we illustrate our constructs and the related enablers for the descriptors of each construct as shown in Figure 3.5. The constructs represent the theories we rely on to develop and evaluate the research model. Enablers are derived according to the literature review and presented in the research framework in relation to the main themes.

Matching the constructs with the research framework can be described as following:

- The descriptors of complexity construct are enabled through the “Self-Organising” theme enablers in the research framework.
- The descriptors of the privacy construct are enabled through the “Maintaining Privacy” theme enablers in the research framework.
- The descriptors of creativity construct are enabled through the enablers of the themes “Knowledge Sharing”, “Enabling Creativity” and “Business Networking”.

The point that should be made clear here, that enablers are enabling the descriptors not the constructs. Constructs may include other descriptors that are not listed here. The descriptors listed are those we consider them to be related to our research context.

In the next section we present the research hypotheses and how they are related to the constructs explained above.

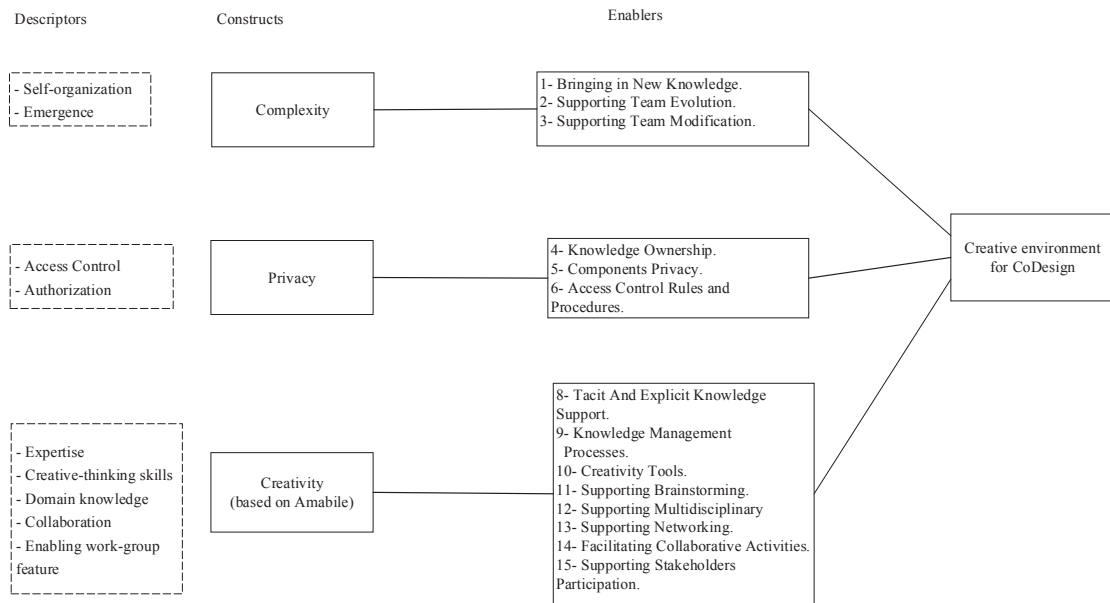


Figure 3.2: Research Constructs and Enablers

### 3.4. Research Hypotheses

Research hypotheses are to be tested to show if the model supports the enablers stated. That will show if the descriptors are enabled by the model in turn.

Based on the model illustrated in Figure 3.2 we state our hypothesis to evaluate CoDAN as grouped according to the constructs:

***Complexity Hypothesis:***

**H1: The model enables businesses in DAN to self-organise in their environment.**

***Privacy hypothesis:***

**H2: The model maintains privacy in the creative CoDesign environment for collaboration between businesses in DAN.**

***Creativity Hypotheses:***

**H3: The model facilitates participants to learn from each other to enhance expertise.**

**H4: The model implements creativity tools where creative thinking skills can be developed.**

**H5: The model enables groups and teams in DAN to collaborate.**

**H6: The model facilitates creativity by creating, filtering and sharing knowledge across CoDesign activities to develop domain knowledge and creative skills.**

**H7: The model supports businesses in DAN to capture both tacit and explicit knowledge for domain knowledge development.**

Figure 3.2 is modified to Figure 3.3 to include our research hypotheses. The model illustrated in Figure 3.3 is described as follows:

*To support businesses in DANs to manage the creativity environment for CoDesign our model should support the enablers listed. These enablers should enable the descriptors related to the three constructs. The seven hypotheses (H1 to H7) are created to be tested for showing if the model supports these enablers.*

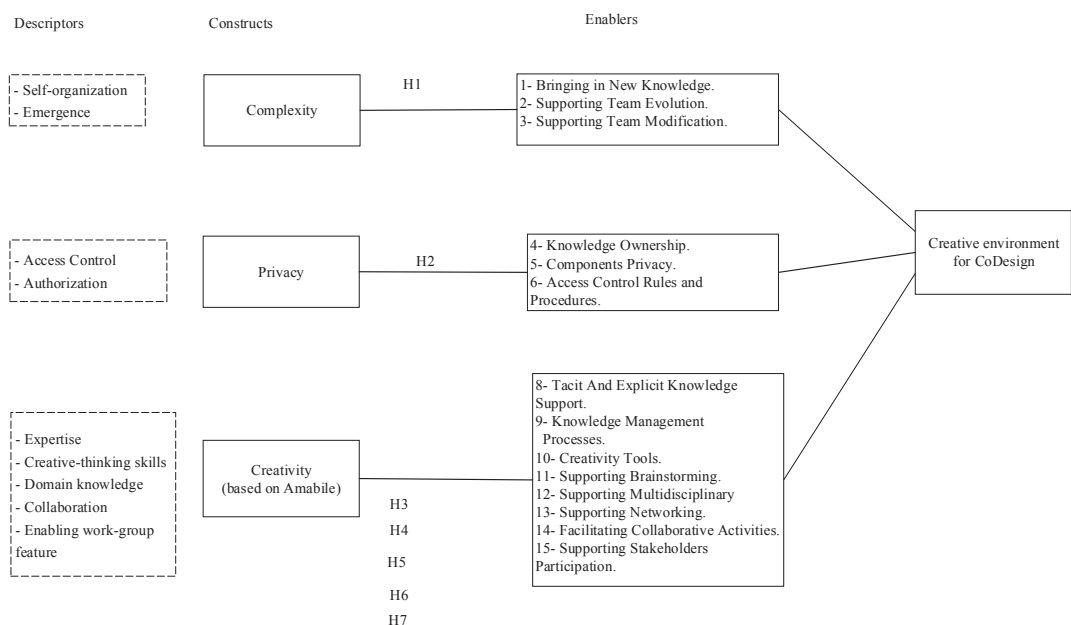


Figure 3.3: Constructs and Enablers in Relation to Hypotheses

Table 3.1 below presents the hypotheses as related to constructs, descriptors and enablers.

Table 3.1: Constructs, enablers and hypotheses

<b>Construct</b>	<b>Descriptors</b>	<b>Enabler(s)</b>	<b>Hypothesis</b>
Complexity	-Self-Organisation -Emergence	1- Bringing in New Knowledge. 2- Supporting Team Evolution. 3- Supporting Team Modification.	H1: The model enables businesses in DAN to self-organise in their environment.
Privacy	-Access Control -Authorisation	4- Knowledge Ownership. 5- Components Privacy. 6- Access control Rules and Procedures	H2: The model maintains privacy in the creative CoDesign environment for collaboration between businesses in DAN.
Creativity	-Expertise	12- Supporting Multidisciplinary 13- Supporting Networking 14- Facilitating Collaborative Activities.	H3: The model facilitates participants to learn from each other to enhance expertise.
	-Creative thinking skills	10- Creativity Tools. 11- Supporting Brainstorming. 12- Supporting Multidisciplinary	H4: The model implements creativity tools where creative thinking skills can be developed.
	-Collaboration	13- Supporting Networking 14- Facilitating Collaborative Activities. 15- Facilitating Stakeholders Participation.	H5: The model enables groups and teams in DAN to collaborate.
	-Domain knowledge -Creative thinking skills	9-Knowledge Management Processes.	H6: The model facilitates creativity by creating, filtering and sharing knowledge across CoDesign activities to develop domain knowledge and creative skills.
	-Domain Knowledge	8- Tacit and Explicit Knowledge Support.	H7: The model supports businesses in DAN to capture both tacit and explicit knowledge for domain knowledge development.

We revisit the hypothesis again in Chapter 6 “Model Evaluation” to explain more about how they are tested.

In the following section we present our methodology and strategy for how our model is to be evaluated. Then we describe our plan of developing this research through the remaining chapters of this thesis.

### 3.5. Choosing Evaluation Methodology

To define our evaluation methodology we refer to the papers which deal with information systems (IS) evaluation. In our research we do not develop an information system. However, information systems design and implementation discipline are seen the suitable source to develop our evaluation strategy and method.

Cronholm and Goldkuhl (2003), cited in 104 publications, and Chen et al. (2011) define three approaches on how to evaluate information systems. These approaches are:

- *Goal-based* evaluation: this means that goals are specified based on the firm context. Goals are used to evaluate the system by using qualitative methods.
- *Goal-free* evaluation: in this approach the information system is seen as a social system where information is embedded. In this approach only the program outcomes and effects are considered. Quantitative and qualitative methods can be utilised in this approach.
- *Criteria-based* evaluation: in this approach the evolution is performed based on the criteria of specified qualities. This approach does not depend on the business goals and is used for later stages of implementation.

Cronholm and Goldkuhl (2003) also present two strategies of what to evaluate. These two strategies are *system as such* and *system in use*.

In the *system as such* strategy users are not involved in the evaluation process. In this case only the evaluator refers to the system and the documentation provided for evaluation. In the *system in use* strategy users are involved in the evaluation process. The two strategies are illustrated in Figure 3.4 and Figure 3.5 according to Cronholm and Goldkuhl (2003).

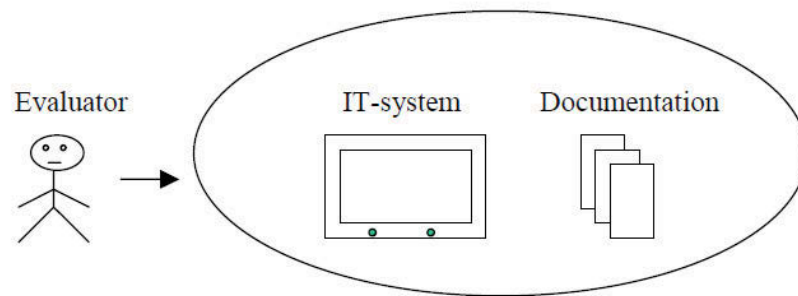


Figure 3.4: System as such strategy (Cronholm and Goldkuhl, 2003)

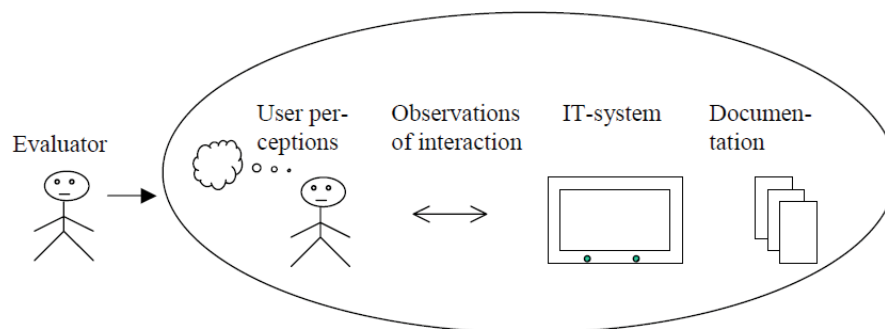


Figure 3.5: System in use strategy (Cronholm and Goldkuhl, 2003)

In our research *goal-based/system as such* combination is seen as the suitable approach to evaluate our research model, CoDAN. When evaluating CoDAN we focus on goals according to our framework presented earlier. The five themes related enablers described at the beginning of this chapter represent the goals that CoDAN should support. CoDAN is to be evaluated according to these goals based on *goal-based/system as such* evaluation approach. As our model is to be evaluated by experts we adopt the *system as such* strategy. Figure 3.6 illustrates our evaluation method based on *goal-based* approach and *system as such* strategy.

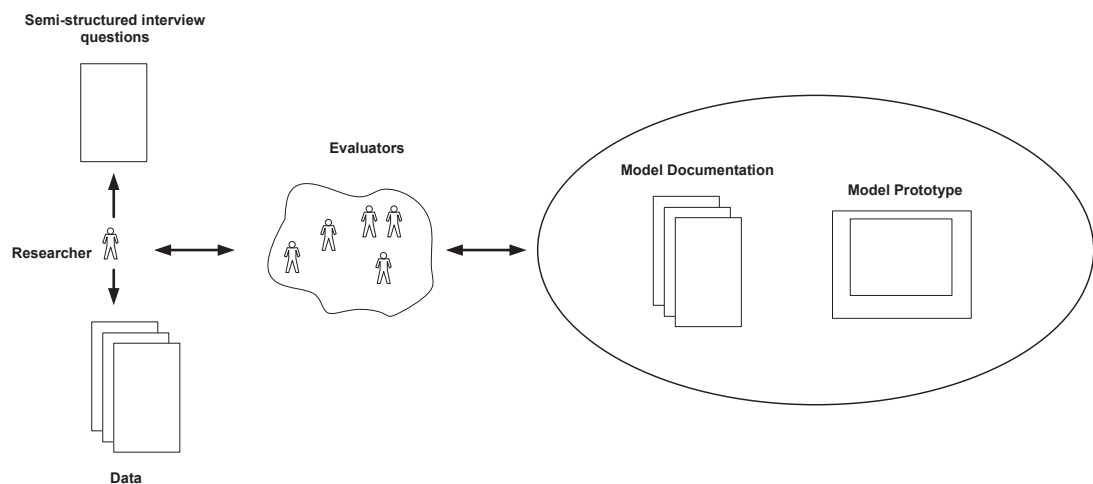


Figure 3.6: CoDAN Evaluation Methodology

Referring to Figure 3.6 we define the following components to define the evaluation method:

- *Model documentation*: these documents are provided to participants which contain the following:
  - CoDAN definition and description.
  - Description of prototype.
  - Pre-prepared scenario.

Model documentation is developed and provided based on model definition as presented in Chapter 5, Model Definition.

- *The Model Prototype*: the model prototype is Internet based software designed and implemented based on the model definition. This prototype does not represent all the features of the model described in the model documentation. However, our focus is on the model in particular. The prototype supports the evaluation process in helping to structure our interview questions. Also, the prototype provides a tangible application to allow evaluators to understand the model in a better way.
- *Evaluators*: evaluators are the expert participants selected to evaluate the model. These participants are selected according to specific criteria, to be described in Chapter 7, Model Evaluation. Before the evaluators are interviewed, they communicate the model documentation and utilise the prototype individually.

Communicating the model and utilising the prototype provides the evaluators with an adequate idea about the model.

- *Researcher (us)*: roles of researcher are:
  - Selecting and contacting evaluators based on the defined selection criteria.
  - Providing documentation and allowing access to the prototype.
  - Conducting sessions to explain the model with evaluators.
  - Preparing and conducting the semi-structured interviews.
  - Collecting and analysing data out of the semi-structured interviews.

In *goal-based* approach qualitative research method is to be conducted for the evaluation process according to Cronholm and Goldkuhl (2003). Here we describe qualitative research method.

### 3.6. Qualitative Research Method

There are two sorts of research methods used in research design, qualitative and quantitative. Qualitative research method focuses on understanding the opinions and observations of those who participate in the evaluation process. Techniques such as interviews, notes and conversations are conducted to collect data and information. Data in qualitative research is gathered by deep exploration of the subject under research and evaluation. One advantage of this method is the interaction between the researcher and participants. The research process here is more open and leads to effective results. Quantitative research is objective-oriented where relationships between variables are tested. These variables are measured when numerical data can statistically analysed. Techniques such as surveys and experiments are used to collect the data. Both methods, qualitative and quantitative, can be used in combination as well. Mixed method is used when both methods complete each other. Data in this case needs to be collected through both methods based on the research context and requirements (Harwell, 2011).

Cronholm and Goldkuhl (2003) report that *goal-based* approach is qualitative research method based. They argue that qualitative method shows if goals are fulfilled and describes how they are fulfilled by the system.



Our aim is to evaluate our research model by experts. Adequate information about the model is to be provided to these experts. Experts are provided with access to the online prototype as well. Experts can utilise the prototype by applying a pre-prepared scenario.

Experts who participate in the evaluation process can be selected internally or externally. Internal experts are selected from the staff of the Faculty of Engineering and Information Technology in the University of Technology Sydney. External experts are selected from the industry. To contact and invite participants for the evaluation process ethics application has been submitted and approved.

In the next section we explain our plan for developing and evaluating our model based on the methodology presented previously.

### 3.7. Research Model Plan

Based on the methodology explained, the model is to be developed and evaluated as follows:

- Dynamic Alliance Network (DAN) types: Chapter 4
- Model definition: Chapter 5
- Model Prototype Design and Implementation: Chapter 6
- Model Evaluation; Chapter 7
- Conclusion and Future Work: Chapter 8

In Chapter 4, we again explore the literature to investigate the types and practical features of the DAN types. Defining the types of DANs and categorising them through their features and dynamics helps in developing the best idea to support DANs for CoDesign.

In Chapter 5, Model Definition, we define our research model. That includes defining the main components of the model and the relationships between these components. Maintaining privacy is modeled as well.

In Chapter 6 we show the prototype design and implementation. Model components are presented by using object-oriented modeling where attributes, methods and relationships are defined.

The prototype is utilised for supporting the model evaluation. The prototype presents the model as a realistic system where people in DANs can create the design environment objects and demonstrate the model functions. However, the features of the model are not fully implemented in the prototype.

In Chapter 7 we show how the model is evaluated according to the hypotheses and evaluation methodology defined. Data analysis and findings are presented as well. Discussion based on our findings is conducted at the end of the chapter.

Our conclusion and suggested future work directions are presented at the last chapter, Chapter 8.

### 3.8. Chapter Summary

In this chapter we have presented the methodology of developing and evaluating our research model. We have started with describing the themes and related enablers developed from the literature review. Then we have presented our theoretical constructs and their descriptors. These constructs are complexity, privacy and creativity. We develop the model of these constructs as related to the enablers defined in the research framework based on themes. The research hypotheses have been defined and categorised based on the constructs. Seven hypotheses are defined to be tested for the research model evaluation. These hypotheses are illustrated in the constructs model as well. We then presented our selection of evaluation methodology based on the literature. The methodology selected has been defined and illustrated. At the end of the chapter we have described our plan to develop the research throughout the remaining chapters in this thesis.



# Chapter 4

## Ch4: Types of Dynamic Alliance Networks

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### 4.1. Introduction

The research goal is to develop a model (CoDAN) to support Dynamic Alliance Networks (DANs) for CoDesign. We have also implemented the model and shown qualitatively that it can be used to support DANs.

During the literature review we found that in practice there are a large number of network structures for DANs. Many of these practical structures have common features. Our goal is to identify a common structure by using the theoretical concepts and then show that our model supports all these concepts. By combining the concepts in flexible ways, we can support the practical structures. In this chapter, we develop a classification for such networks by using the theoretical concepts. In the next chapter, Chapter 5, we show how our model, based on these concepts, supports the different types of network.

Our research goal considers three aspects when developing the CoDAN:

- Supporting business networking that brings the best people to address the problem collaboratively.
- Supporting creativity that generates business value from ideas following a process.
- Maintaining privacy by assuring that participants do not lose confidential data.

Supporting business networking is facilitated by allowing businesses to create and manage creativity environments. In these creativity environments, businesses invite each other to join and collaborate for CoDesign.

In the creativity environments, businesses are provided with creativity tools to create and share the knowledge. In our research we present Design Thinking tools as a kind of creativity tools. However, other creativity tools may be included in the model as well.

Maintaining privacy is an important requirement to be supported in these creativity environments. Rules and policies should be defined to provide a kind of control on the creativity environment.

In this chapter we investigate the common features of the different types of the alliance network. Describing the common features of the alliance networks allows the development of the generic model to support these networks in the best way.

In section 4.2 of this chapter we describe the practical classification of the alliance networks from the literature. We identify the features and dynamics of the alliance networks in practical terms. The exploration of the literature includes investigating the different types of alliance networks to define the common features. In section 4.2 we identify 15 types of alliance network based on the literature.

Then in section 4.3 we define the conceptual framework, which we also found from the literature. These concepts include domination, governance, collaboration, knowledge management and privacy.

In section 4.4 we then categorise the 15 types of network discovered in the literature by the practical features.

We reduce them in four categories in terms of the concepts as presented in section 4.5.

Based on these four categories we show the idea of our research model in Chapter 5 and how the model supports these categories in CoDesign.

### 4.2. Practical Classification of the Alliance Networks

Business alliance network is defined in Gulati (1998) as an arrangement between businesses to collaborate in developing products and services. Tallman and Chacar (2011) refer to the alliance network as the network organisation. Network organisation is where organisations join to share knowledge for innovation. Alliance network according to Chen and Chen (2002) is where businesses jointly collaborate based on agreed goals and business outcomes.

In this thesis we refer to an organisation, company or firm as a business. According to the business dictionary (2018a) a business provides goods or services, either privately owned or not-for-profit.

Accordingly, the alliance network can be described as the joining of a number of businesses to design and develop one or more products or services. In the alliance network the joined businesses collaboratively create and share knowledge to achieve goals and outcomes.

Pitt et al. (2006) mention the importance of the alliance networks to the small businesses. Because of the market globalisation, small businesses struggle against large businesses and rapid market changes. For this reason the small businesses are encouraged to be a part of the business networks. That allows the small businesses to develop relationships with the global businesses for collaboration and sharing of resources to enhance the business outcomes.

In the alliance networks participating businesses learn from each other and share skills, technologies and knowledge (Chen and Chen, 2002).

By joining the alliance network, the business must be aware of other members' market, resources and expertise. An alliance network, like the individual business, needs an appropriate kind of management and coordination. Alliance networks are dynamic in their nature, where the participating business develops its relations based on the changes and requirements (Sroka and Hittmar, 2013).

Businesses join the alliance networks, despite the business's sizes, to achieve business goals that cannot be achieved by the individual business itself. In fact, CoDesign is a collaborative process as presented in Chapter 2, Literature Review. According to the literature, the business joins the alliance network as a part of the value chain to develop a product or service. This means the joining businesses participate in the CoDesign process according to their capacities.

In our research we develop a model to support managing these networks for CoDesign by taking into consideration their features and maintaining their privacy.

Next, in this section, we explore the business alliance networks in terms of their dynamics and features. Defining the dynamics and features of alliance networks allows developing the proper idea of supporting these networks for CoDesign.

The literatures have been explored to investigate the types of alliance networks and their dynamics and features. Based on the literatures explored, each literature presents the types of alliance networks according to different criteria and perspectives.

For analysis and easy referencing we tag the types presented in the explored literatures as Type-1, Type-2, Type-3.....

### 4.2.1. Types of alliance networks based on the outsourcing domination

Miles and Snow (1992) classify the alliance networks based on how the outsourcing is dominated in the network. Based on this criterion authors describe three types of alliance network based on the value to be achieved and outsourced as following (Figure 4.1):

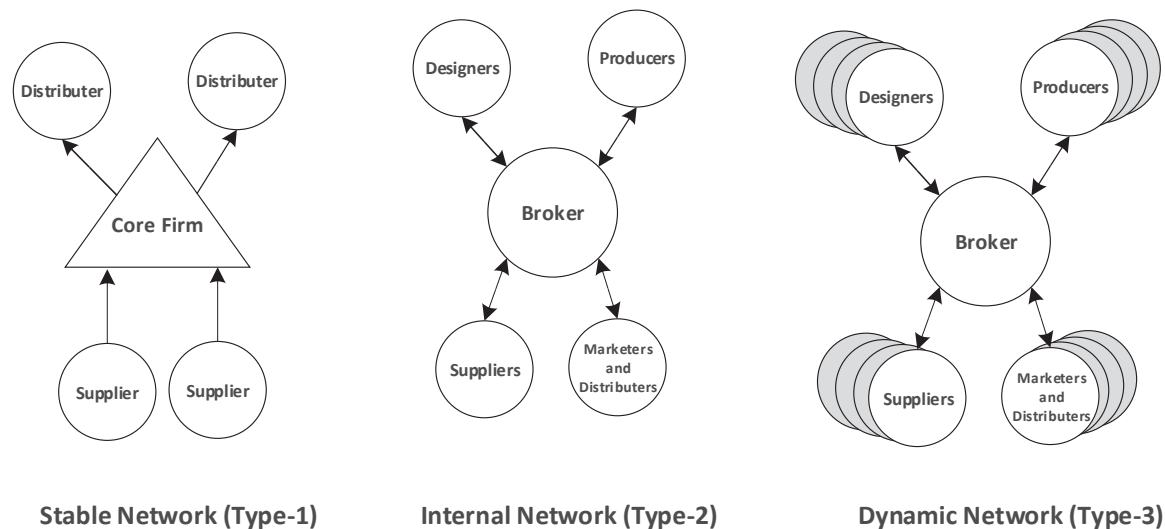


Figure 4.1: Types of Alliance Network (Miles and Snow, 1992)

- **Stable (Type-1):** In this type a core firm invites a number of businesses to participate in the network. Core firm deals with the production and manufacturing processes, while the joined members are either suppliers or distributors. The core business, as shown in Figure 4.1, owns all or most of the assets in the network. For this reason, the network is dominated and governed by the core business. This type of network is stable

because of the long-term relationship between the dominant business and the members in the network. Because of its stability, less outsourcing is needed within the stable network.

- **Internal (Type-2):** this type of network also is dominated by a dominant business that operates as a broker in terms of buying and selling the products. The member of the network can be a supplier, distributor, marketer, designer or producer. As in the stable network, the dominant business owns most or all of the assets in the network. According to Miles and Snow (1992) this type of network is called “Internal” because the units of the core business control the pricing. The members of the network are the businesses that benefit from the collaboration with the dominant business. These benefits are usually in terms of collaboration in the functions of the value chain or by owning a minor part of the assets or shareholdings.
- **Dynamic (Type-3):** in this type the core business, the dominant, operates as a broker such as in the Internal network and usually focuses on creativity and development. The network is re-configured based on the project to be implemented. Once the current project is finished the alliance is decoupled and a new alliance is created. Hence because of this configuration and re-configuration the network is described as dynamic. Like the Internal network, Type 2, the members in the dynamic network benefit from the collaboration with the core firm. These benefits are usually in terms of collaboration in the functions of the value chain or by sharing in a part of the assets. However, in the Dynamic network the dominant business owns all or most of the assets as well.

### **4.2.2. Types of alliance networks based on the members’ relationships**

Child et al. (2005) classify the alliance based on the relationships between the members in the network. Two types of networks have been defined by Child et al. (2005):

- **Dominated network (Type-4):** this type of network is like the stable network (Type-1). In this type there is a single business called the parent and the other small business are connected directly to the parent business. The main relationship of these small businesses is with the parent business which is considered as the dominant. The dominant business controls the activities within the network. The relationship between



the small businesses and the dominant business can be established, for example, by contribution with a minor shareholding and/or by participating in the board membership. The benefit of the dominant business here is to rely on pre-agreed prices for the long-term relationship. An example of the benefits gained by the member in the network is the secure and reliable orders over time that guarantees a stable cash flow.

- **Equal-partner network (Type-5):** in this type there is no single business which controls the network. However, it is not necessary that the members of the network have the same power. In the Equal-partner network, the member can make a relationship with any of the other members. The strength of the relationship differs from one couple of members to another. This kind of network can be configured and re-configured based on the changes and market needs. The lack of a central controller to lead and dominate the network is a disadvantage according to the authors. In fact most of the businesses prefer to network with the businesses of brand names. Equal-partner network can be a transition to the dominated network according to Child et al. (2005).

### **4.2.3. Types of alliance networks based on the relationship with the dominant business**

Liu and Brookfield (2000) classify the alliance networks into four types; star, ring, tiered and multi-centred. This classification also is based on the relationship between the leading business and the members in the network as mentioned by Child et al. (2005). The 4 types are illustrated in Figure 4.2.

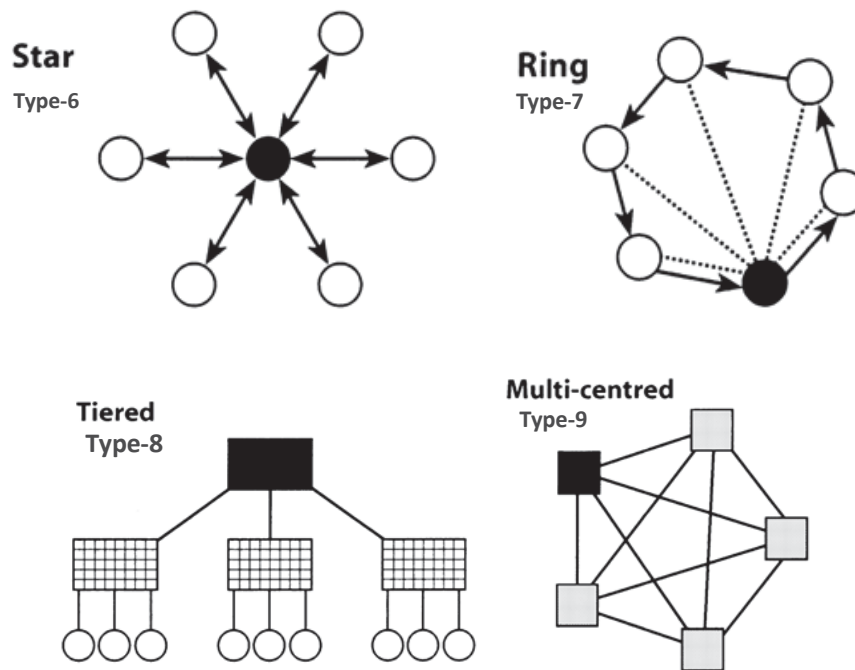


Figure 4.2: Types of Alliance Network (Liu and Brookfield, 2000)

- **Star (Type-6):** in this type of network the alliance is lead by a central business where the other members are surrounding the central business. An example of this network is found in Taiwan where the surrounding businesses operate as suppliers of parts to the central business. The central business operate as the assembly point of these parts to the final product. This kind of network is like the network Type-1 “Stable”, where the suppliers have secure orders which are supplied to the central business (the manufacturer) over time.
- **Ring (Type-7):** The example of this network also is found in Taiwan as the Star type. In the ring structure the assembly process is done through the members of the alliance instead of the central business. Each member participates in one stage of the assembly process. However, the central business still has the role of governing the alliance. In the ring network the manufacturing load is reduced from the central business. The dotted lines shown in the Ring network illustrated in Figure 4.2 represent the flow of knowledge as controlled by the dominant business according to Liu and Brookfield (2000). The dominant business, presented with the black circle, dominates and

controls the knowledge transfer in the network. Although the Ring network is dominated by a central business there is an inter-relationship between the members as well.

- **Tiered (Type-8):** the Tiered network is dominated by several big businesses which take care of the major tasks in the network. Each one of these big businesses deals with its own suppliers. This means the Tiered network can be dominated by more than one business.
- **Multi-Centred (Type-9):** In the Multi-Centred network there is no single business which leads and dominates the network. The governing of the network may change from one business to another in the network based on the product to be developed. This kind of network is flexible in terms of production and leadership. The flexibility in terms of production means that the network may change to a new product once the first one finishes. That is followed by changing the leadership. A new leader may be assigned based on the new product needed to be produced. This is like the case in the Dynamic network, Type-3.

#### 4.2.4. Types of alliance networks based on the stage of growth

Lin and Zhang (2005) classify the alliance networks based on the stage of growth and development by time. These types are illustrated in Figure 4.3 and described as following:

- **Centre-Satellite (Type-10):** This kind of network is dominated by a central business. The member businesses may be larger or smaller than the central business in size. Centre-Satellite network is similar to the Stable network (Type-1) and Star network (Type-6), according to Lin and Zhang (2005). Lin and Zhang (2005) argue that the member of the Centre-Satellite network may process a part of the production such as is the case in the Star (Type-6) and Ring networks (Type-7). Also, some members may have their own alliance within the network such as in the Tiered network (Type-8).
- **Co-opetition (Type-11):** this is the second stage of growth according to Lin and Zhang (2005). There are two types of Co-opetition networks, *the agent type* and the *leader type*. In the *agent type* the network is managed by a trading agent. In the *leader type* the network is lead by a member business. The leading business, in *leading type*, produces products for the same customers of the members in the network. Co-

opetition network is similar to Internal network (Type-2) as mentioned by Lin and Zhang (2005).

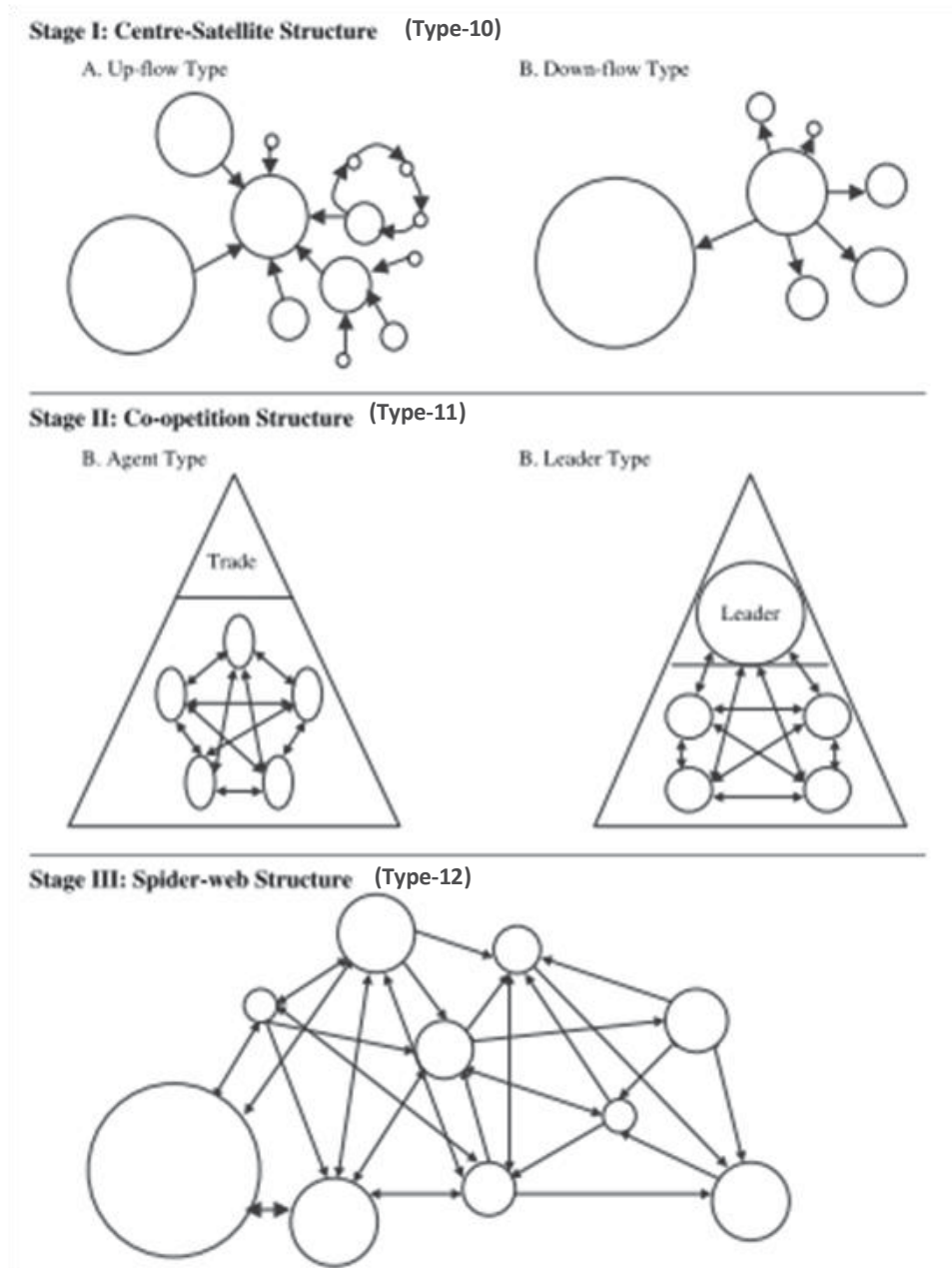


Figure 4.3: Types of Alliance Network (Lin and Zhang, 2005)

- **Spider-Web network (Type-12):** in the Spider-Web structure there are flexible relationships between the members of the network. This kind of network is utilised by the businesses where a central leading business cannot be setup. Projects between members can involve external members, however. As the Spider-Web network has no

leading business it has a similarity with the Multi-Centred network (Type-9). Also, it has a similarity with the Dynamic network (Type-3) as the alliances within the network are re-configured based on the product.

#### **4.2.5. Types of alliance networks based on the management structure**

Sroka and Hittmár (2013) classify the alliance networks based on the management structure. The types of networks based on this classification are:

- **General Meeting (Type-13):** The General Meeting network is joined by businesses while there is no a leading business. The purpose of this kind of network usually is the negotiation between the members in the network to define a dominant business over time.
- **Core and peripheral business (Type-14):** in this type, the network is dominated by a number of businesses with a closed relationship. The dominant businesses represent the core of the network. The core is connected with other businesses by loose relationships. These connected businesses are called the peripherals.
- **Network Management by a leading Company (Type-15):** This is the most common type of networks as per Sroka and Hittmár (2013). In this type a single dominant business leads the group of businesses in the network. The benefit gained by these member businesses is the guaranteed orders over time acquired by the dominant business. This is similar to the case in the Stable network, Type-1.

### **4.3. Dynamic Alliance Network (DAN) Terminology**

Each type of business alliance network presented above is referred to as **Dynamic Alliance Network (DAN)** in this thesis. These networks are considered dynamic alliances because of the changes which can occur within these networks over time. These changes can be seen from different aspects including; the size of the DAN, the DAN structure, the relationships and the collaborative activities conducted in the DAN. These aspects can be described as follows:

- ***The change of the size of the DAN.*** The size of the DAN is determined by the number of members in the network. Increasing of the network size is considered as a sign of

success. The more competitive the dominant business, the more businesses are willing to join the network, and the size of the network increases (Sroka and Hittmár, 2013). In our research we develop a model for supporting the businesses in the DAN to create their creativity environments for CoDesign. In terms of the increasing and decreasing of the DAN size, the model should provide the capabilities of new participants joining or existing participants resigning flexibly in the creativity environment.

- ***The change of the structure of the DAN:*** The structure of the DAN may change from one form to another. The most common scenario of this kind of change is when transitioning from the not dominated to dominated DAN type. An example of this reformation is when transitioning from the General Meeting (Type-13) to the Network Management by a Leading Business (Type-15) according to Sroka and Hittmar (2013). Our model, CoDAN, should provide a capability to such networks to modify the existing creativity environment to support the new structure. The other option is to provide a capability to create a new creativity environment to facilitate the new DAN structure.
- ***The change of the collaborative activities in the DAN.*** Businesses create DANs for competitive advantages. These competitive advantages are achieved by creating collaborative activities among businesses to develop products or services. The collaborative activities may change according to the change of business goals within the network. For example, when a new innovation is introduced new activities may evolve or the existing activities may be modified. The change in the collaborative activities may include a change in the teams which perform such activities. Changing the teams includes evolving new teams or bringing in new members to the existing teams. CoDAN should provide the capability to deal with creating the collaborative activities and managing the teams which perform such activities.

Based on the aspects stated above the alliance networks are considered dynamic in their nature. Accordingly, the alliance network is referred to as the Dynamic Alliance Network (DAN) in this thesis.

The types of DAN have been presented according to different literatures and different criteria mentioned in these literatures. However, that does not mean these are the only types of DAN; other types of DAN with other features and dynamics may be extracted from the literature. The main purpose of our investigation is to have an idea about the

major types of DAN. Accordingly, we develop, as explained next, our conceptual framework based criteria to classify these networks to support them for CoDesign. This conceptual framework can be then applied to any type of DAN which might not be presented here.

## 4.4. Conceptual Framework

In this research we develop a model, CoDAN, to support the DANs for CoDesign. The aim is to facilitate the businesses in the DAN to create creativity environments for networking and collaboration. That includes providing creativity tools to perform different CoDesign activities. CoDAN should provide methods to maintain privacy in the creativity environment.

In the creative environment businesses collaborate to carry out CoDesign activities. Through these activities businesses negotiate, share ideas and collaborate for designing products and services. By performing CoDesign activities businesses in the DAN create and share knowledge. Businesses are provided with creativity tools to create and share knowledge within the CoDesign activities.

Accordingly, there are a number of issues to be addressed here:

- Who does setup, control and manage the creativity environments for the DAN?
- Who does govern the creativity environment?
- Who does dominate the knowledge and manage it?
- How the relationships between businesses are defined in the DAN for collaboration?
- how are the levels of privacy defined to develop different methods for the businesses to collaborate based on these levels of privacy?

We address these questions in terms of the conceptual framework according to the following concepts:

- Domination.
- Governance.
- Collaboration.
- Knowledge Management.
- Privacy.

These concepts are defined based on the literature exploration as well. By defining these concepts we create the conceptual framework. The 15 types of DANs described previously are also re-defined against the conceptual framework in the Table 4.1.

Explaining these concepts and their features and how they are applied to the DAN types as presented in Table 4.1 are explained in the section 4.4 next.

Conceptual framework should not result in confusion with research framework defined at the end of Chapter 2, Literature Review. Research framework defines the themes and their related enablers to be supported by CoDAN to manage CoDesign in DANs. Conceptual framework in this chapter, Chapter 4, is represented by concepts to be applied to the different types of DANs to define their features and dynamics. Conceptual framework mainly focuses on business networking theme of research framework. Defining the DAN types and their features helps to develop the best approach to support the enablers defined in the research framework. For example, by defining the DAN in terms of domination and governance that provides an idea for how to govern and control the creativity environment in CoDAN. By knowing how the knowledge is dominated and managed within the DAN that provides an idea on how the knowledge to be dominated and knowledge processes to be enabled in CoDAN.



Table 4.1: DAN Types against the concepts of the conceptual framework

Types		Domination		Governance		Collaboration		Knowledge Management		Privacy	
		Dominated	Contributed	Hierarchical	Flat	Open	Closed	Dominated	Shared	Low	High
Type-1	Stable	✓	✓	✓			✓	✓			✓
Type-2	Internal	✓	✓	✓			✓	✓			✓
Type-3	Dynamic	✓	✓	✓			✓	✓			✓
Type-4	Dominated network	✓	✓	✓			✓	✓			✓
Type-5	Equal-partner network		✓		✓	✓	✓		✓		✓
Type-6	Star	✓	✓	✓			✓	✓			✓
Type-7	Ring	✓	✓	✓			✓	✓			✓
Type-8	Tiered	✓	✓	✓			✓	✓			✓
Type-9	Multi-Centered		✓		✓	✓	✓		✓		✓
Type-10	Centre-Satellite	✓	✓	✓			✓	✓			✓
Type-11	Co-opetition		✓	✓			✓	✓			✓
Type-12	Spider-Web		✓		✓	✓	✓		✓		✓
Type-13	General Meeting		✓		✓	✓			✓	✓	
Type-14	Core and peripheral business	✓	✓	✓			✓	✓			✓
Type-15	Network Management by a Leading Business	✓	✓	✓			✓	✓			✓

## 4.5. DAN Types Based on the Conceptual Framework

### 4.5.1. Types of DANs based on the domination concept

The domination concept has been observed from the explored literature to define the types of DANs presented previously in the section 4.2. Accordingly we define two features under the domination concept as follows:

- **The dominated DAN:** The DAN is considered *dominated* if it is dominated by at least one business. The DAN can be dominated by more than one business. The business which dominates the DAN is called the *dominant business*. The business dominates the DAN when, for example, it owns all or most of the assets and/or shareholdings in the network. Also, the domination is gained when the dominant business has an experience and expertise over the other member businesses in the network.
- **The contributed DAN:** the DAN is considered as contributed when a number of businesses participate in the DAN. One of the reasons which leads businesses to participate is to benefit from the opportunities provided by the network. This is the case of the dominated DAN such as Type-1 and Type-2 according to Table 4.1. Also, the contribution can be for introduction and negotiating the business opportunities and goals such as in the case of the DAN of Type-13, General Meeting.

Based on the two features of DAN, according to Table 4.1, DANs can be considered as *dominated and contributed* or *contributed only*.

As shown in the Table 2.1 there are two types of DANs according to the domination concept:

- ***The dominated and contributed DAN type:*** In this type the DAN is dominated by at least one dominant business and the other members are contributors. This type represents most of the DAN types listed in Table 4.1. The DAN types considered as *dominated and contributed* are; Type-1, Type-2, Type-3, Type-4, Type-6, Type-7, Type-8, Type-10, Type-14 and Type-15.

***The contributed only DAN type:*** In the *contributed only DAN* type there is no dominant business. Businesses contribute to provide an advantage and/or gain an advantage. The contribution usually is as being a part of the value chain in the network. The members of these DANs may perform business collaboration without involving a dominant business as in the case of Type-11 “Co-opetition”. The other scenario of the contributed only DAN may be developing to the *dominant and contributed* type. An example of this scenario is the case of Type-13 “General Meeting” which can be developed to Type-14 “Core and peripheral business” according to the literature.

The types of DANs considered as *contributed only DAN* type are; Type-5, Type-9, Type-11, Type-12 and Type-13.

#### **4.5.2. Types of DANs based on the governance concept**

The governance of the DAN defines how the process inside the network is supervised in terms of management and coordination. Examples of the governing business tasks are coordinating the network and assigning the roles. We suggest two kinds of governance, based on Pisano and Verganti (2008), the hierarchical governance and the flat governance.

- **Hierarchical governance:** According to Pisano and Verganti (2008) the *hierarchical governance* is where a specific business has the authority to supervise the process in the DAN. This business is considered the *governor* or the *governing business*. The governing business defines the problem, selects the solutions and selects the proper contributors for solving the problem.
  - In the Table 4.1 the network is considered as *hierarchical governed DAN* if there is any evidence from the literature which refers to this kind of governance. This is as the case of the “Co-opetition” network (Type-11). The Co-opetition network is governed by an external agent business or a member business from the network itself, according to the literature.
  - The DAN also is considered of *hierarchical governance* if it is dominated and the literature does not refer to the governance of the DAN.

The following types, as shown in the Table 4.1, are with the hierarchical governance; Type-1, Type-2, Type-3, Type-4, Type-6, Type-7, Type-8, Type-10, Type-11, Type-14 and Type-15.

- **Flat governance:** The *flat governance*, according to Pisano and Verganti (2008), is when the members of the network share the responsibility of governing and supervising the network. The flat governance usually encourages sharing the costs, risks and challenges between the members in the DAN.
  - One of the options of the flat governance is when the member businesses share governing the projects in the DAN, a different governor for each project. An example of this option is the Equal-partner network, Type-5
  - The other option of the flat governance is when there is no governing business in the DAN as the case of the General Meeting network, Type-13.

As shown in Table 4.1 the DAN type is considered with *flat governance* if it is not dominated unless there is an evidence from the literature about the governance.

Types of DAN considered with flat governance are; Type-5, Type-10, Type-12 and Type-13.

Again, although the Type-11 “Co-opetition” is not a dominated network, but it is considered with hierarchical governance by the evidence from the literature. Co-opetition network is either governed by a member business or an external business agent as per literature.

### 4.5.3. Types of DANs based on the collaboration concept

Based on collaboration concept we suggest two modes of collaboration according to Pisano and Verganti (2008), the closed mode and open mode.

- **Closed mode collaboration:** Pisano and Verganti (2008) considers the network is in *closed mode collaboration* if the problem and knowledge domain are defined and the proper collaborators are selected. As shown in Table 4.1 the dominated DANs are considered with closed mode of collaboration. According to the literature, the dominated DANs are created by a dominant business where the members of the DAN are selected and invited by the dominant business. The selection of these members of course is based on the problem to be solved, business goals and the innovation to be

developed. The DAN types that are considered with closed mode of collaboration are Type-1, Type-2, Type-3, Type-4, Type-6, Type-7, Type-8, Type-10, Type-14 and Type-11. Again, the Type-11 “Co-opetition” is considered with closed mode collaboration while it is not a dominated DAN. The reason is that the local businesses form this kind of network to compete with the international businesses in a specific industry according to Lin and Zhang (2005). In this case the businesses in the network define the business goals and the domains of knowledge according to the products or services to be developed.

- ***Open mode collaboration:*** In this mode, knowledge domain is not defined as by the definition of Pisano and Verganti (2008). Businesses which collaborate in open mode may develop to the closed mode over time. This mode is more about sharing ideas and negotiation. The DAN type which suits the *open mode collaboration* is the General Meeting network (Type-13).
- ***Open and closed mode collaboration:*** In the Table 4.1 the DAN types Type-5 (Equal-Partner), Type-9 (Multi-Centred) and Type-12 (Spider-Web) are ticked as with open and closed mode of collaboration. This does not mean that these DANs perform the open mode and closed mode at the same time. These DANs, as per their features from the literature, shift from one project to another over time. Also, these DANs are not dominated and the governance of the network is handled by any member based on the project itself. Accordingly, the members in these DAN types enter open mode to negotiate the idea of the project, for example, and who will govern it. The member businesses then define the knowledge domain and the DAN starts in closed mode of collaboration for developing the project.

#### **4.5.4. Types of DANs based on the knowledge management**

Knowledge Management (KM) here means the processes taking place in the DAN, including knowledge creating, knowledge transferring and knowledge sharing. In relation to the KM concept KM processes are to be dominated or shared.

- ***Dominated KM:*** the KM is considered dominated when at least one business controls the KM processes in the DAN. This definition suits the dominated DANs. In the dominated DANs the dominant business is considered as a central point that leads and manages the network. The case of dominated knowledge management is described by

Sroka and Hittmár (2013). The governing business according to Sroka and Hittmár (2013) facilitates the knowledge sharing and transferring between the members in the network. Also, the governing business acts as a repository of the knowledge in the network. In the dominated KM DANs the relationships and flow paths of the knowledge are well defined and under the control of the dominant business. Based on the Table 4.1 the DAN types considered with dominated KM are; Type-1, Type-2, Type-3, Type-4, Type-6, Type-7, Type-8, Type-10, Type-11, Type-14 and Type-15.

- **Shared KM:** the KM is considered shared, not dominated, when there is no specific business which dominates the KM processes. The sharing of the knowledge management does not involve a specific business as a central point of management. The knowledge is shared and transferred based on the relationships between the members of the network. The knowledge flow paths are not well defined as the case of DANs with dominated KM. Policy can be defined by the members of the DAN to outline the knowledge management and control in the network. Based on the Table 4.1 the DAN types considered with dominated KM are; Type-5, Type-9, Type-12 and Type-13.

### 4.5.5. Types of DANs based on the privacy concept

As we mentioned earlier in this thesis the maintaining of privacy is a requirement to be supported by our model. Also, there is a lack of research in relation to implementing privacy in CoDesign and knowledge management as mentioned previously in Chapter 2. We here create guidelines in order to define the privacy concept in our conceptual framework. These guidelines are defined based on the literature as follows:

- According to Mohamed and Ahmad (2012) one of the factors that makes the knowledge of high privacy concern is the loss of the knowledge. Losing the knowledge means, it may be captured and used by unauthorised people and businesses. In the case of DANs the lost knowledge may be utilised by the competitors.
- According to Zeng et al. (2012), collaboration becomes a way for designing and developing products and services. Hence, protecting and controlling the access to the knowledge become a requirement in such collaborative environments.

- According to Preibusch (2013) maintaining the knowledge privacy is to limit and control accessing the knowledge to only those who are authorised.
- Preibusch (2013) reports that the privacy concern should be identified to maintain the privacy of the knowledge. The author mentions two levels of privacy concern, high level and low level.

Based on these guidelines we define two levels of privacy concern; high level and low level as mentioned by Preibusch (2013). These levels are described as following in relation to the types of DANs:

- **High level of privacy concern:** In the high level of privacy the privacy is with a high concern in the DAN. The DAN is considered with a high level of privacy when there are design and development processes performed among the members of the DAN. When supporting the DAN with a high level of privacy requirement, methods should be defined and implemented to control accessing the knowledge and the other components in the best way. In the Table 4.1 all of the DAN types are considered with high level of privacy except the Type-13, General Meeting. These DANs are more about design and development as per the literature. For example, the Type-5, “Equal-partner network” is not a dominated network and the privacy is considered in a high level of concern. That is because there are design and development processes among the members in the network.
- **Low level of privacy concern:** In the low level of privacy the privacy is with a low concern in the DAN. The DAN is considered with a high level of privacy concern when there are no design and development processes performed among the members of the DAN. In the DAN with low level of privacy, the privacy of knowledge and components are with less concern than in the high level. Type-13 “General Meeting” is the only type of DAN that is considered with low level of privacy concern. In this type of DAN there are no activities which are considered competitive such as designing or developing. The low level of privacy concern does not mean the privacy should not be considered when creating the creativity environment. It should be considered but not as the case in the high level of privacy concern.

In the next chapter, Chapter 5, we explain how DANs are supported either if they are with high or low level of privacy concern.

Based on the concepts and the related features of our conceptual framework we categorise and simplify the 15 types of DANs in Table 4.1 as explained in the next section and presented in Table 4.2.

## 4.6. Categories of DANs Based on the Conceptual Framework

In the previous section we have defined the features of each DAN type based on the concepts of our conceptual framework. Each type of DAN has been defined in terms of each of the following concepts:

- Domination: the DAN can be either *dominated and contributed* or *contributed only*.
- Governance: the DAN is with *hierarchical* or *flat* governance.
- Collaboration: the DAN is with *open mode* of collaboration, *closed mode* of collaboration or *both modes* of collaboration.
- Knowledge Management: the DAN is with *dominated* or *shared* knowledge management.
- Privacy: the DAN is either with a *high level* or *low level* of privacy concern.

Based on the conceptual framework the Table 4.2 below summarises the 15 types of DANs into four categories.

Table 4.2: The four categories of DANs based on the conceptual framework

Category	Concepts	DAN types
Cat-1	<ul style="list-style-type: none"> <li>• Domination: Dominated &amp; Contributed.</li> <li>• Governance: Hierarchical</li> <li>• Collaboration: Closed mode</li> <li>• KM: Dominated</li> <li>• Privacy concern: High</li> </ul>	Type-1, Type-2, Type-3, Type-4, Type-6, Type-7, Type-8, Type-10, Type-14, Type-15



Cat-2	<ul style="list-style-type: none"> <li>• Domination: Contributed</li> <li>• Governance: Flat</li> <li>• Collaboration: Open &amp; Closed modes</li> <li>• KM: Shared</li> <li>• Privacy concern: High</li> </ul>	Type-5, Type-9, Type-12
Cat-3	<ul style="list-style-type: none"> <li>• Domination: Contributed</li> <li>• Governance: Hierarchical</li> <li>• Collaboration: Closed mode</li> <li>• KM: Dominated</li> <li>• Privacy concern: High</li> </ul>	Type-11
Cat-4	<ul style="list-style-type: none"> <li>• Domination: Contributed</li> <li>• Governance: Flat</li> <li>• Collaboration: Open mode</li> <li>• KM: Shared</li> <li>• Privacy concern: Low</li> </ul>	Type-13

In the following sub-sections, we explain each of the four categories of DANs.

#### 4.6.1. DANs Category 1 (Cat-1)

The types of DAN which fall into Cat-1 are; Type-1 “**Stable**”, Type-2 “**Internal**”, Type-3 “**Dynamic**”, Type-4 “**Dominated network**”, Type-6 “**Star**”, Type-7 “**Ring**”, Type-8 “**Tiered**”, Type-10 “**Centre-Satellite**”, Type-14 “**Core and peripheral business**”, Type-15 “**Network management by a leading company**”.

Based on the literature the general features of these DANs are as follows:

- All these DANs are dominated by at least one business.
- All these DANs are contributed to by businesses for collaboration in design and development.
- The contributing business is involved in one or more of the value chain functions.
- The relationships and communication links in these networks are well defined. That gives an idea of how the knowledge flows in the network.

Based on the conceptual framework the features of the Cat-1 are as follows:

- **Domination: *Dominated & Contributed*.** DANs of Cat-1 are dominated. At least one business in the network dominates the DAN. The other businesses contribute to benefit from the advantages provided in the DAN.
- **Governance: *Hierarchical*.** Cat-1 DANs are governed by at least one business. The governing business, which here is usually the dominant business, supervises and coordinates the processes inside the DAN.
- **Collaboration: *Closed mode*.** The governing business, which here is the dominant business, identifies the knowledge domain for the DAN members to collaborate for a defined project and selects the contributors.
- **KM: *Dominated*.** Knowledge management processes including knowledge sharing and transfer are dominated by the governing business. In the dominated DANs the governing business is usually the dominant business itself. According to the literature the structure of the dominated types of DANs shows that the knowledge flow links are connected centrally with the dominant business. The dominant business decides what knowledge is to be shared and transferred and to whom. Type-11 of DAN, the Co-opetition network, is not dominated. However, KM processes are dominated by the governing business, then KM is considered dominated here.
- **Privacy concern: *High*.** DANs of this category are with a high level of privacy concern. The members of this DANs category collaborate in design and development. Accordingly, the competitive advantage is created where dealing with knowledge should be controlled in a high level of privacy.

Here we present a scenario that demonstrates the category Cat-1 of DANs.

**Scenario: Cisco DAN**

The scenario, Cisco DAN, demonstrates the Cat-1 DANs. The scenario is derived from Furr et al. (2016). Furr et al. (2016) explain the multiparty innovation by presenting Cisco collaborative labs as an example. Cisco has established what is called Cisco Hyperinnovation Living Labs (CHILL). In CHILL, as illustrated in Figure 4.4, Cisco invites different businesses for networking to negotiate and share ideas of projects. These ideas are converted to projects. Businesses which join the CHILL are considered the members of the Cisco DAN. Once specific businesses agree to implement an idea they

create their own alliance under the governance of Cisco and they start implementing the project. The outcome of the project here is a prototype for a product or service to be presented to investors later on.

The guidelines of the Cisco DAN are as following:

- Each business can be represented by 6 people maximum.
- The process is dominated and governed by Cisco
- Intellectual Property protection is guaranteed which encourages businesses to share knowledge without fear.
- Each alliance in the DAN should not include more than 4 businesses.

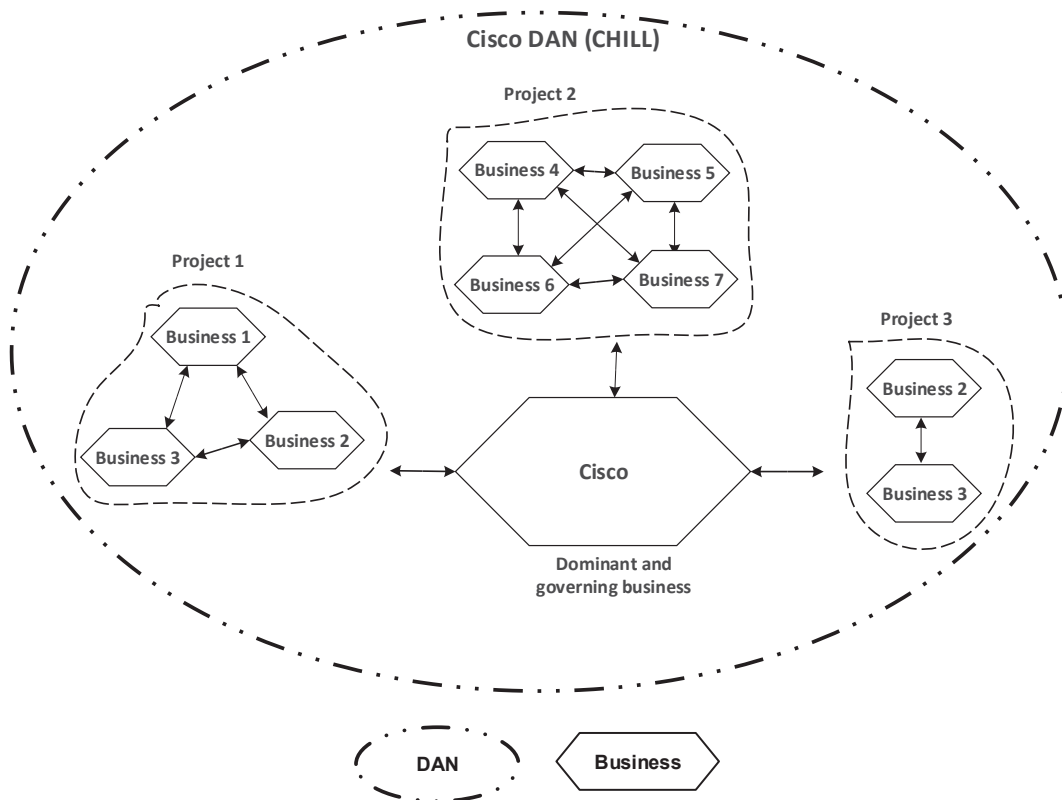


Figure 4.4: Cisco DAN Scenario as derived from Furr et al. (2016)

Based on the categories of DAN defined, CHILL, the Cisco DAN, has the Cat-1 features:

- Domination: *Dominated and Contributed*. CHILL is dominated by Cisco and contributed by the businesses invited.
- Governance: *Hierarchical*. Processes in CHILL are governed and coordinated by Cisco.

- Collaboration: *closed mode*. Knowledge domains within the alliances are well defined and contributors are selected by Cisco.
- KM: *Dominated*. Relationships and links between businesses in the DAN are defined by Cisco. KM processes are dominated by Cisco to protect the businesses' IPs.
- Privacy concern: *High*. Privacy here is of high concern. IPs should be protected and the businesses in the alliances perform design and developing processes.

We revisit the Cisco DAN scenario later in Chapter 5 to show how it is supported by our research model, CoDAN.

#### 4.6.2. DANs Category 2 (Cat-2)

The types of DANs which fall into Cat-2 are; Type-5 “**Equal-partner network**”, Type-9 “**Multi-Centred**” and Type-12 “**Spider-Web**”.

Based on the literature the general features of these DANs are as follows:

- There is no business in the network which has the power to dominate the DAN.
- All these DANs are joined by businesses for collaboration in design and development.
- More than one project can be established in DANs of Cat-2. The governing business can be different from one project to another.
- The contributing business is involved in one or more of the value chain functions.
- The relationships and communication links in these networks are not well defined as in the DANs of Cat-1. The knowledge can flow between any couple of businesses.

Based on the conceptual framework the features of the Cat-2, as shown in Table 4.2, are as follows:

- **Domination: Contributed.** There is no dominant business in the DANs of Cat-2. The businesses contribute in these DANs collaborate without involvement of a dominant business.

- **Governance: *Flat*.** Cat-2 DANs are not governed by a specific business. Coordinating the processes can be shared between the contributors. The other option, the contributors can agree about the governing business for each emerged project.
- **Collaboration: *Open and Closed mode*.** Collaboration in Cat-2 DANs is mainly in the closed mod. However, collaboration can be started in open mode to brainstorm an idea of a project, for example. By creating the idea, the knowledge domain is defined and the collaboration then starts in the closed mode.
- **KM: *shared*.** As the governance is flat there is no domination on the knowledge management processes by a specific business. KM is dominated by the business that governs the project which is different from one project to another.
- **Privacy level: *High*.** DANs of Cat-1 are with a high level of privacy concern. The members of these DANs collaborate in design and development. Accordingly, the competitive advantage is created where dealing with knowledge should be controlled in a high level of privacy.

#### 4.6.3. DANs Category 3 (Cat-3)

The only type of DAN to fall into Cat-3 is the Type-11 “**Co-opetition**”.

Based on the literature the general features of Type-11 DAN are:

- There is no business in the network that has the power to dominate the DAN.
- Businesses join this type of DAN for collaboration in design and development.
- The contributing business is involved in one or more of the value chain functions.
- This type of network is governed by a contributing business or an external business agent.
- The relationships and communication links in these networks are not well defined as in the DANs of Cat-1. The knowledge can flow between any two businesses in the network.

Based on the conceptual framework the features of the Cat-3, as shown in Table 4.2, are as follows:

- **Domination: Contributed.** DANs of Cat-3 are contributed. There is no dominant business in the DANs of Cat-3. The businesses contribute in these DANs to collaborate without involvement of a dominant business.
- **Governance: Hierarchical.** Based on the Type-11 general features, the only type represents Cat-3, the DANs of this category are governed by a governing business or external agent. The governor supervises and coordinates the processes inside the DAN.
- **Collaboration: Closed mode.** The governor identifies the domain knowledge for the DAN members.
- **KM: dominated.** The knowledge flow links are not well defined based on the structure of the Type-11. It is the task of the governor to identify and dominate the knowledge flow and transfer between the contributing businesses.
- **Privacy: High.** DANs of this category are with a high level of privacy concern. The members of these DANs category collaborate in design and development. Accordingly, the competitive advantage is created where dealing with knowledge should be controlled in a high level of privacy.

#### 4.6.4. DANs Category 4 (Cat-4)

The only type of DAN which falls into Cat-4 is the Type-13 “**General Meeting**”.

Based on the literature the general features of Type-13 DAN are as follows:

- There is no business in the network that has the power to dominate the DAN.
- Businesses join this type of DAN for negotiation and sharing ideas only.
- There is no specific business that dominates or governs the DAN.
- The relationships and communication links in these networks are not well defined as in the DANs of Cat-1 for example. The knowledge can flow between any two businesses in the network.

Based on the conceptual framework the features of the Cat-4, as shown in Table 4.2, are as follows:

- **Domination: Contributed.** DANs of Cat-4 are contributed. There is no dominant business in the DANs of Cat-4.

- **Governance: *Flat*.** Cat-4 DANs are not governed by a specific business.
- **Collaboration: *Open mode*.** There is no specific knowledge domain identified.
- **KM: *Shared*.** Knowledge management processes including knowledge sharing and transfer are shared. There is no a specific business that dominates the KM in the DAN.
- **Privacy concern: *Low*.** DANs of this category are with a low level of privacy concern. The members of these DANs category do not collaborate in design and development. Accordingly, there is no competitive advantage created and the knowledge is considered with low level of privacy concern.

In this chapter we have identified the general features of the different DAN types based on the conceptual framework we developed.

In the next chapter, Chapter 5, we define our research model, CoDAN, and how it can be utilised to support the DAN types of the four categories presented earlier.

## 4.7. Chapter Summary

In this chapter we have explored more literature in order to investigate the Dynamic Alliance Networks (DANs) practical features and dynamics. Literatures have presented the types of business alliance networks based on different criteria. These criteria include the outsourcing domination, network members relationships, stage of growth and management structure. 15 types of DANs have been presented as a result of this investigation. To simplify the features of DANs to develop a generic model to support them we have developed a conceptual framework to define these features. The five concepts; domination, governance, collaboration, knowledge management domination and privacy concern levels have been defined. These concepts with their defined features represent the conceptual framework. The 15 types of DANs have been defined against the concepts and their features according to the conceptual framework. The 15 types have been categorised into four categories according to these conceptual features. These features provide a general idea and understanding of DANs to develop the model to support them for CoDesign as will be explained in the next chapter.

# Chapter 5

## Ch5: Research Model

### 5.1. Introduction

In this chapter we define our research model, CoDAN. CoDAN allows businesses to define different kinds of spaces which can be combined to support the different kinds of business networks. We show how the different kinds of spaces can be configured to support the different DAN types described in Chapter 4. DAN types are summarised in Table 4.2. and classified into four categories based on the concepts of domination, governance, collaboration modes, knowledge management domination and privacy concern levels.

In section 5.2, in this chapter, we first describe the kinds of spaces supported by CoDAN, DAN space and CoDesign space. In section 5.3 we show how the spaces support the concepts of conceptual framework in section 4.3 in Chapter 4 by making a distinction between Governed DAN space and Not-Governed DAN space. Basically, this distinction is needed to support the concepts in the conceptual framework. We then show, in more detail, how they are needed to support each of the four categories of DAN types in Table 4.2.

In the sections 5.5, 5.6 and 5.7 we explain in more details CoDAN including roles that are necessary to manage privacy and knowledge transfer. We then present the structure of CoDesign activities and creativity tools and how to relate them to the two types of the DAN space, the Governed and Not-Governed. The relation of the roles, activities and tools with the spaces is to be explained based on the privacy modeling as well. We also show how roles, CoDesign activities and creativity tools are utilised to support the different types of DAN as well.



Different scenarios are presented in this chapter to demonstrate how CoDAN supports the different types of DANs.

Figure 5.1 illustrates the different types of spaces that can be defined by CoDAN. As shown in the figure there are two major types of spaces, DAN-Space and CoDesign-Space. DAN spaces show the businesses that work together and CoDesign-Spaces show how they work together. CoDesign-Spaces are created into the DAN-Space as shown by the dashed arrow. DAN-Space is also classified to two types, Governed and Not-Governed.

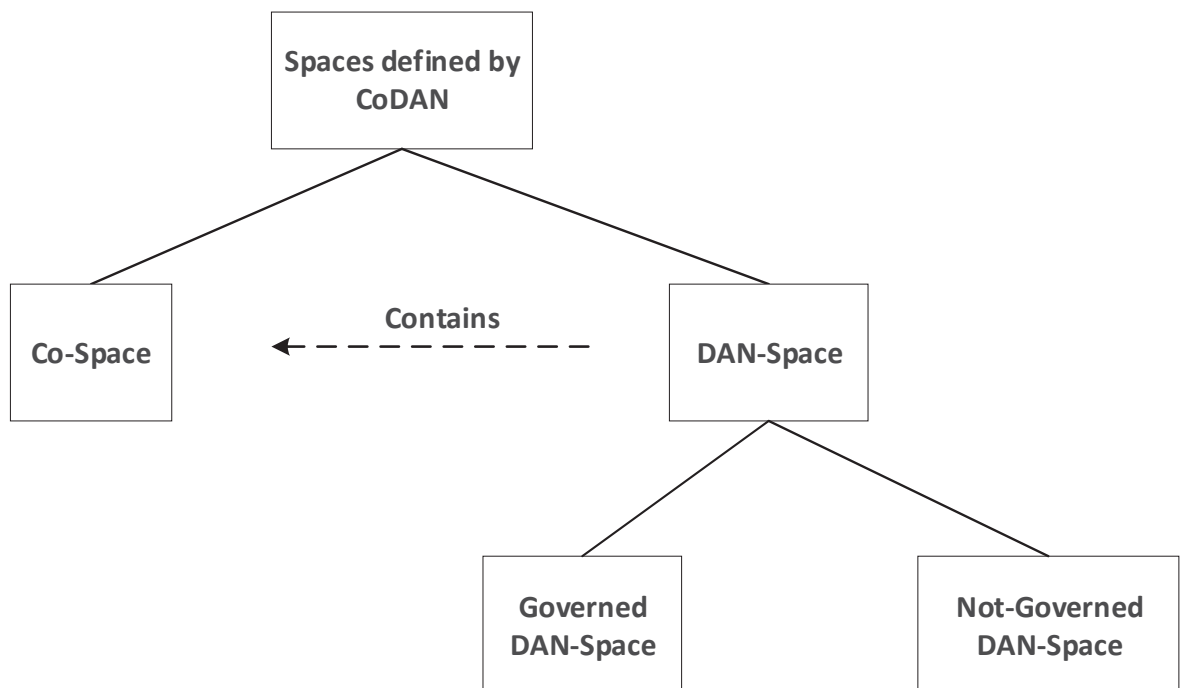


Figure 5.1: The kinds of spaces defined by CoDAN

In the next section we explain our idea of spaces and how it is utilised to support the DAN categories as defined in Table 4.2 based on the conceptual features.

## 5.2. DAN Spaces (DAN-Spaces) and CoDesign Spaces (CoDesign-Spaces)

Our idea in this research is to support DANs by providing ways to create DAN-Spaces and CoDesign-Spaces, using CoDAN. A CoDesign-Space in this research is where a group of people from a DAN join together to carry out the tasks in a DAN-Space. CoDAN creates DAN-Spaces for businesses in DAN and businesses in a DAN-Space create CoDesign-

Spaces to carry out their work. The idea of DAN-Spaces, and CoDesign-Spaces are illustrated in Figure 5.2.

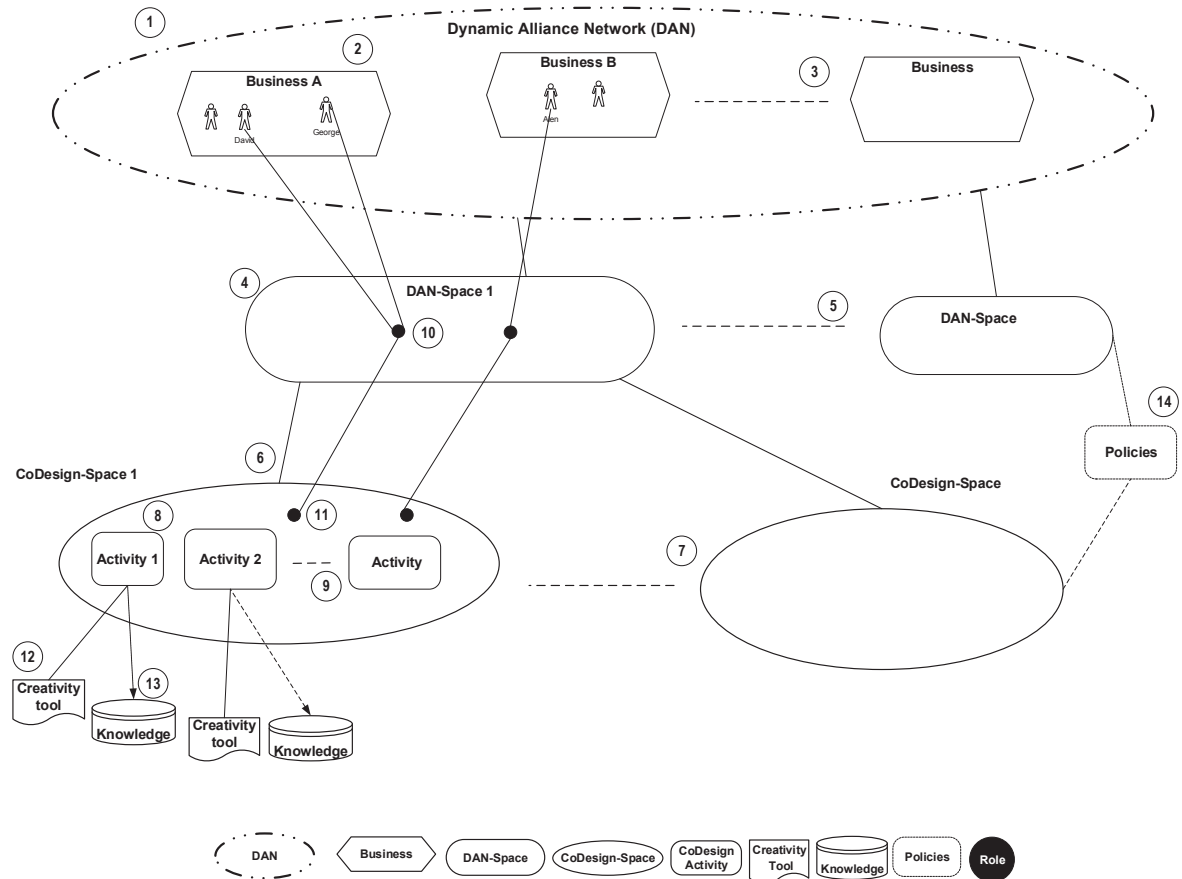


Figure 5.2: CoDAN model (DAN-Spaces and CoDesign-Spaces)

Numbers in the diagram are referred to in the text

In a dynamic networking environment we can start with a minimum of two businesses, and then use CoDAN to develop the network as new knowledge is needed. In summary Figure 5.2 shows:

- DAN businesses network together to collaborate through Dynamic Alliance Network (DAN) (1 & 2).
- There is an unlimited number of businesses in DAN (3).
- Businesses in DAN use CoDAN to create DAN-Spaces (4). Each such DAN-Space includes any number of people from businesses in the DAN.
- There is an unlimited number of DAN-Spaces that can be created by the DAN utilising CoDAN (5).
- Businesses that participate in the DAN-Space can create CoDesign-Spaces (6).

- There is an unlimited number of CoDesign-Spaces created under a single DAN-Space (7).
- CoDesign activities are created in the CoDesign-Spaces (8) by authorised members of the DAN-space.
- There is an unlimited number of CoDesign activities created in a single CoDesign-Space (9).
- People in businesses are assigned roles when they join DAN-Spaces and CoDesign-Spaces. The roles in the two kinds of spaces are different (10 & 11).
- People assigned to CoDesign-Spaces utilise creativity tools to perform the CoDesign activities (12).
- Knowledge created is stored based on the activity. This knowledge is retrieved for sharing and transfer by utilising the tools (13).
- Policies are created based on the roles assigned to people who join DAN-Spaces and CoDesign-Spaces. These policies are created based on defined control rules for maintaining privacy in CoDAN (14).

In Chapter 2, Literature Review, we show that customers, consumers and users are a main part of CoDesign process. Although the model presented in Figure 5.2 focuses on DANs but the model allows customers, consumers and users to have roles within DAN-Spaces and CoDesign-Spaces. The scenario presented in Figure 5.12 later in this chapter shows how our model supports these participants in CoDesign.

The remainder of the chapter describes CoDAN in more detail.

### **5.2.1. DAN Space (DAN-Space)**

As shown in Figure 5.2 DAN represents the alliance network. Businesses in DAN decide on some ideas, and create DAN-Spaces where selected businesses CoDesign to follow up the ideas. They create CoDesign-Spaces where designers, experts and stakeholder join to bring in new knowledge. In CoDAN:

1. An unlimited number of DAN-Spaces can be created by member businesses in the DAN.

2. It is not necessary that all of the businesses in the DAN participate in each DAN-Space. Participation in the DAN-Space depends on factors such as the type and structure of the DAN itself and what is to be done.
3. Dominating and governing the DAN-Space also depends on the structure and the type of the DAN as will be explained later in this chapter.

The DAN-Space defined in CoDAN itself is classified into 2 types, the Governed and Not-Governed as will explained later in this chapter.

### **5.2.2. CoDesign Space (CoDesign-Space)**

CoDesign space (CoDesign-Space) is where actual design activities take place. CoDesign-Spaces are created in the DAN-Spaces and joined by people who participate in the DAN-Space. CoDesign-Spaces support the CoDesign level in our model. CoDesign-Space contains the CoDesign activities that are performed by utilising the creativity tools. Activities, in a business context, are described in Hawryskiewicz (2010) as a breakdown of the business process. In this research, CoDesign activities are a break-down of CoDesign process. CoDesign activities are created in the CoDesign-Spaces and performed using creativity tools by the people in CoDesign-Spaces. The relation between the CoDesign-Spaces and DAN-Spaces can be summarised as follows:

1. Unlimited number of CoDesign-Spaces can be created from a single DAN-Space.
2. People who participate in the DAN-Space can be assigned to any CoDesign-Space.
3. It is not necessary that all of the DAN-Space participants join each CoDesign-Space.

Figure 5.3 illustrates the generic structure of DAN, DAN-Spaces and CoDesign-Spaces as explained.

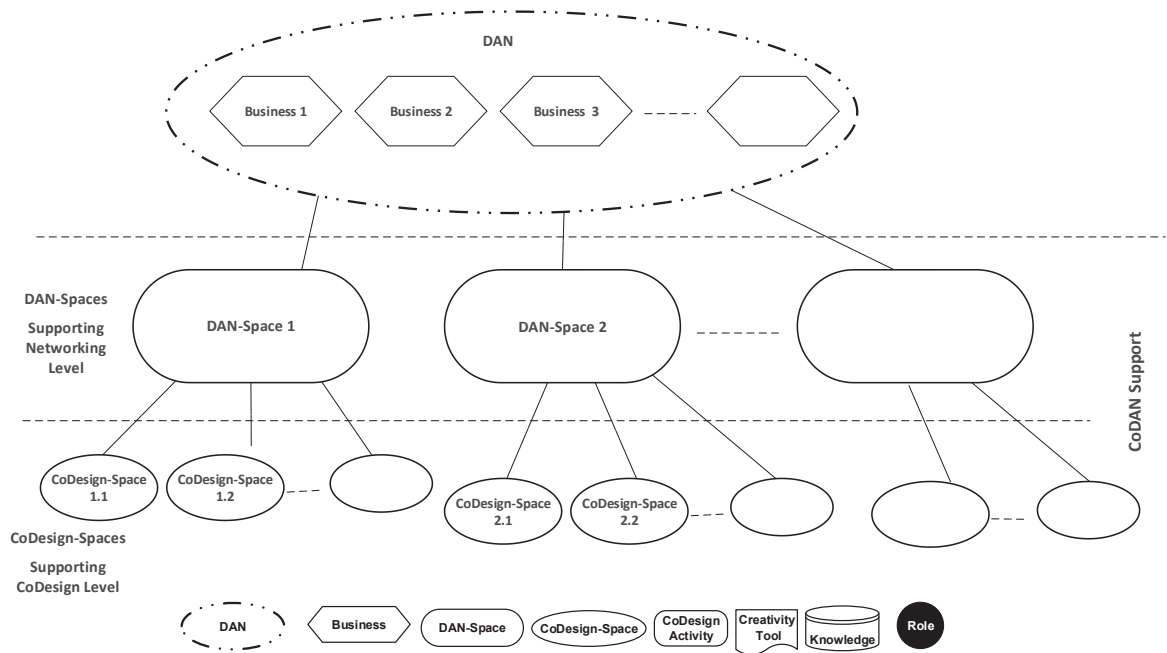


Figure 5.3: Generic structure of DAN, DAN-Spaces and CoDesign-Spaces

In the following sections we explain how the spaces can be configured to support all the different kinds of business network. We go through two stages to show how CoDAN supports all categories of business networks based on their categories as shown in Table 4.2. Firstly, in section 5.3 we show how CoDAN supports the concepts of the conceptual framework and the reason for distinguishing between Governed and Not-Governed DAN-spaces. Then in Section 5.4 we show how these different kinds of spaces can model the four categories of networks shown in Table 4.2.

### 5.3. Governed and Not-Governed DAN-Space

In this section we show how the spaces can be configured to realize the 4 categories of business networks in Table 4.2, and in this way support all business networks. We do this through 4 tables:

In Table 5.1 show how the concepts of our conceptual framework, based on their features, are supported in CoDAN, either in DAN-Space or CoDesign-Space.

In Table 5.2 we explain the idea of Governed DAN-Space and Not-Governed DAN-Space. In Table 5.3 we use the options described in Table 5.1 to show how to create Governed and Not-Governed DAN-Space.

In Table 5.4 we then describe how to combine the spaces to support the categories in Table 4.2.

In Section 5.4, we show how each DAN category, in Table 4.2, is supported by either Governed or Not-Governed DAN-Space.

### **5.3.1. Supporting the conceptual framework features by DAN-Space and CoDesign-Space**

Earlier in this chapter, we have defined our idea of DAN-Spaces and CoDesign-Spaces facilities provided by CoDAN in Section 5.2.

The question is to be addressed here, *how can DAN-Spaces and CoDesign-Spaces be designed and defined in a way to support all the different categories of DAN types based on the conceptual framework?*.

To address this question, in this research we recall that the two concepts; domination and governance are supported by the DAN-Space, while KM and collaboration are supported by CoDesign-Space. Table 5.1 shows how DAN-Space and CoDesign-Space support the conceptual framework based on the defined concepts.

Table 5.1: Supporting conceptual framework by DAN-Space and CoDesign-Space

Concept	Supporting Space	Concept Feature	How to set the supporting space to support the concept feature
Domination	DAN-Space	Dominated	The dominant business should have the full access on knowledge and other components (CoDesign-Spaces and CoDesign activities) in the DAN-Space.
		Contributed	The contributing business has a limited access on knowledge and other components (CoDesign-Spaces and CoDesign activities) in the DAN-Space.
Governance	DAN-Space	Hierarchical	The governing business of DAN creates and governs the DAN-Space
		Flat	Option 1: A number of projects are developed in DAN. The governing business is different from one project to another. A DAN-Space for each project is created and governed by the governing business that governs the project in DAN. Option 2: There are no design and development processes. There is no governing business in the DAN-Space in this case. DAN-Space can be created by any contributing business in DAN.
KM domination	CoDesign-Space	Dominated	If KM is dominated in DAN then: <ul style="list-style-type: none"> <li>- Dominant business should have the full access on CoDesign-Spaces created in DAN-Space.</li> <li>- The governing business in DAN governs KM processes in DAN-Space.</li> </ul>
		Shared	If KM is shared then only the business that creates CoDesign-Space dominates and governs KM.
Collaboration	CoDesign-Space	Open	CoDesign-Spaces are created for open collaboration to define knowledge domains
		Closed	CoDesign-Spaces created for closed collaboration based on knowledge domains defined.
Privacy	DAN-Space	High level of concern	Privacy is controlled in DAN-Space level
	CoDesign-Space	Low level of concern	Privacy is controlled in CoDesign-Space level

### 5.3.2. The idea of Governed and Not-Governed DAN-Space

To simplify our idea of suggesting the Governed and Not-Governed DAN-Space types:

- As we mentioned earlier that governance and domination concepts are supported in DAN-Space level.
- From Table 5.1 we see that if the DAN is of hierarchical governance feature then DAN-Space is created and governed by the governing business in DAN.
- From Table 5.1 we see that if the DAN is of flat governance feature there are two options:
  - o Option1: there are developing and design processes of one project or more in DAN. In this case, the governing business of the project creates and manages the DAN-Space of this project.
  - o Option 2: there are no developing and design processes in DAN. In this case, any contributing business in DAN can create a DAN-Space for the DAN and there is no governance on the created DAN-Space.
- If the DAN is dominated then the dominant business can have the full access on the DAN-Space created under the dominated DAN.

Accordingly, the two types of DAN-Space, Governed and Not-Governed are suggested:

- **The Governed DAN-Space:** created and governed by the governing business of DAN or the governing business of a single project in DAN. If the DAN is dominated then the dominant business has an option to have full access on the DAN-Space. According to the literature the dominated DAN is governed by the dominant business itself or by a contributing business in DAN. However, usually the dominant business governs the dominated DAN. Also, and according to the literature, there are design and developing processes in the dominated DAN.
- **Not-Governed DAN-Space:** Created by a contributing business in the DAN and there is no governing business that governs this type of DAN-Space. This suits the case where there are no design and developing processes in DAN.

The comparison of the two types of DAN-Space is shown in Table 5.2.



The other three concepts; KM domination, collaboration modes and privacy follow the DAN-Space type chosen:

- If the DAN-Space type is Governed then CoDesign-Space is governed by the governed business of DAN-Space. Here, privacy is controlled at DAN-Space level by the governing business.
- If the DAN-Space is Not-Governed then CoDesign-Space is governed by the business that creates it. Privacy, in this case, is controlled at CoDesign-Space level.

Table 5.2: Governed DAN-Space and Not-Governed DAN-Space Comparison

<b>Governed DAN-Space</b>	<b>Not-Governed DAN-Space</b>
The business creating the DAN-Space becomes the governor of the DAN-Space	The business creating the DAN-Space does not become the governor of the DAN-Space
The governing business invites people from the DAN to participate in the DAN-Space	Any participant in the DAN-Space can invite people from the DAN to participate in the DAN-Space
The governing business creates and manages the CoDesign-Spaces	Any participant in the DAN-Space can create and manage CoDesign-Spaces
Privacy is maintained in the DAN-Space level.	Privacy is maintained in the CoDesign level.

## 5.4. Supporting DANs by Governed and Not-Governed DAN-Space

As mentioned in the last section that we suggest two types of DAN-Space to support the concepts of the conceptual framework. These two DAN-Space types are Governed and Not-Governed.

Based on Table 5.1 and Table 5.2 we derive Table 5.3 to show how the two types of DAN-Space support the conceptual framework.

Table 5.3: Supporting conceptual framework by Governed and Not-Governed DAN-Space

Concept	Where the concept is supported (DAN-Space or CoDesign-Space)	Concept Feature	Choosing whether DAN-Space should be Governed or Not-Governed to support the concept feature
Domination	DAN-Space	Dominated	<b>Governed:</b> usually dominated DANs are governed and dominated by the dominant business(es).
		Contributed	<b>Governed:</b> if the contribution of the contributing businesses is governed by the governing business in DAN. <b>Not-Governed:</b> if there is no governance on the contribution in DAN
Governance	DAN-Space	Hierarchical	<b>Governed:</b> the DAN is governed by a governing business
		Flat	<b>Governed:</b> if DAN develops different projects <b>Not-Governed:</b> There are no projects developed in DAN
KM domination	CoDesign-Space	Dominated	<b>Governed:</b> KM processes are dominated and governed by the governing business
		Shared	<b>Governed:</b> if there are different projects governed by different businesses. KM processes are governed by different governing businesses <b>Not-Governed:</b> there are no projects developed in DAN
Collaboration	CoDesign-Space	Open	<b>Governed or Not-Governed:</b> CoDesign-Space is utilised for open mode collaboration in both of the DAN-Space types.
		Closed	<b>Governed or Not-Governed:</b> CoDesign-Space is utilised for closed mode collaboration in both of the DAN-Space types
Privacy	DAN-Space	High level of concern	<b>Governed:</b> privacy should be controlled in DAN-Space level
	CoDesign-Space	Low level of concern	<b>Not-Governed:</b> privacy is controlled in CoDesign-Space level

As shown in Table 5.3, the features in terms of being supported by the DAN-Space type can be classified into:

- Those supported by the Governed DAN-Space type
- Those supported by the Not-Governed DAN-Space type
- Those supported by either Not-Governed or Governed DAN-Space type

The main objective is to support the DAN types based on their categories' features. The DAN category is defined by the combination of its features in the conceptual framework. The DAN category is supported by one type of DAN-Space, either Governed or Not-Governed. Again, we use the domination and governance features to choose between either Governed DAN-Space or Not-Governed DAN-Space for the category. We refer to Table 5.3 as guidance to decide which type of DAN-Space supports the category.

Table 5.4 describes the categories defined earlier in Table 4.2, in Chapter 4, by showing how each category is supported by one DAN-Space type. The second column in Table 5.4 presents the conceptual features of each category as defined in Table 4.2.

Table 5.4: Supporting DAN categories by DAN-Spaces

<b>Category</b>	<b>Concept features of the DANs in the category</b>	<b>DAN-Space type chosen using Table 5.3</b>	<b>Supporting the conceptual features in Table 5.3</b>
Cat-1	<ul style="list-style-type: none"> <li>• Domination: Dominated &amp; Contributed.</li> <li>• Governance: Hierarchical</li> <li>• Collaboration: Closed mode</li> <li>• KM: Dominated</li> <li>• Privacy: High</li> </ul>	Governed	<ul style="list-style-type: none"> <li>• DAN-Space is governed and dominated by dominant business.</li> <li>• Contribution in DAN-Space is governed by the governing business.</li> <li>• CoDesign-Spaces can be created by the governing business for closed mode collaboration.</li> <li>• Knowledge processes are controlled by the governing business.</li> <li>• Privacy is controlled by the governing business in DAN-Space level.</li> </ul>

Cat-2	<ul style="list-style-type: none"> <li>• Domination: Contributed</li> <li>• Governance: Flat</li> <li>• Collaboration: Open &amp; Closed modes</li> <li>• KM: Shared</li> <li>• Privacy: High</li> </ul>	Governed	<ul style="list-style-type: none"> <li>• Contribution in DAN-Space is governed by the governing business of a specific project in DAN.</li> <li>• CoDesign-Spaces can be created by the governing business for open and closed mode collaboration.</li> <li>• Knowledge processes are controlled by a different governing business in each DAN-Space.</li> <li>• Privacy is controlled by the governing business in DAN-Space level.</li> </ul>
Cat-3	<ul style="list-style-type: none"> <li>• Domination: Contributed</li> <li>• Governance: Hierarchical</li> <li>• Collaboration: Closed mode</li> <li>• KM: Dominated</li> <li>• Privacy: High</li> </ul>	Governed	<ul style="list-style-type: none"> <li>• Contribution in DAN-Space is governed by the governing business of DAN.</li> <li>• DAN-Space is governed by the governing business of DAN</li> <li>• CoDesign-Spaces can be created by the governing business for closed mode collaboration.</li> <li>• Knowledge processes in DAN-Space are controlled by the governing business.</li> <li>• Privacy is controlled by the governing business in DAN-Space level.</li> </ul>
Cat-4	<ul style="list-style-type: none"> <li>• Domination: Contributed</li> <li>• Governance: Flat</li> <li>• Collaboration: Open mode</li> <li>• KM: Shared</li> <li>• Privacy: Low</li> </ul>	Not-Governed	<ul style="list-style-type: none"> <li>• Contribution in DAN-Space is not governed by a governing business.</li> <li>• There is no governance on DAN-Space.</li> <li>• CoDesign-Spaces can be created by the governing business for open mode collaboration.</li> <li>• Knowledge processes in DAN-Space are not controlled by a governing business.</li> <li>• Privacy is controlled in the CoDesign-Space</li> </ul>

In the following sub-sections, we explain how each DAN category is supported by one of the DAN-Space types based on the category's conceptual features.

### 5.4.1. Supporting the category Cat-1 of DANs

Governed DAN-Space type is chosen to support the category Cat-1 of DAN types.

Table 5.5 shows how the Governed DAN-Space type is used to support this category based on its features.

Table 5.5: Supporting Cat-1 DAN types by the Governed DAN-Space type

Feature in Cat-1 of DANs	Supporting by Governed DAN-Space
Domination: <i>Dominated &amp; Contributed</i>	<ul style="list-style-type: none"> <li>- The dominant business has full access on the components and knowledge in DAN-Space</li> <li>- The contributing business has a limited access to DAN-Space governed by the governing business of DAN.</li> </ul>
Governance: <i>Hierarchical</i>	<ul style="list-style-type: none"> <li>- DAN-Space is governed by a governing business.</li> <li>- The governing business is usually the dominant business.</li> <li>- Governing business governs DAN-Space in terms of:               <ul style="list-style-type: none"> <li>o Inviting people from businesses in DAN to participate in DAN-Space</li> <li>o Inviting people from outside DAN to participate in DAN-Space</li> <li>o Creating and managing CoDesign-Spaces</li> <li>o Authorising the dominant businesses for full access to DAN-Space (if the dominant is not the governor)</li> </ul> </li> </ul>
Collaboration: <i>Closed mode</i>	<ul style="list-style-type: none"> <li>- The governing business creates CoDesign-Spaces and related CoDesign activities based on the knowledge domain defined.</li> </ul>
KM: <i>dominated</i>	<ul style="list-style-type: none"> <li>- The governing business governs KM processes</li> <li>- The governing business controls and supervises the knowledge transfer between CoDesign Activities in CoDesign-Space and between CoDesign-Spaces in DAN-Space.</li> </ul>
Privacy concern: High	<ul style="list-style-type: none"> <li>- DAN-Space supports the privacy of high level of concern</li> <li>- The governing business has the full control on DAN-Space</li> <li>- The dominant business has the full access on DAN-Space.</li> </ul>

The Governed DAN-Space has been chosen to support the category Cat-1 of DAN types by referring to Table 5.3. By referring to the features of this category and to Table 5.3 we find that all the features of the category are supported by the Governed DAN-Space.

The following scenario demonstrates the category Cat-1 of DANs as supported by the Governed DAN-Space.

<b>Scenario: Cisco DAN as supported by the Governed DAN-Space</b>	
<ul style="list-style-type: none"> <li>• Cisco DAN has been described previously in Chapter 4.</li> <li>• Cisco creates a Governed DAN-Space to allow the contributors of Cisco DAN in CHILL labs to collaborate.</li> <li>• The Governed DAN-Space provides Cisco, as the dominant business, the advantage to govern and dominate the DAN-Space.</li> <li>• Businesses who contribute in the DAN pass through two steps to implement a suggested project, negotiation and implementation.</li> <li>• As shown in the Figure 5.4 the three businesses, Business 1, 2 and 3 enter the negotiation stage by creating CoDesign-Space 1 for negotiation.</li> <li>• Once these businesses agree about a project CoDesign-Space 2 is created for design and implementation.</li> <li>• The two CoDesign-Spaces are created by the governing business, Cisco.</li> <li>• Knowledge created in the negotiation stage at CoDesign-Space 1 can be transferred to CoDesign-Space 2. The transfer of knowledge is governed by Cisco, the governing business.</li> <li>• Table 5.6 shows how the conceptual framework defined features are supported by the Governed DAN-Space type.</li> </ul>	
<p>Table 5.6: Supporting Cisco DAN by the Governed DAN-Space type</p>	
Feature in Cisco DAN	Supporting by Governed DAN-Space
<p>Domination: <i>Dominated &amp; Contributed</i></p>	<ul style="list-style-type: none"> <li>- Cisco has full access on the DAN-Space, components and knowledge</li> <li>- The contributing businesses have limited access to the DAN-Space that is governed by Cisco.</li> </ul>
<p>Governance: <i>Hierarchical</i></p>	<ul style="list-style-type: none"> <li>- DAN-Space is governed by Cisco.</li> <li>- Cisco governs DAN-Space in terms of:                             <ul style="list-style-type: none"> <li>○ Inviting people from Cisco DAN to participate in DAN-Space.</li> <li>○ Creating and managing CoDesign-Spaces businesses in DAN to negotiate and develop different ideas of projects they create.</li> </ul> </li> </ul>

Collaboration: <i>Closed mode</i>	- Cisco creates CoDesign-Spaces based on knowledge domains defined by businesses which intend to work together.
KM: <i>Dominated</i>	- Cisco governs the knowledge transfer between activities in the CoDesign-Space and between CoDesign-Spaces in the DAN-Space.
Privacy: <i>High</i>	- Cisco DAN is considered of high level of privacy concern. - Cisco, as the dominant and governing business, has the full access and control on the DAN-Space.

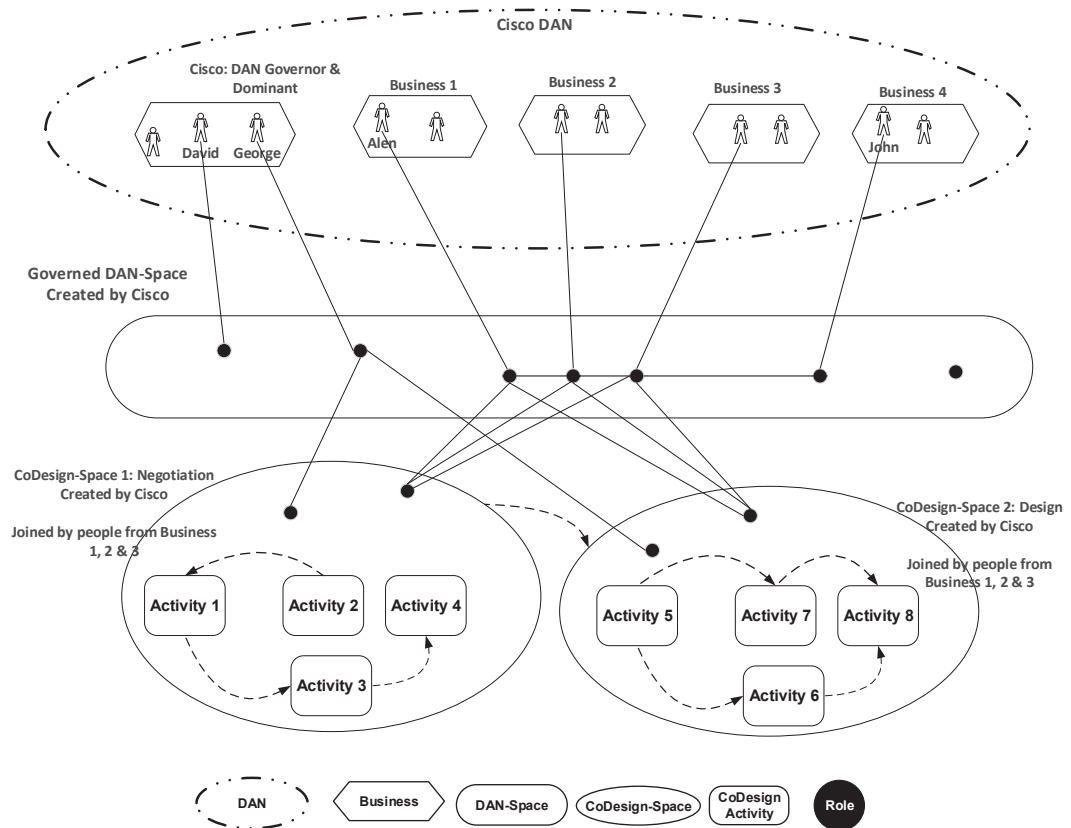


Figure 5.4: Governed DAN-Space Scenario (Supporting Cat-1 DANs)

### 5.4.2. Supporting the category Cat-2 of DANs

Governed DAN-Space type is chosen to support the category Cat-2 of DAN types.

Table 5.7 shows how the Governed DAN-Space type is used to support this category based on its features.

Table 5.7: Supporting Cat-2 DAN types by the Governed DAN-Space type

Feature in Cat-2 of DANs	Supporting by Governed DAN-Space
Domination: <i>Contributed</i>	- The contributing businesses access DAN-Spaces based on their contribution to the projects.
Governance: <i>Flat</i>	<ul style="list-style-type: none"> <li>- Each DAN-Space, related to a specific project can be governed by a different governing business.</li> <li>- Governing business governs DAN-Space in terms of:               <ul style="list-style-type: none"> <li>o Inviting people from businesses in DAN to participate in DAN-Space</li> <li>o Inviting people from outside DAN to participate in DAN-Space.</li> <li>o Creating and managing CoDesign-Spaces.</li> <li>o Authorising businesses for full access to DAN-Space (if required)</li> </ul> </li> </ul>
Collaboration: <i>Open and Closed mode</i>	<ul style="list-style-type: none"> <li>- CoDesign-Spaces can be created for both open and closed mode of collaboration.</li> <li>- In open mode, businesses brainstorm ideas of projects to define knowledge domains.</li> <li>- In closed mode they CoDesign based on the defined knowledge domains.</li> </ul>
KM: <i>Shared</i>	- The governing business of a specific project governs the KM processes in the related DAN-Space.
Privacy concern: High	<ul style="list-style-type: none"> <li>- Governed DAN-Space supports the privacy of high level of concern.</li> <li>- The governing business of a specific project has the full control on the related DAN-Space</li> <li>- The governing business of a specific DAN-Space can authorise other businesses for full access to the DAN-Space if required.</li> </ul>

Supporting Cat-2 DAN types by the Governed DAN-Space type needs some explanation and clarification.

According to Table 5.3 the DAN-Space type selected is the Governed DAN-Space for the following reasons based on the features of Cat-2 of DANs:



- The flat governance in Cat-2 of DANs means that the projects developed are governed by different businesses not only one business. In this case, each project should be facilitated by at least one DAN-Space which should be governed by the governing business of the related project.
- The same case is with KM domination; as KM domination here is shared that means in each project in the DAN, KM processes are controlled by the governing business of the project. Accordingly, the Governed DAN-Space is selected.
- For collaboration modes the Governed DAN-Space is selected according to the governance.
- As the privacy is of high concern in these types of DANs then the Governed DAN-Space is selected according to Table 5.3.

As shown in the Figure 5.5, more than one project can be developed in the same DAN. The governor of the single project is selected based on the project. Different projects can have different governing businesses.

As shown in Figure 5.5 one Governed DAN-Space is created for each project. The reason, as mentioned, is that the project governor changes based on the project.

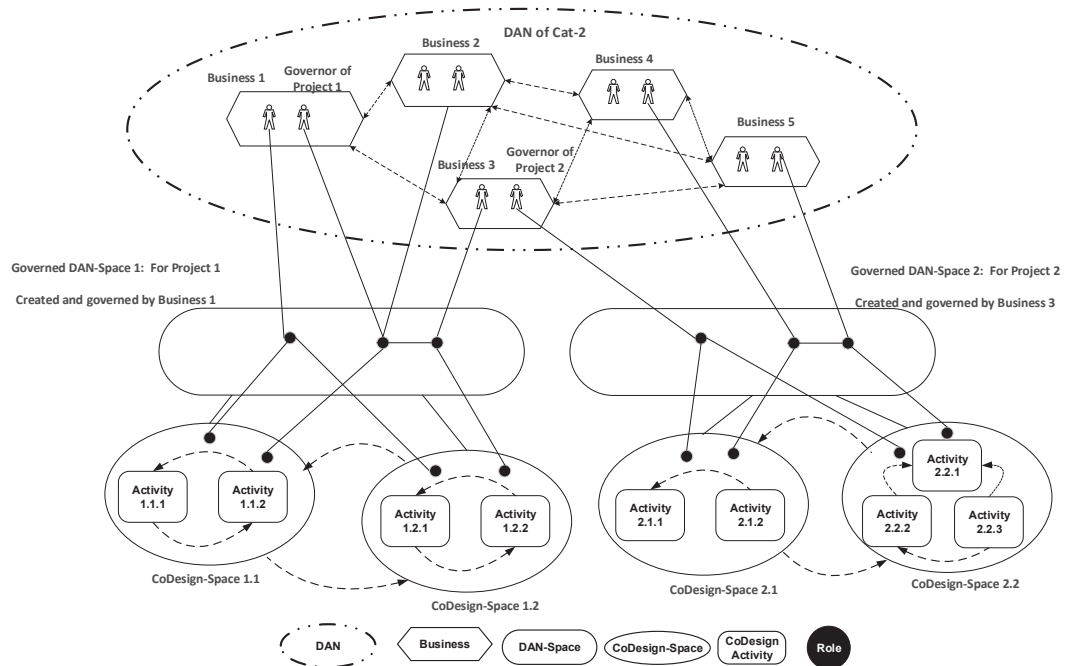


Figure 5.5: Supporting Cat-2 DANs by Governed DAN-Space

The business in DAN may contribute in more than one project with different roles. Accordingly, it contributes in more than one DAN-Space with different roles as well. As shown in Figure 5.5, Business 3 contributes in DAN-Space 1 (for Project 1) that is governed by Business 1. In DAN-Space 2 (for Project 2) Business 3 is the governor of the DAN-Space.

Although the DANs of Cat-2 are not dominated, they are considered with a high level of privacy concern, because the members in these DANs collaborate in design and development. Accordingly, the knowledge created in the DAN is considered of competitive advantage and the privacy is with high level of concern.

### 5.4.3. Supporting the category Cat-3 of DANs

The Governed DAN-Space type is selected to support the category Cat-3 of DAN types.

Table 5.8 shows how the Governed DAN-Space type is used to support this category based on its features.

Table 5.8: Supporting Cat-3 DAN types by the Governed DAN-Space type

Feature in Cat-3 of DANs	Supporting by Governed DAN-Space
Domination: <i>Contributed</i>	<ul style="list-style-type: none"> <li>- The contributing businesses access DAN-Spaces by the control of the governing business.</li> <li>- The contributing business may have full access on the DAN-Space by the authorisation of the governing business if required.</li> </ul>
Governance: <i>Hierarchical</i>	<ul style="list-style-type: none"> <li>- DAN-Space is governed by a governing business.</li> <li>- The governing business is a member business or an external agent.</li> <li>- Governing business governs DAN-Space in terms of:                             <ul style="list-style-type: none"> <li>o Inviting people from businesses in DAN to participate in DAN-Space</li> <li>o Inviting people from outside DAN to participate in DAN-Space.</li> <li>o Creating and managing CoDesign-Spaces.</li> <li>o Authorising businesses for full access to DAN-Space (if required)</li> </ul> </li> </ul>

Collaboration: <i>Closed mode</i>	- The governing business creates CoDesign-Spaces and related CoDesign activities based on the knowledge domain defined.
KM: <i>dominated</i>	- The governing business governs KM processes - The governing business governs the knowledge transfer between the activities in CoDesign-Space and between CoDesign-Spaces in DAN-Space.
Privacy concern: <i>High</i>	- DAN-Space supports the high level of privacy concern - The governing business has the full control on the DAN-Space

The only type of DAN that represents the category Cat-3 is Type-11, the Co-opetition network as shown in Table 4.2. The structure of the Type-11 is similar to the DANs in the Cat-2 except that the governor of the DAN is defined, according to the literature. As per literature all the members in the Type-11 DAN collaborate for designing the same product for co-opetition purposes. The Governed DAN-Space is suggested for this DAN category. Figure 5.6 shows how Cat-3 DANs as supported by the Governed DAN-Space.

Based on the features of Cat-3 DAN types and by referring to Table 5.3 Governed DAN-Space is selected to support this category. Referring to Table 5.3, the features of governance, KM and privacy concepts are supported by the Governed DAN-Space. The other two features relating to domination and collaboration should be supported by the Governed DAN-Space accordingly. As the domination is contributed, accessing the DAN-Space by the contributed businesses is governed by the governing business here. The governing business creates and manages CoDesign-Spaces for collaboration based on the knowledge domain defined.

As shown in the Figure 5.6 the governing business is either a member business or an external business agent which creates and governs the Governed DAN-Space for the businesses in the DAN to collaborate. It is optional for the governing business in Cat-3 DANs to create a DAN-Space for each project if required.

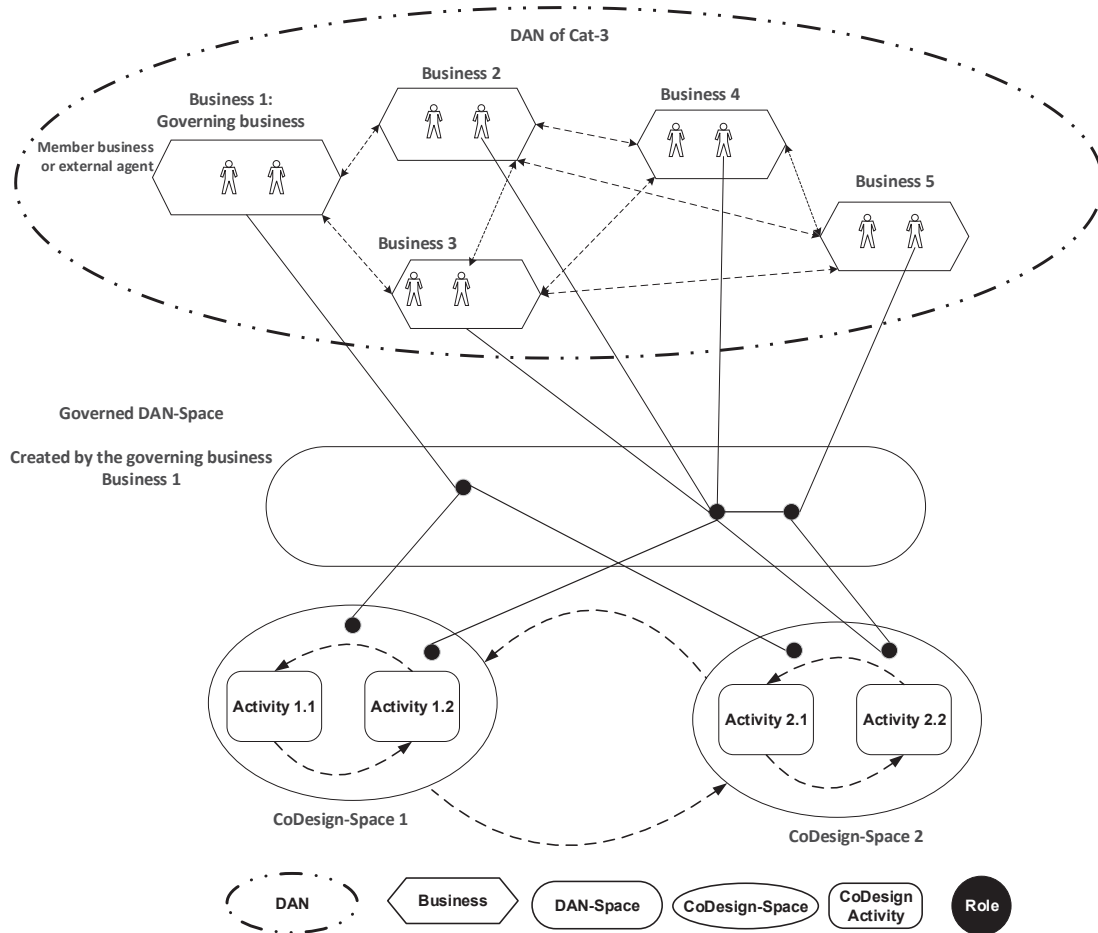


Figure 5.6: Supporting Cat-3 DANs by Governed DAN-Space

### 5.4.4. Supporting the category Cat-4 of DANs

Not-Governed DAN-Space type is chosen to support the category Cat-4 of DAN types.

Table 5.9 shows how the Not-Governed DAN-Space type is used to support this category based on its features.

Table 5.9: Supporting Cat-4 DAN types by the Not-Governed DAN-Space type

Feature in Cat-4 of DANs	Supporting by Not-Governed DAN-Space
Domination: <i>Contributed</i>	- The contributing businesses access DAN-Spaces by inviting each other to the DAN-Space. There is no governing or domination on this type of DAN-Space.

Governance: <i>Flat</i>	<ul style="list-style-type: none"> <li>- There is no governing business in this type of DAN-Space.</li> <li>- Each participant in the DAN-Space can create and manage CoDesign-Spaces.</li> <li>- Each participant in DAN-Space can invite people from DAN and outside DAN.</li> </ul>
Collaboration: <i>Open mode</i>	<ul style="list-style-type: none"> <li>- There is no a specific knowledge domain defined in DAN.</li> <li>- Participants can create CoDesign-Spaces for open mode collaboration in the DAN-Space.</li> <li>- By this way, they may define knowledge domains for closed mode collaboration later on.</li> </ul>
KM: <i>Shared</i>	<ul style="list-style-type: none"> <li>- There is no governing business controlling KM processes.</li> <li>- Who creates the CoDesign-Spaces controls the KM processes in it.</li> </ul>
Privacy concern: <i>Low</i>	<ul style="list-style-type: none"> <li>- Not-Governed DAN-Space supports the privacy of low level of concern.</li> <li>- Privacy only controlled through the CoDesign-Spaces.</li> </ul>

The only type of DAN that represents the category Cat-4 is the Type-13 “General Meeting”. The privacy concern level in this category is considered low, because there is no design and development processes in these types of DANs. This category of DANs can utilise a different type of DAN-Space, the Not-Governed. In the Not-Governed DAN-Space the DAN-Space level is partially isolated from the CoDesign-Space level. There is no direct governance on the CoDesign-Space from the DAN-Space. The main feature of the Not-Governed DAN-Space is that any participant in the DAN-Space can create a CoDesign-Space and allow people participating in the DAN-Space to join it. Also any participant in the Not-Governed DAN-Space can invite people to participate from DAN or outside of DAN.

Similar to the Cat-2 and Cat-3 DANs, the relationships between businesses in Cat-4 DANs are not centrally controlled. Any couple of businesses can create a relationship among themselves, as shown by the bi-directional dashed arrows in Figure 5.7.

Figure 5.7 shows the scenario of the Cat-4 DANs as supported by the Not-Governed DAN-Space.

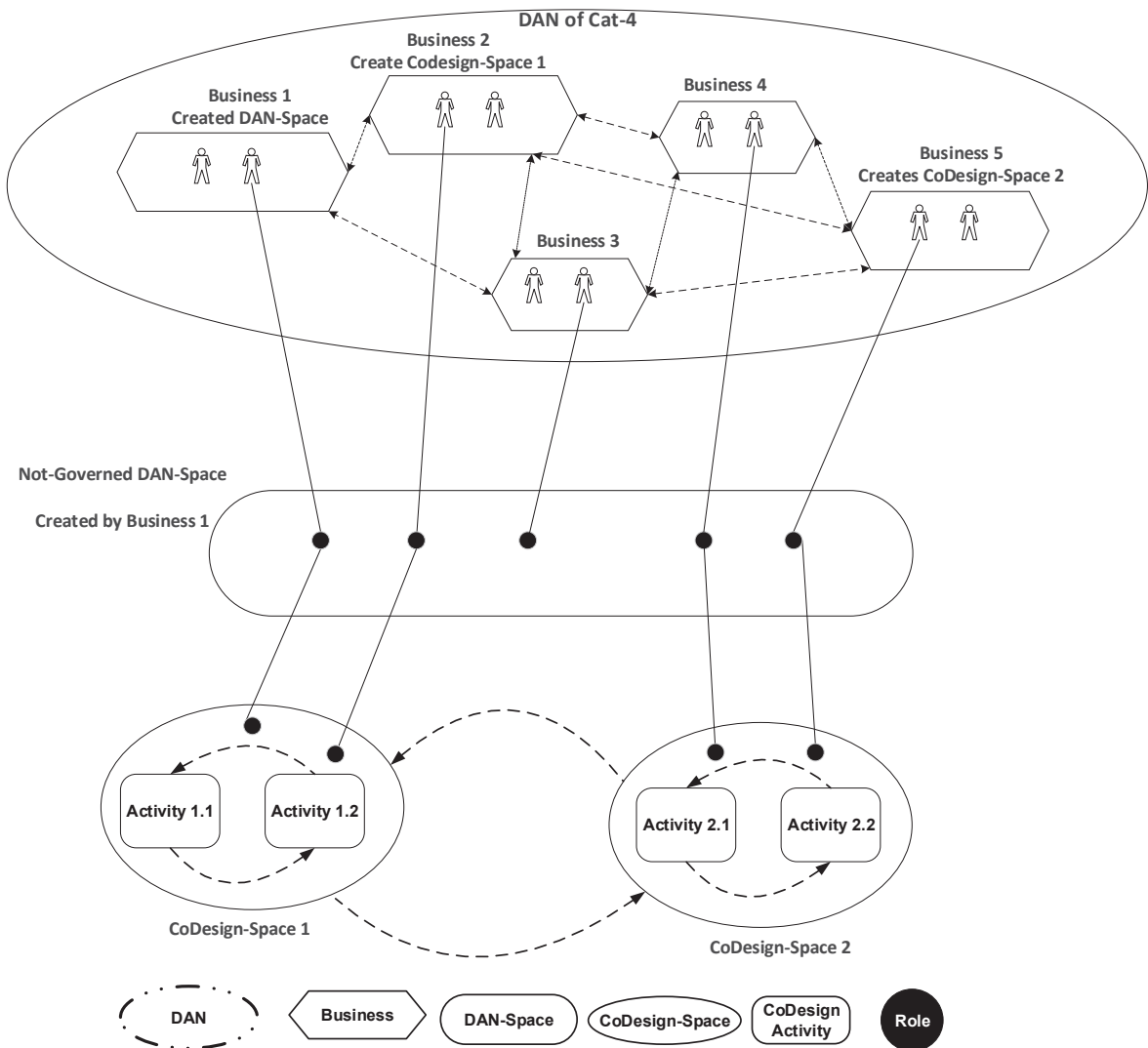


Figure 5.7: Supporting Cat-4 DANs by Not-Governed DAN-Space

Practically, businesses join DAN-Spaces and CoDesign-Spaces through the people of these businesses. The person in the business should be assigned a role when joining a DAN-Space and/or CoDesign-Space.

In the next section we present the roles defined by the CoDAN.

## 5.5. Roles Defined by CoDAN

Two types of DAN-Space are defined by CoDAN, the Governed and the Not-Governed. Roles in a DAN-Space are assigned to people from businesses in DAN. The roles are assigned by the businesses in DAN as those shown in Table 5.10 and Table 5.11 below.

The kinds of roles depend on the type of DAN-Space, Governed or Not-Governed. For example, the person who governs a Governed DAN-Space is from the governing business in DAN. People from contributing businesses in DAN have a different role in DAN-Space. In the Not-Governed DAN-Space any business from DAN can create a DAN-Space. The person who creates the DAN-Space in a DAN does not govern the DAN-Space. However, this person can invite people from businesses in DAN to participate in the DAN-Space. Roles and responsibilities are different here.

Also, when people in DAN-Space are assigned to CoDesign-Space they are given other roles. These roles depend on whether the person created the CoDesign-Space or just participates in it. In our model the roles in CoDesign-Space are the same in both types of DAN-Space, Governed and Not-Governed, as explained later.

From the privacy perspective CoDAN has rules for each role, and people assigned roles follow these rules.

There is a lack of research and literature that define the roles of people in DANs. However, in the work by Sroka and Hittmar (2013), for example, responsibilities of the manager role in DANs were defined. These responsibilities include but are not limited to:

- co-ordinating the activities among individuals and groups inside the DAN.
- establishing solid and powerful relationships among the businesses and people in the DAN.

Sroka and Hittmar (2013) suggest that the manager role should be assigned to a person from the leading business of the DAN. The reason, according to Sroka and Hittmar (2013), is to avoid the unfairness that may be considered by the other members in the alliance.

In the next sub-section we describe the roles defined by CoDAN and how they are assigned to different people of businesses in DAN.

### **5.5.1. CoDAN roles description**

As mentioned previously roles defined by CoDAN are assigned to people from businesses in DAN. These roles should support the different DANs categories defined in Table 4.2, based on the DAN-Space type used, Governed or Not-Governed.

The main difference between the Governed and Not-Governed DAN-Space types is that the Governed DAN-Space is governed by a governing business in DAN.

Based on Table 4.2, which shows the four categories of DANs, the types of businesses in DAN are:

- Dominant business
- Contributing business
- Governing business

The governing business is responsible for creating the DAN-Space by using CoDAN. Also, the governing business can be the dominant business itself, the contributing business or an external business agent as in the case in the Co-opetition network, Type-11.

Based on these three types of businesses we define the roles of people in these businesses in DAN-Space.

The other point should be highlighted here, that businesses in DAN may invite other people outside the DAN to participate in CoDesign such as customers and users. This is the human-centered design feature of CoDesign as mentioned in our literature review and should be supported by CoDAN.

Accordingly, the roles defined by CoDAN are:

- **DAN-Space-Coordinator:** assigned to people from the governing business in DAN
- **DAN-Space-Dominant:** assigned to people from the dominant business in DAN
- **DAN-Space-Contributor:** assigned to people from the contributing businesses in DAN
- **DAN-Space-Participant:** assigned to people who participate in CoDesign from outside DAN
- **CoDesign-Space-Owner:** assigned to the person who creates CoDesign-Space.
- **CoDesign-Space-Participant:** assigned to people who are assigned to CoDesign-Space for CoDesign,

Table 5.10 and Table 5.11 show CoDAN defined roles and presents their responsibilities and features according to the two DAN-Space types, the Governed and Not-Governed, then followed by the description of these roles.



Table 5.10: CoDAN Roles in Governed DAN-Space

<b>Features &amp; Responsibilities</b>	<b>Roles</b>					
	<b>DAN-Space-Coordinator</b>	<b>DAN-Space-Dominant</b>	<b>DAN-Space-Contributor</b>	<b>DAN-Space-Participant</b>	<b>CoDesign-Space-Owner</b>	<b>CoDesign-Space-Participant</b>
In DAN assigned to	a person from governing business in DAN who creates and manages the DAN-Space by the DAN governing business	a person from dominant business in DAN by the DAN dominant business	a person from contributing business in DAN by his/her business	a person participates in CoDesign from outside DAN by businesses in DAN	a person in DAN-Space who creates CoDesign-Space. The DAN-Space-Coordinator here	a person from DAN-Space assigned to CoDesign-Space by CoDesign-Space-Owner
In DAN-Space assigned by	The governing business in DAN	DAN-Space-Coordinator	DAN-Space-Coordinator	DAN-Space-Coordinator	DAN-Space-Coordinator	DAN-Space-Coordinator
Applicable in Governed DAN-Space	Yes	Yes	Yes	Yes	Yes	Yes
Full access to knowledge and components in DAN-Space	Yes	Yes	No	No	No	No
Inviting people to join DAN-Space	Yes	No	No	No	No	No
Creating and managing CoDesign-Spaces	Yes	No	No	No	No	No
Assigning people to CoDesign-Space	Yes	No	No	No	Yes	No
Carrying out CoDesign activities	Yes	No	No	No	Yes	Yes

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Transferring knowledge in CoDesign-Space	Yes	No	No	No	Yes	Yes
Transferring knowledge among CoDesign-Spaces	Yes	No	No	No	Yes	No
Relevance to Cat-1 DANs	Assigned to a person from the DAN governing business	Assigned to a person from a DAN dominant business	Assigned to a person from a DAN contributing business	Assigned to a person from outside DAN	Assigned to the person who creates CoDesign-Space (DAN-Space-Coordinator here)	Can be assigned to any person in DAN-Space
Relevance to Cat-2 DANs	Assigned to a person from the governing business of a specific project	Assigned to a person from a dominant business	Assigned to a person from a DAN contributing business	Assigned to a person from outside DAN	Assigned to the person who creates CoDesign-Space (DAN-Space-Coordinator here)	Can be assigned to any person in DAN-Space
Relevance to Cat-3 DANs	Assigned to a person from the DAN governing business	Assigned to a person from a dominant business	Assigned to a person from a DAN contributing business	Assigned to a person from outside DAN	Assigned to the person who creates CoDesign-Space (DAN-Space-Coordinator here)	Can be assigned to any person in DAN-Space
Relevance to Cat-4 DANs	NA	NA	NA	NA	NA	NA

Table 5.11: CoDAN Roles in Not-Governed DAN-Space

<b>Features &amp; Responsibilities</b>	<b>Roles</b>					
	<b>DAN-Space-Coordinator</b>	<b>DAN-Space-Dominant</b>	<b>DAN-Space-Contributor</b>	<b>DAN-Space-Participant</b>	<b>CoDesign-Space-Owner</b>	<b>CoDesign-Space-Participant</b>
Assigned to	NA	NA	a person from contributing business in DAN by his/her business	a person participates in CoDesign from outside DAN by businesses in DAN	a person in DAN-Space who creates CoDesign-Space by assigned by his/her business	a person from DAN-Space assigned to CoDesign-Space
In DAN-Space assigned by	NA	NA	DAN-Space-Contributor	DAN-Space-Contributor	DAN-Space-Contributor	CoDesign-Space-Owner
Applicable in Not Governed DAN-Space	No	No	Yes	Yes	Yes	Yes
Full access to knowledge and components in DAN-Space	No	No	No	No	No	No
Inviting people to join DAN-Space	No	No	Yes	No	No	No
Creating and managing CoDesign-Spaces	No	No	Yes	No	No	No
Assigning people to CoDesign-Space	No	No	No	No	Yes	No
Carrying out CoDesign activities	No	No	No	No	Yes	Yes

Ch5: Research Model

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Transferring knowledge in CoDesign-Space	No	No	No	No	Yes	Yes
Transferring knowledge among CoDesign-Spaces	No	No	No	No	Yes	No
Relevance to Cat-1 DANs	NA	NA	NA	NA	NA	NA
Relevance to Cat-2 DANs	NA	NA	NA	NA	NA	NA
Relevance to Cat-3 DANs	NA	NA	NA	NA	NA	NA
Relevance to Cat-4 DANs	NA	NA	Assigned to a person from a DAN contributing business	Assigned to a person outside DAN	Assigned to the person who creates CoDesign-Space (DAN-Space-Coordinator here)	Can be assigned to any person in DAN-Space

According to Table 5.11, the assignment of the role to a person in the Governed DAN-Space is as following:

1. The business in DAN, which contributes in DAN-Space, assigns the role to the person from the business.
2. DAN-Space-Coordinator then assigns the role to the person in DAN-Space.
3. The person assigned to CoDesign-Spaces by DAN-Space-Coordinator from DAN-Space (who is the CoDesign-Space-Owner here)

DAN-Space-Coordinator is assigned to the person when he/she creates the Governed DAN-Space.

According to Table 5.12, the assignment of the role to a person in the Not Governed DAN-Space is as following:

1. The business in DAN, which contributes in DAN-Space, assigns the role to the person from the business.
2. A DAN-Space-Contributor then assigns the role to the person in DAN-Space.
3. The person is assign to CoDesign-Space by CoDesign-Space-Owner.

The roles are described as follows:

#### **DAN-Space-Coordinator:**

DAN-Space-Coordinator role is only in the Governed DAN-Space. The role is assigned to the person from the governing business in DAN to govern the Governed DAN-Space. The main task of this role is creating and governing the DAN-Space. This role has the full access to knowledge and other components into the DAN-Space created. It coordinates all the processes according to its responsibilities which include:

- Creating the Governed DAN-Space.
- Inviting any person from the dominant business in DAN to become a DAN-Space-Dominant.
- Inviting any person from a contributing business in DAN to become a DAN-Space-Contributor.
- Inviting any person from outside DAN to become a DAN-Space-Participant.
- Creating and managing CoDesign-Spaces in the DAN-Space created.
- Managing the knowledge created in terms of share and transfer.

As shown in Table 5.10 DAN-Space-Coordinator is relevant to the three categories of DAN, Cat-1, Cat-2 and Cat-3. DAN-Space-Coordinator is assigned to the person from the governing business in DAN. In Cat-3 DANs it is assigned to the person from the business that governs a specific project in DAN. In this case there can be more than one DAN-Space-Coordinator based on how many projects in DAN that need dedicated DAN-Spaces.

### **DAN-Space-Dominant:**

As we mentioned, that it is not necessary for the dominant business to govern DAN-Space. In this case if the dominant business is not the governing business, then it should have a full access to the DAN-Space including the knowledge and other components. For this reason the DAN-Space-Dominant role has been defined in CoDAN. DAN-Space-Dominant is assigned to a person in a business which dominates the DAN. In DAN-Space this role is assigned to DAN-Space-Coordinator. There are no governing responsibilities for this role. The main feature given to the person of this role is the full access to the knowledge and other components in the Governed DAN-Space. DAN-Space-Dominant also can be assigned by CoDesign-Space-Owner to CoDesign-Space and becomes CoDesign-Space-Participant to participate in the CoDesign-Activities.

DAN-Space-Dominant is relevant to the dominated DANs such as Cat-1 DAN types. This role also can be used by Cat-2 and Cat-3 DANs whenever the full access to DAN-Space is required by any contributing business in DAN.

### **DAN-Space-Contributor:**

This role is assigned to a person in DAN-Space by the contributing business in DAN. In DAN-Space it is assigned by the DAN-Space-Coordinator. This role can be in both the DAN-Space types, the Governed and Not-Governed.

In the Governed DAN-Space this role can be assigned later to CoDesign-Space by CoDesign-Space-Owner to become CoDesign-Space-Participant.

In the Not-Governed DAN-Space, DAN-Space-Contributor can:

- invite any other person from businesses that contribute in DAN to become a DAN-Space-Contributor.
- invite any person outside DAN to become a DAN-Space-Participant.

- create CoDesign-Spaces and manage them.

**DAN-Space-Participant:**

As mentioned at the beginning of this section, DAN-Space-Participant is defined in CoDAN to be assigned to people who participate in CoDesign from outside the DAN. This role can be in Governed and Not-Governed DAN-Space. The person with the DAN-Space-Participant role then can be assigned to CoDesign-Space by the CoDesign-Space-Owner and becomes a CoDesign-Space-Participant.

This role has been defined in CoDAN to provide a kind of isolation for privacy purposes. DAN-Space-Participant role has been defined to distinguish between the people who are assigned DAN-Space-Contributed role in DAN and those assigned from outside the DAN to participate in CoDesign. This allows the DAN-Space-Coordinator to create dedicated CoDesign-Spaces for people coming from outside DAN to carry out specific activities when required.

DAN-Space-Participant role is of relevance to all DAN categories. In categories Cat-1, Cat-2 and Cat-3 it is assigned by DAN-Space-Coordinator. In Cat-4 it is assigned by DAN-Space-Contributor.

**CoDesign-Space-Owner:**

CoDesign-Space-Owner is assigned to the person who creates CoDesign-Space in the DAN-Space. This role can be in the Governed and Not-Governed DAN-Space.

In Governed DAN-Space CoDesign-Space-Owner is assigned to the DAN-Space-Coordinator when he/she creates CoDesign-Space.

In the Not-Governed DAN-Space CoDesign-Space-Owner is assigned to DAN-Space-Contributor when he/she creates CoDesign-Space.

CoDesign-Space-Owner role is relevant to the four categories of DAN. In the categories Cat-1, Cat-2 and Cat-3 CoDesign-Space-Owner role is assigned to DAN-Space-Coordinator.

In the category Cat-4 CoDesign-Space-Owner is assigned to the person with DAN-Space-Contributor role. This person is assigned by a contributing business in DAN to create and manage a specific CoDesign-Space.

**CoDesign-Space-Participant:**

CoDesign-Space-Participant role is in both types of DAN-Space, the Governed and Not-Governed DAN-Space.

CoDesign-Space-Participant role is assigned to DAN-Space-Contributor, DAN-Space-Participant and DAN-Space-Dominant by CoDesign-Space-Owner. The person who is assigned CoDesign-Space-Participant role is usually selected by the business in DAN to participate in CoDesign-Space. This role also is assigned to the people from outside DAN who are assigned DAN-Space-Participant in DAN-Space.

In Governed DAN-Space CoDesign-Space-Participant is assigned by CoDesign-Space-Owner (DAN-Space-Coordinator here).

In the Not-Governed DAN-Space CoDesign-Space-Participant is assigned by CoDesign-Space-Owner (DAN-Space-Contributor here).

CoDesign-Space-Participant role is relevant to the four categories of DAN. In the four categories CoDesign-Space-Participant role is assigned to DAN-Space-Participant or DAN-Space-Contributor.

The person who is assigned this role is selected by a contributing business from DAN to participate. Also it can be assigned to a person from outside DAN.

**5.5.2. Knowledge transfer modes in CoDAN**

Two modes of knowledge transfer can be facilitated by CoDAN, the Activity to Activity mode and CoDesign-Space to CoDesign-Space mode.

*Activity to Activity transfer mode:* in this mode knowledge is transferred from one activity to another within the same CoDesign-Space.

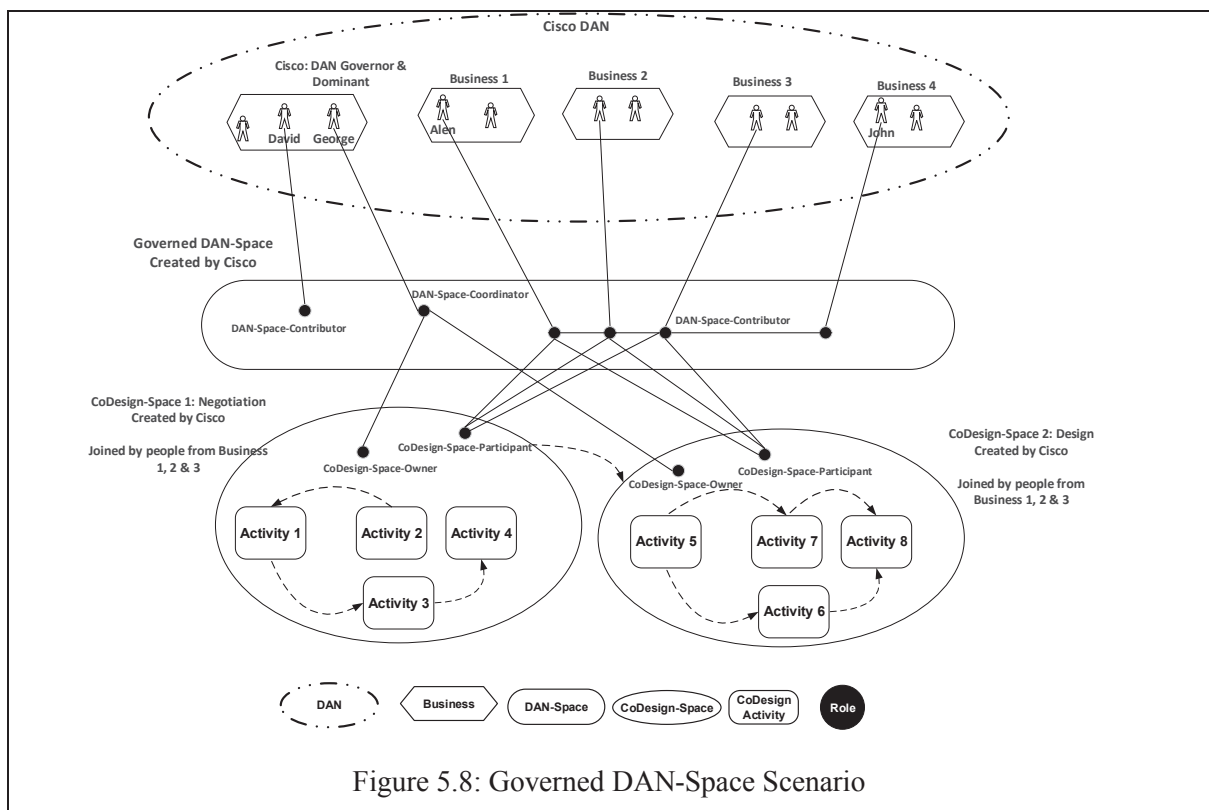
*CoDesign-Space to CoDesign-Space transfer mode:* in this mode the knowledge is transferred from one CoDesign-Space to another within the same DAN-Space



The two modes of knowledge transfer are associated with the roles defined in CoDAN. Accordingly, the mechanisms of performing the two modes differ from the governed DAN-Space to the not governed type. The two modes in relation to DAN-Space types are shown in Table 5.10 and Table 5.11.

**Scenario: Cisco DAN as supported by the Governed DAN-Space Roles**

- In the sub-section 5.5.1 of this chapter we have presented the Cisco DAN scenario as how it is supported by utilising the Governed DAN-Space.
- We revisit this scenario to explain how CoDAN defined roles are utilised. The scenario is illustrated with CoDAN defined roles in Figure 5.8.
- Cisco, the governing business, creates the Governed DAN-Space.
- The person who creates the DAN-Space (George) becomes the DAN-Space-Coordinator.
- George, the DAN-Space-Coordinator, invites people from the businesses in Cisco DAN to participate in the DAN-Space. These people are assigned DAN-Space-Contributor role.
- George, the DAN-Space-Coordinator, creates the 2 CoDesign-Spaces, CoDesign-Space 1 and CoDesign-Spaces 2 and becomes the CoDesign-Space-Owner of the 2 CoDesign-Spaces.
- George, the DAN-Space-Coordinator, creates CoDesign-Activities in the CoDesign-Spaces.
- George assigns the people of DAN-Space-Contributor role in DAN-Space to the CoDesign-Spaces.
- People assigned to the two CoDesign-Spaces are assigned CoDesign-Space-Participant role.



## 5.6. Maintaining Privacy

There is a lack of research in privacy in relation to managing CoDesign in DANs. Most literature which presents privacy in the context of knowledge management has been investigated. However these literatures show that there is a lack in proposing solutions for privacy issues in knowledge management as reported by Chen (2009). Also it was concluded that CoDesign and knowledge management systems support explicit knowledge more than the tacit type as per literature. CoDesign is seen as a tacit oriented process. The idea of the research model, CoDAN, is to facilitate businesses in DANs to collaborate by creating DAN-Spaces and CoDesign-Spaces defined previously. These spaces are shared environments. Here, privacy should be maintained to control who accesses what and does what. Anyone who comes to the system should have a trust that the knowledge is not released to any one unless authorised. Privacy methods should be implemented according to the roles that are assigned to individuals and teams who perform CoDesign process. In the CoDAN diagram, shown in Figure 5.2, privacy methods are represented by the

“Policies” box. CoDAN facilitates participants who join the DAN-Space to define these policies for privacy.

Earlier in this chapter we have defined the DAN-Space and CoDesign-Space and how they are facilitated by CoDAN to support the different types of DANs. In the previous explanation of our model, the privacy is considered through the following aspects:

- First, privacy has been described as a concept in our conceptual framework. According to the privacy concept the DAN is considered with either high level of privacy concern or low level of privacy concern.
- Second, and according to the first aspect, two types of DAN-Space have been defined by CoDAN, the Governed DAN-Space and Not-Governed DAN-Space. DANs with design and development processes can utilise the Governed DAN-Space as it was explained.
- Third, we have presented the roles defined by CoDAN. These roles have different responsibilities and features based on the DAN-Space type utilised.

In this section we present our idea of maintaining the privacy in CoDAN. According to Figure 5.2, the symbolic illustration of the CoDAN defined components, privacy maintaining is based mainly on four components. These components are DAN-Space, CoDesign-Space, Role and Policy. This means people in DAN create DAN-Spaces and CoDesign-Spaces. These people are assigned roles in the spaces. These roles are based on the type of DAN-Space the person is assigned to. Based on the roles of the person his/her policy is created accordingly. Policy is a group of rules which decide what the person’s responsibilities and permissions in DAN-Space are.

In the next sub-section we present how we selected the privacy modelling approach according to the literature. Then, we explain how this approach is applied on the two types of DAN-Space, the Governed and Not-governed, for maintaining privacy in our model.

### **5.6.1. Selecting the privacy modeling approach in CoDAN**

To define our approach of privacy modeling in CoDAN, we refer to Bertino et al. (2006) and Sandhu et al. (1996). Bertino et al. (2006) present two models based on user to role approach to implement privacy for knowledge management. The first model is called Role Based Access Control (RBAC). RBAC, as mentioned by the authors, is more related to

protecting the information in the local and global environments. This model is based on assigning permissions and roles to users. Users in our model are the people in businesses joining the DAN.

The other model presented by the authors is the usage control model (UCON). Compared to RBAC model, the attributes of the user according to UCON may be changed and updated when accessing a new object within the system. Also the attributes of the user are changed and updated when releasing the access of an object.

There is a number of research which relies on Bertino et al. (2006) to maintain privacy and security in knowledge management. Example of that is the model developed by Das (2008).

Based on the two models, RBAC and UCOM, roles in CoDAN are managed through two processes, assigning and updating. Based on the RBAC model access control is based on the roles assigned to the person. Based on the UCOM model the roles of the person are changed and updated when accessing a new component.

Figure 5.9 shows a scenario for assigning and updating roles in CoDAN based on RBAC and UCOM. As shown in the figure, Danny from the contributing Business 1 in the contributed DAN (type of Cat-4) has been assigned DAN-Space-Contributed role in the Not-Governed-DAN-Space created by Danny (1). Danny then created CoDesign-Space 1. In this case Danny is assigned a new role which is CoDesign-Space-Owner in CoDesign-Space 1 (2). Then Danny has been assigned CoDesign-Space-Participant in CoDesign-Space 2 created by John (3). In CoDAN roles are updated once the person's roles change. In the same scenario of Figure 5.9 if John resigns Danny from CoDesign-Space 2 then Danny's roles are updated.

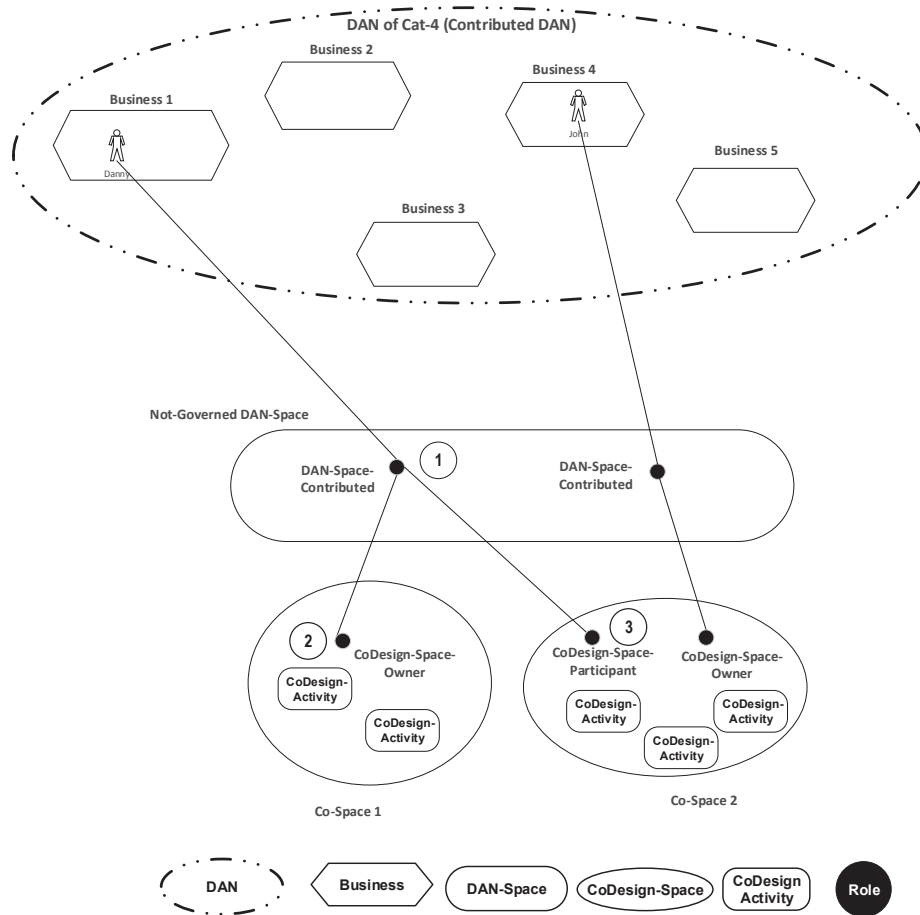


Figure 5.9: Assigning and updating roles in CoDAN

We define the following components in relation to privacy modeling in CoDAN, based on RBAC and UCOM models:

**User (U):** the person who is assigned one role or more. User in CoDAN can be a person from a business in DAN or a person outside DAN.

**Role (R):** A defined CoDAN role that is assigned to User (U)

**Rule:** rule is either permission or constraint. Based on the participant’s role and the accessed object the rule applied is either a permission or constraint.

**Permission (P):** what is allowed for the user when assigned a role (R) (What the user can do).

**Constraints (C):** what is denied from the user when assigned a role (R) (What the user is restricted from accessing or doing).

**Policy (POL):** the group of rules applied on the User (U) once he/she is assigned one role or more.

By considering the components of CoDAN and the concepts derived from RBAC and UCOM we illustrate the symbolic diagram of the privacy modeling in CoDAN as shown in Figure 5.10.

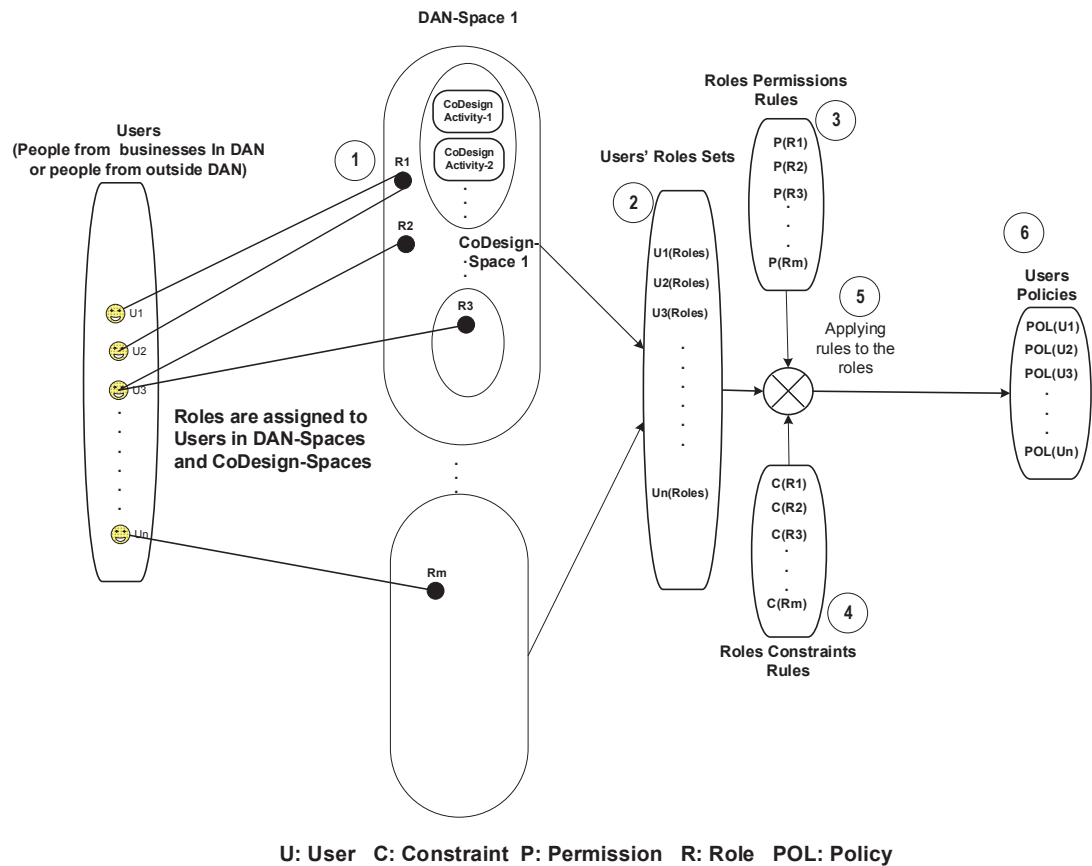


Figure 5.10: Privacy Modeling in CoDAN

*Numbers in the diagram are referred to in the text*

When a person is assigned roles in DAN-Spaces and CoDesign-Spaces the rules related to these roles are applied and the policy for this person is created. This policy is updated whenever the person's roles are updated.

Figure 5.10 can be described as follows by referring to the numbers in the figure:

1. People from DAN or outside DAN (Users) are assigned roles in DAN-Spaces and CoDesign-Spaces. Roles are defined as R1, R2, ....., Rm.
2. In this case a set of roles U(Roles) for each user is created.

3. There is a set of permission rules for each role.
4. There is a set of constraint rules for each role.
5. The rules are applied to each user's set of roles.
6. The policy for the user is created. The user's policy is updated when the users' roles set is updated.

In summary accessing the components and knowledge is based on the roles assigned to the user.

The responsibilities of each role and the rules applied are based on the type of DAN-Space joined.

Next we explain in details the roles in each type of the DAN-Space, Governed and Not-Governed, based on the permissions and constraints.

### **5.6.2. Roles Defined in CoDAN based on Permissions and Constraints**

Table 5.12 and Table 5.13 present the roles responsibilities in terms of permissions and constraints in Governed DAN-Space and Not-Governed DAN-Space respectively.

Based on Table 5.12 and Table 5.13 we clarify the following points:

1. The relationship between the role and responsibility is either a permission or constraint. If the relationship is a permission, then the role is allowed for the responsibility. If the relationship is a constraint the role is denied from the responsibility.
2. In Table 5.12 (in relation to Governed DAN-Space):
  - a. DAN-Space-Coordinator is permitted to all of the responsibilities in the Governed DAN-Space because DAN-Space-Coordinator is the governor here.
  - b. The only permission DAN-Space-Dominant is to have full access. Nothing to do with governance. The person with this role can be assigned to CoDesign-Space by CoDesign-Space-Owner as a CoDesign-Space-Participant to participating in CoDesign.
  - c. DAN-Space-Coordinator is permitted to the same responsibilities that are permitted to CoDesign-Space-Owner. The reason is because DAN-Space-Coordinator is the CoDesign-Space-Owner in Governed DAN-Space.

3. In Table 5.13 (in relation to Not-Governed DAN-Space):
  - a. DAN-Space-Coordinator and DAN-Space-Dominant are not applicable in Not-Governed DAN-Space.
  - b. To get the responsibilities of CoDesign-Space-Owner, DAN-Space-Contributor should create CoDesign-Space.
  - c. The permissions of CoDesign-Space-Owner are only applied on the owned CoDesign-Space.

Table 5.12: Roles in Governed DAN-Space (Permissions and Constraints)

P=Permissions - C=Constraints

Responsibilities	Roles					
	DAN-Space-Coordinator	DAN-Space-Dominant	DAN-Space-Contributor	DAN-Space-Participant	CoDesign-Space-Owner	CoDesign-Space-Participant
Full access to knowledge and components in DAN-Space	P	P	C	C	C	C
Inviting people to join DAN-Space	P	C	C	C	C	C
Creating CoDesign-Space	P	C	C	C	C	C
Managing CoDesign-Space	P	C	C	C	P	C
Assigning people to CoDesign-Space	P	C	C	C	P	C
Carrying out CoDesign Activities	P	C	C	C	P	P
Transferring knowledge in among CoDesign-Activities in CoDesign-Space	P	C	C	C	P	P
Transferring knowledge among CoDesign-Spaces in DAN-Space	P	C	C	C	P	C



Table 5.13: Roles in Not-Governed DAN-Space (Permissions and Constraints)

P=Permissions - C=Constraints - NA=The role is not applicable

Responsibilities	Roles					
	DAN-Space-Coordinator	DAN-Space-Dominant	DAN-Space-Contributor	DAN-Space-Participant	CoDesign-Space-Owner	CoDesign-Space-Participant
Full access to knowledge and components in DAN-Spacer	NA	NA	C	C	C	C
Inviting people to join DAN-Space	NA	NA	P	C	C	C
Creating CoDesign-Space	NA	NA	P	C	C	C
Managing the owned CoDesign-Space	NA	NA	C	C	P	C
Assigning people to the owned CoDesign-Space	NA	NA	C	C	P	C
Carrying out CoDesign-Activities in the owned CoDesign-Space.	NA	NA	C	C	P	P
Transferring knowledge in among CoDesign-Activities in the owned CoDesign-Space	NA	NA	C	C	P	P
Transferring knowledge among the owned CoDesign-Spaces in DAN-Space	NA	NA	C	C	P	C

In the previous sections we have explained our model and how it can be utilised to support the different DAN types. We have explained the two types of DAN-Spaces facilitated by CoDAN and how each type can be used to support DANs. The roles defined by CoDAN that people can be assigned when in DAN-Spaces and CoDesign-Spaces have been presented. Also, we have explained how the privacy maintaining is modelled in our model. According to the privacy modelling we have shown how the policy of a person who is assigned roles in any type of DAN-Space can be created.

The main goal of this research is to develop a model to facilitate businesses in DANs to create their creativity environments to collaborate in CoDesign. Collaboration and creativity have been facilitated in CoDAN by creating CoDesign-Spaces. CoDesign Activities then can be created in the CoDesign-Spaces and creativity tools are utilised to perform these activities.

In the next section we explain the CoDesign activities and tools as defined in CoDAN.

## 5.7. Enabling Creativity by CoDAN

In this section we explain how the creativity is enabled in CoDAN. As per Amabile (1998) the knowledge creating and sharing support the creativity within the business. In our model, knowledge sharing and creating is supported through two ways. First is bringing in people and expertise to the creativity environment. Those people usually are with business roles within the DAN. People outside the DAN can join when required. In CoDAN that is facilitated by creating DAN-Spaces and CoDesign-Spaces as explained previously. Second is providing these people with creativity tools to perform the different CoDesign activities according to business goals and outcomes agreed upon. There is no specific type of creativity tools that should be defined in CoDAN. However, for better understanding of creativity tools and CoDesign activities we adopt the tools defined by Design Thinking for prototype implementation. The reason here, is that Design Thinking tools are becoming widely used in performing CoDesign process. Other creativity tools rather than Design Thinking can be defined in the model as well.

CoDesign activities are created into the CoDesign-Spaces and performed by utilising the creativity tools.

In this section we need to clarify CoDesign activity and creativity tool terminology. Also, we provide an idea of how CoDesign activities are defined in CoDAN.

### 5.7.1. CoDesign activities and creativity tools

Activities are described in Hawryszkiewicz (2010) as a breakdown of the business process. In this research, CoDesign activities are referred as breakdowns of the CoDesign process. CoDesign activities are created into the CoDesign-Spaces and performed by the people who join the CoDesign-Spaces.

Creativity tools are the tools utilised by people joining the CoDesign-Space to perform the CoDesign activity and to achieve the activity outcome. Examples of the creativity tools are the tools defined in Design Thinking such as storyboarding, persona-map and lotus blossom.

According to the literature, as mentioned in Chapter 2, CoDesign becomes an iterative process. At any stage of design, designers may return back to any earlier stage. Design

Thinking process relies on what is called convergence and divergence as it is understood from Design Thinking models presented in Tschimmel (2012). Ideas are gathered and brainstormed in the divergent phase, and then these ideas are filtered and extracted in the convergent phase. The extracted ideas can be used to create new ideas and/or solutions again by returning back to the divergent phase. Solutions can be suggested, brainstormed and selected in the same way. The CoDesign activities alternate between divergence and convergence phases until the proper solution is defined.

Design Thinking tools are utilised in CoDesign as these tools facilitate the divergence and convergence phases. Our focus in this research is not mainly on Design Thinking and its tools. However, we consider Design Thinking theory and practice as a source to define a variety of creativity tools in our model. Other creativity tools, rather than Design Thinking related, can be defined when required.

In CoDAN, the single CoDesign activity can be performed and supported by more than one creativity tool. Businesses in DANs when they create CoDesign activities they can define what tools are to be utilised to perform the activity.

The example illustrated in Figure 5.11 shows how CoDesign activities and creativity tools are defined in our model.

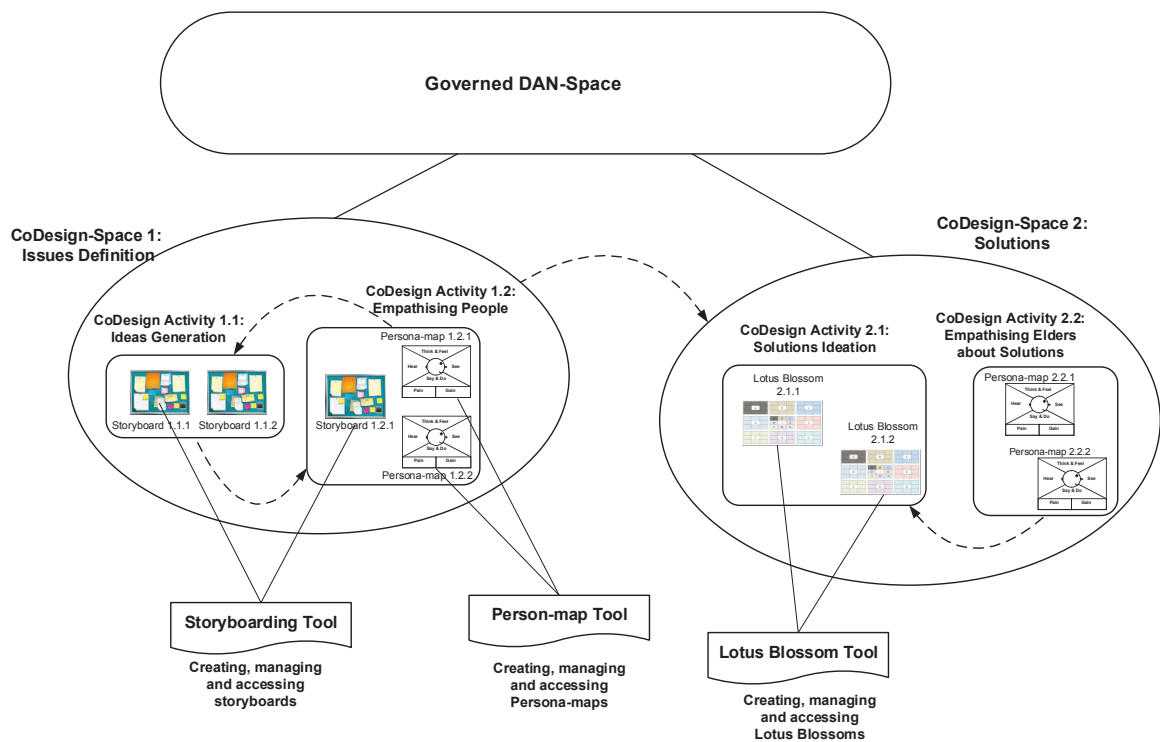


Figure 5.11: CoDesign activities and Creativity Tools

The example shows two CoDesign-Spaces, CoDesign-Space 1 and CoDesign-Space 2 under a Governed DAN-Space. CoDesign-Space 1 is for brainstorming people in the workplace about any issues or ideas that needs solutions or can be converted to business opportunities. CoDesign-Space 2 is for designing solutions for a selected idea from CoDesign-Space 1. Design Thinking tools are utilised to perform the CoDesign activities in the CoDesign-Spaces:

- Storyboarding: the storyboard is where people post their ideas and stories (Tschimmel, 2012).
- Persona-map: persona-map is a Design Thinking tool for empathising people and getting more feedback from people about a specific idea, issue or solution ((Tschimmel, 2012) and Crandall (Crandall, 2010)).
- Lotus Blossom: lotus blossom tool (Sefertzi, 2000) is implemented to ideate and brainstorm for problem solutions.

As shown in Figure 5.11 two activities have been created into CoDesign-Space 1:

- Activity 1.1 for ideas posting. By utilising the storyboarding tool two storyboards are created to manage the ideas posted in this activity.

- Activity 1.2 is for empathising people about any selected idea. Here, two tools are utilised, the storyboarding and persona-map as shown in the figure.

Also two activities have been created in CoDesign-Space 2:

- Activity 2.1 to ideate solutions. In this activity lotus blossom tool is utilised.
- Activity 2.2 to empathise people and obtaining feedback about the solutions created by utilising persona-map tool.

The dashed arrows in the figure represent the knowledge transfer. Knowledge can be transferred between the activities in the CoDesign-Space. Also, knowledge can be transferred between CoDesign-Spaces. Knowledge created in CoDesign-Space 1 can be utilised in CoDesign-Space 2 to support solutions ideation.

This example just shows how activities and tools are defined in CoDAN. It shows that more than one activity can be created in a single CoDesign-Space. More than one creativity tool can be utilised for a single activity.

In Chapter 6, we show how we implemented the activities and tools in the model prototype for model evaluation.

In the following scenario we provide an example of how to use CoDAN to support DANs of category Cat-1. In this scenario we show how all of the components defined by CoDAN are utilised to support businesses to contribute in the DAN for CoDesign

### **Scenario: Producing and Distributing Laptops with their bags.**

The scenario demonstrates an alliance network (DAN) of a number of businesses lead by a dominant business. The scenario is illustrated in Figure 5.12 below.

- The DAN was created and dominated by Business A, Worldwide Distributor. Worldwide Distributor invites different suppliers and manufacturers to contribute in the DAN.
- Worldwide Distributor collaborates with the DAN contributors to design and manufacture products based on the market needs. These products can be distributed by Business A, Worldwide Distributor.
- Business B, Quality Bags, contributed in the DAN by Worldwide Distributor to collaborate in designing and producing different bag styles and models based on the

market needs. The produced bags were distributed by Worldwide Distributor.

- Business C, All Computers, has contributed later to collaborate in the DAN and benefit from the experience of the dominant business, Business A, in goods design and distribution.
- One of the design projects to be performed collaboratively by the three businesses is producing and distributing laptops with special bags.
- The dominant business, Worldwide Distributor, uses CoDAN to create creativity environment for design with the other contributors. The aim is to design special laptop bags to be attached to laptops and distributed by Worldwide Distributor.
- The DAN here demonstrates category Cat-1 DAN types. The DAN type here is similar to the Type-3 of DAN, Dynamic network.

***Using CoDAN:***

- Because the DAN falls in the category Cat-1 that means the DAN-Space type supports this DAN type is the Governed DAN-Space.
- Originally, Worldwide Distributor creates the Governed DAN-Space. The governor of this DAN-Space is Worldwide Distributor itself.
- As Worldwide Distributor collaborates with Quality Bags in designing different bag styles it creates CoDesign-Space 1 and CoDesign-Space 2 for this purpose. CoDesign-Space 1 is for designing the bags and CoDesign-Space 2 is for empathising customer needs in the market.
- For laptops bags project Worldwide Distributors, the governing business, creates CoDesign-Space 3 to collaborate in design with the two businesses.

***CoDesign-Space activities***

- Activities are created in CoDesign-Spaces and performed by utilising creativity tools.
- CoDesign-Space 1 Activities: CoDesign-Space 1 is the first CoDesign-Space created by Worldwide Distributors to collaborate with Quality Bags. The activities created in this CoDesign-Space are:
  - Stories: This activity contains storyboards where ideas of bags and stories are posted and shared. Also, in this activity, stories of issues and problems in relation to bags are posted for creating solutions later.

- Design activity: once an idea of a new style of bag is selected from Stories activity, designing this bag is performed through Design activity. In this activity storyboard and lotus blossom tools can be utilised for solutions ideation.
- CoDesign-Space 2 activities: This space is to empathise the customers and community to involve them in the CoDesign process. The activities created in CoDesign-Space 2 are:
  - Empathising needs activity: in this activity persona-map tool is utilised to create persona-maps to empathise people in the market for the needs in relation to bags.
  - Empathising design activity: in this activity persona-map tool is utilised to create persona-maps to empathise people in the market for the designed bags and getting feedback.
- CoDesign-Space 3 activities:
  - Laptop Bags Design: in this activity storyboarding tool is utilised to create and manage storyboard to brainstorm ideas of laptop bags. Lotus blossom is created to ideate solutions and design them.

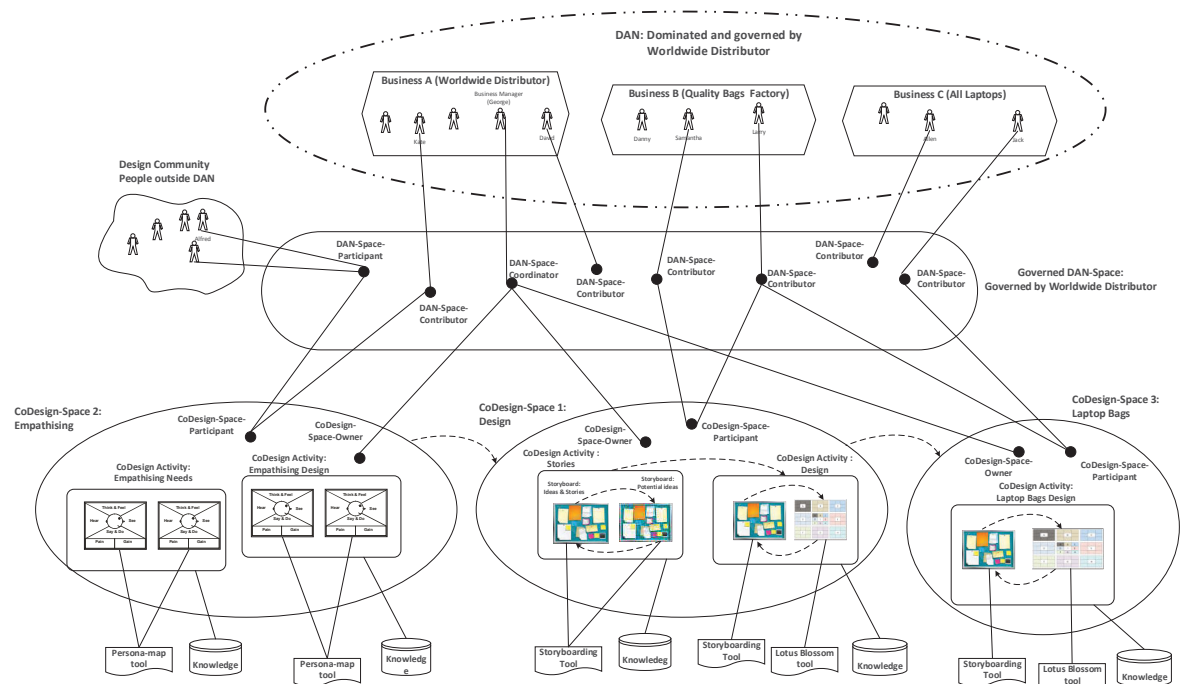


Figure 5.12: Governed DAN-Space Scenario

***Roles in the DAN-Space and CoDesign-Spaces:***

**Roles assigned to people from businesses in DAN:**

<b>Business</b>	<b>Person</b>	<b>Role</b>	<b>In</b>
Worldwide Distributor (Business A)  Dominant and governing business	George	DAN-Space- Coordinator	DAN-Space
		CoDesign-Space- Owner	CoDesign-Space 1, CoDesign-Space 2 and CoDesign- Space 3
	Kate	DAN-Space- Contributor	DAN-Space
		CoDesign-Space- Participant	CoDesign-Space 2
David	DAN-Space- Contributor	DAN-Space	
Quality Bags Factory (Business B)  Contributing Business	Samantha	DAN-Space- Contributor	DAN-Space
		CoDesign-Space- Participant	CoDesign-Space-1
	Larry	DAN-Space- Contributor	DAN-Space
		CoDesign-Space- Participant	CoDesign-Space-1 and CoDesign- Space-3
All Laptops (Business C)  Contributing Business	Allen	DAN-Space- Contributor	DAN-Space
	Jack	DAN-Space- Contributor	DAN-Space
		CoDesign-Space- Participant	CoDesign-Space-3



Roles assigned to people outside DAN

<b>Person</b>	<b>Role</b>	<b>In</b>
Alfred	DAN-Space-Participant	DAN-Space
	CoDesign-Space-Participant	CoDesign-Space 2

## 5.8. Research Model and Research Framework

Our research framework has been presented at the end of Chapter 2 “Literature Review” and at the beginning of Chapter 3 “Research Methodology”. In the research framework five themes of managing CoDesign have been stated. These themes are knowledge sharing, self-organising, business networking, enabling creativity and maintaining privacy. Enablers to enable each of the themes have been defined.

These enablers are supported by CoDAN as the goal of this research.

In the Table 5.14 below we show how each of the enablers is supported by CoDAN.

Table 5.14: Enablers supported by CoDAN

<b>CoDesign Requirement (Theme)</b>	<b>Enablers</b>	<b>CoDAN Support</b>
<b>Business Networking</b>	Supporting Networking	-Creating DAN-Spaces and inviting people from DANs and outside DANs to participate
	Facilitating Collaborative Activities.	-Creating CoDesign-Spaces and CoDesign-Activities -Defining Creativity Tools to utilise
	Facilitating Stakeholders Participation	-Allowing people from DAN and outside of DAN to be assigned different roles in DAN-Spaces and CoDesign-Spaces.
<b>Maintaining Privacy</b>	Knowledge Ownership	-Defining different roles with different responsibilities -Creating CoDesign-Spaces -Defining Governed and Not-Governed DAN-Space
	Components Privacy	-Defining different roles with different responsibilities -Creating CoDesign-Spaces -Defining Governed and Not-Governed DAN-Space
	Access Control Rules and Procedures	-Defining different roles with different responsibilities -Creating CoDesign-Spaces -Defining Governed and Not-Governed DAN-Space
<b>Self-Organising</b>	Bringing in New Knowledge	-Creating DAN-Spaces -Inviting people from businesses in DANs to participate in DAN-Spaces -Inviting people from outside DANs to participate in DAN-Spaces - Creating CoDesign-Spaces
	Supporting Team Evolution	-Creating and managing CoDesign-Spaces

	Supporting Team Modification	<ul style="list-style-type: none"> <li>- Inviting new people when needed to DAN-Space.</li> <li>-Creating new CoDesign-Spaces when needed.</li> <li>-Assigning new participants to CoDesign-Spaces</li> <li>-Creating new CoDesign-Activities when needed.</li> </ul>
<b>Knowledge Sharing</b>	Tacit and Explicit Knowledge Support	<ul style="list-style-type: none"> <li>-Creating DAN-Spaces</li> <li>-Creating CoDesign-Spaces and CoDesign-Activities</li> </ul>
	Knowledge Management Processes Support	<ul style="list-style-type: none"> <li>-Creating CoDesign-Activities</li> <li>-Defining Creativity Tools to utilise</li> <li>-Knowledge transfer modes</li> </ul>
<b>Enabling Creativity</b>	Creativity Tools	-Defining different creativity tools to carry out the CoDesign-Activities.
	Supporting Brainstorming	<ul style="list-style-type: none"> <li>-Creating CoDesign-Spaces</li> <li>-Carrying out CoDesign-Activities by utilising Creativity Tools</li> </ul>
	Supporting Multidisciplinary	<ul style="list-style-type: none"> <li>-Defining different creativity tools</li> <li>-Defining different roles</li> <li>-Creating CoDesign-Spaces and CoDesign-Activities</li> </ul>

In the next chapter, Chapter 6 “Prototype Design and Implementation”, we present how CoDAN prototype is designed and implemented. As we mentioned that the prototype is utilised for CoDAN evaluation process.

## 5.9. Chapter Summary

In this chapter we have presented CoDAN, our research model. The model has been developed based on the features of DANs defined by our conceptual framework. The model should support CoDesign enablers defined in the research framework, defined according to the literature review. We have explained the idea of DAN-Space and

CoDesign-Space to support DANs in our model. Then we have defined the two types of DAN-Space, the Governed and Not-Governed. Based on the two kinds of DAN-Space we developed the features in the conceptual framework and we developed our guidance table to decide what DAN-Space type supports each type of DAN category. Roles defined by CoDAN are presented. Then privacy modeling was based on Role Based Access Control (RBAC) model and Usage Control Model (UCOM). Roles based on privacy modeling have been explained. Regarding supporting creativity we explained in more details the CoDesign activities and creativity tools terminology. At the end of the chapter we have shown how the enablers defined in the research framework are supported by CoDAN.

# Chapter 6

## Ch6: Prototype Design and Implementation

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### 6.1. Introduction

Our research is to develop a model to support Dynamic Alliance Networks (DANs) for CoDesign. In Chapter 3 we have defined the methodology of our model development and evaluation. Evaluation process, as defined by the methodology, is to be conducted using the model documentation and model prototype. Experts are provided with the model documentation and access to the prototype, and then a semi-structured interview is conducted with them. Evaluation method is based on Cronholm and Goldkuhl (2003) where the *goal-based/system as such* method is suggested to evaluate the model, CoDAN. Based on *goal-based/system as such* method the documentation and the prototype of the model are needed for evaluation. We have adopted the *goal-based* approach as we focus on goals in our research and involve experts in the evaluation process by conducting the qualitative method.

In Chapter 5 the model was defined based on the three aspects, supporting networking, supporting creativity and maintaining privacy.

- Supporting networking is by creating DAN-Spaces.
- Supporting creativity is by creating CoDesign-Spaces where CoDesign-Activities are created and utilised by creativity tools.
- Maintaining privacy is by defining rules to create the policies based on the roles assigned to the people when joining DAN-Spaces and CoDesign-Spaces.

In this chapter, Chapter 6, we show the design and implementation of the model prototype. In this research we do not focus on the prototype but on the research model, CoDAN. The prototype demonstrates the research model, CoDAN, and supports constructing the semi-structured interview questions. The prototype design and implementation is based on the model defined in Chapter 5.

The prototype does not include the full functionality of the model. The following features and functionality are considered in our prototype:

1. Governed DAN-Space type.
2. CoDesign-Spaces.
3. CoDesign Activities
4. Creativity Tools by implementing selected Design Thinking tools
5. Maintaining privacy in the Governed DAN-Space.
6. Activity to Activity knowledge transfer.
7. CoDesign-Space to CoDesign-Space knowledge transfer.

In section 6.2 of this chapter we explain the main components to be implemented based on CoDAN as defined in Chapter 5.

Section 6.3 presents how we utilised the Object-Oriented Modeling methodology to define the components as objects in relation to their attributes and methods.

A description of the software tools used to implement the prototype is provided in section 6.4.

In section 6.5 we show the block diagram of the main modules that have been implemented to facilitate the model functions in the prototype.

In section 6.6 we explain how the three aspects, networking, creativity and privacy are supported by the prototype. In this section we provide a demonstration through Cisco DAN Scenario described in Chapter 5 by showing and describing the different User Interface screens.

In designing the prototype we have used the Object-Oriented Modeling (OOM). We have utilised the Unifying Modeling Language (UML) to develop the object-oriented model. Please see Appendix 5 for more information about OOM and UML. By utilising the UML we have defined the model components based on their classes. These classes are defined

through their attributes and methods. Each component is presented by a class where objects can be created for this component. The relationships between these components have been defined as well. The object-oriented model of the prototype is derived according to the components defined in Chapter 5.

## 6.2. Model Components in the CoDAN Prototype

Model components have been defined and presented in Chapter 5, Model Definition. Model components have been illustrated in Figure 5.2 of Chapter 5. The model components are shown in Figure 6.1 as well in this chapter.

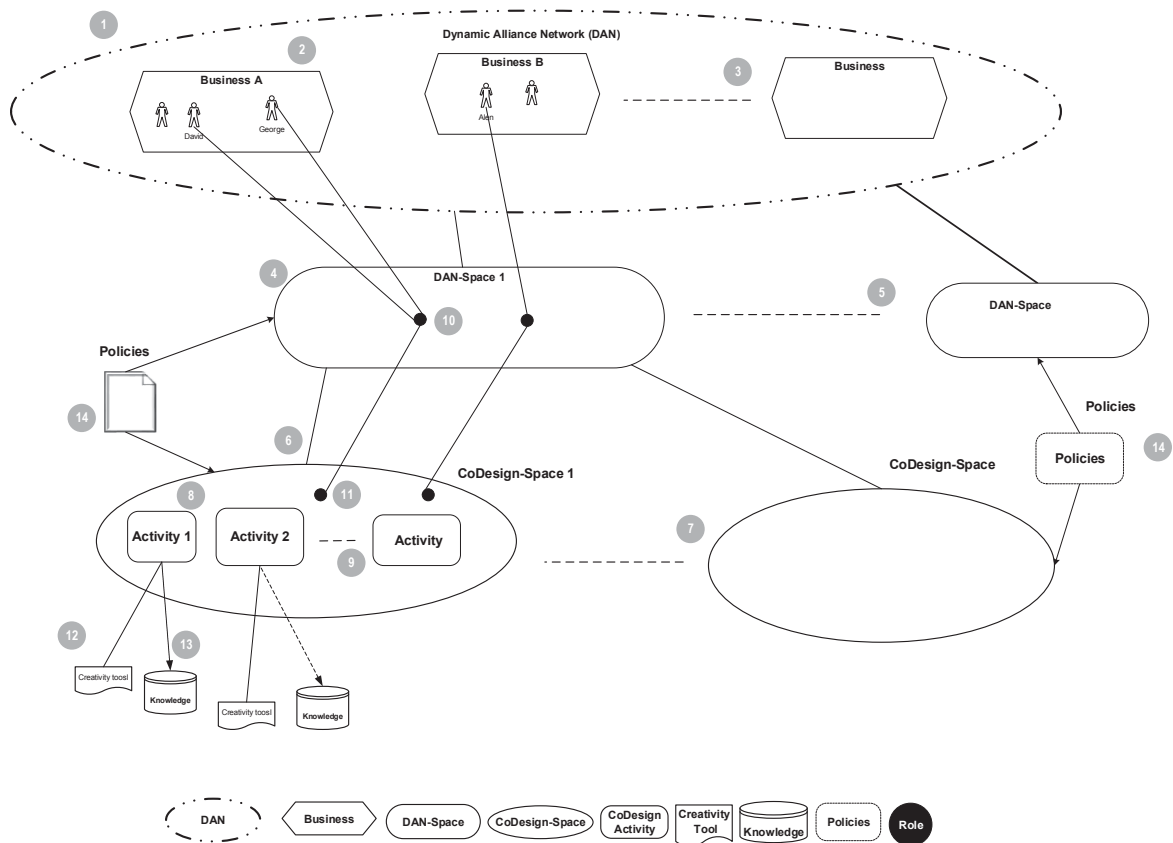


Figure 6.1: CoDAN defined components (as shown in Figure 5.2)

In this section we provide an idea about how the components could be facilitated throughout the model prototype.

- **DAN Space (DAN-Space):** DAN-Space is the facility of supporting business networking. Prototype should provide capabilities through the software modules for



people in DANs to create and manage DAN-Spaces. People also should be able to invite each other to participate in the DAN-Space. Modules managing the DAN-Space also should allow creating CoDesign-Spaces in the DAN-Space.

- **CoDesign Space (CoDesign-Space):** CoDesign-Space is where the creativity takes place. Modules which support CoDesign-Spaces should provide users with the capability to assign participants from the DAN-Space to join CoDesign-Spaces. Modules which manage CoDesign-Spaces should provide the functionality of creating CoDesign activities into CoDesign-Spaces as well.
- **CoDesign-Activities and Creativity Tools:** the tools to be implemented in the prototype are those defined in Design Thinking. Three different types of tools are suggested:
  - Storyboarding
  - Persona-map
  - Lotus Blossom

In Chapter 5 we mentioned that the CoDesign activity can be utilised by more than one tool. Here, and for simplicity, we consider the activity to be utilised by only one tool. Hence, the activity is named based on the tool to be utilised. For example, the storyboarding activity is utilised by the storyboarding tool and the persona-map activity is utilised by the persona-map tool. Figure 6.2 illustrates this idea.

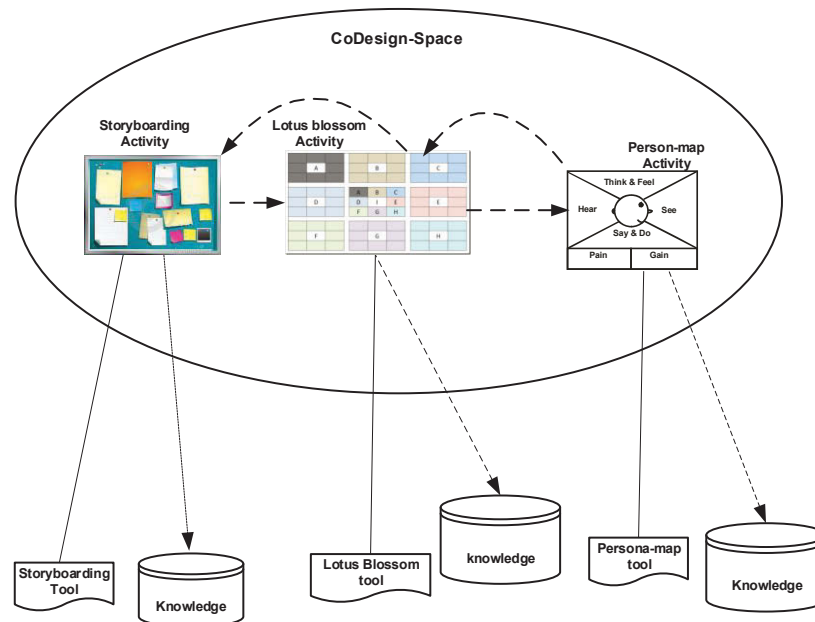


Figure 6.2: Design Thinking activities and tools in the prototype

Figure 6.2 shows an example of CoDesign-Space where three Design Thinking activities are created. Each activity is performed with its dedicated tool. The dotted arrows between the activities show the knowledge transfer between these activities.

- **Roles:** one of the functions provided by the modules in the prototype is the roles management. Roles defined by CoDAN for the Governed DAN-Space in Chapter 6 are:
  - DAN-Space-Coordinator
  - DAN-Space-Dominant
  - DAN-Space-Contributor
  - DAN-Space-Participant
  - CoDesign-Space-Owner
  - CoDesign-Space-Participant

The prototype implemented software should provide the capability of managing these roles. The management of roles includes:

- Assigning people to these roles in DAN-Spaces and CoDesign-Spaces.
- Creating the user's policy based on the roles assigned.

- **Knowledge:** Knowledge created throughout the creativity tools in CoDesign-Activities is stored and retrieved based on the activity, CoDesign-Space and DAN-Space. Knowledge accessing is controlled based on the user's policy.

In this section, we have just provided an idea about how the model components are to be implemented and managed throughout the prototype.

Before we explain how the prototype has been designed and implemented we provide more details about the Design Thinking tools implemented in the prototype.

### 6.3. Design Thinking Tools Defined in the Prototype

For demonstration, prototyping and evaluation purposes we present three different tools here as defined in Design Thinking. These tools are storyboarding, persona-map and lotus blossom. These tools are commonly used and can be utilised in the different stages of the CoDesign process and for different purposes.

These three tools are defined as following:

***Storyboard for gathering stories.*** According to Tschimmel (2012) storyboard is a number of labeled images that describe a story or a concept. In fact the story is a concept or an issue which can be described in writing and sketching as well. The classic storyboard in business and design environments is where people can post their ideas in the form of labels. More than one storyboard can be used. For example each storyboard is used for a specific purpose. Posts or stories can be transferred or copied among the storyboards when required.

In the prototype the storyboard has been implemented as a CoDesign activity and utilised by the storyboarding tool as explained previously. The purpose of the storyboard activity is defined by the person who creates the activity. By accessing the storyboarding activity through the storyboarding tool, people can perform the following functions:

- Posting stories and ideas.
- Commenting on the posts and ideas.
- Downloading the knowledge created.

- Attaching other files formats, such as voice and video to the posts.

**Persona-map for empathising.** Persona-map is alternatively called empathy map as well. According to Crandall (2010) of Stanford d.school and Tschimmel (2012) persona-map is used to know about the user. Persona-map is used to understand the needs of people. These needs are understood and absorbed through what these people feel, think, see and do. Empathised people are asked specific questions and these questions are categorised in a way that leads to understand people's pains in the problem domain. Empathising people using persona-map supports defining the problem or issue in a better way for proper solutions. Empathising people using persona-map also can be conducted to get feedback about the suggested solutions as well. Figure 6.3 shows an example of persona-map diagram.

In order to utilise the persona-map tool, a persona-map activity should be created by the prototype. The person who creates the persona-map activity defines the activity through its purpose and the questions to be asked to people for empathising. These questions are related to the themes as shown in Figure 6.3 such as what the people feel, hear and see. The persona-map tool then is utilised to post the answers of these questions and the comments on the answers. The knowledge created through the persona-map tools can be downloaded and organised based on the themes by using the tool.

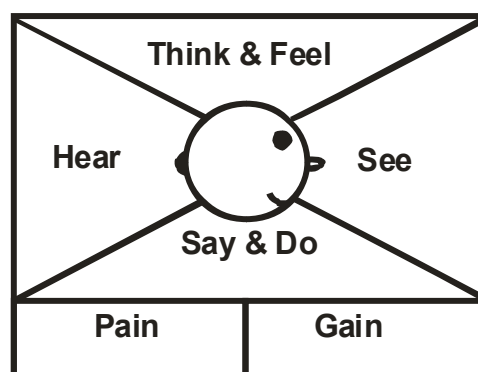


Figure 6.3: Persona-map Tool

**Lotus Blossom to create solutions.** Lotus blossom technique has been implemented by Yasuo Matsumura of Clover Management Research in Chiba City of Japan, and is

explained in his book (Frey, 2011).

Lotus blossom tool (Sefertzi, 2000) is implemented to ideate and brainstorm for problem solutions. Usually lotus blossom is utilised by the professional people in the business who design and develop solutions. Examples of these people in business can be the managers, designers and developers. Utilising lotus blossom does not mean that this is a final step of brainstorming for the solution. Designers may return back to utilise the other tools such as persona-map to empathise for more knowledge if needed for example. Practically, all creativity tools are utilised in combination for CoDesign outcomes.

As shown in Figure 6.4 that lotus blossom is presented by a parent central cell and nine children cells. The central cell of the parent presents the main theme. The eight surrounded squares of the parent present the expanded themes in relation to the main theme. For example, the core parent may represent the main problem and the children themes represent the possible major solutions. These solutions, in turn, can be expanded again. The Figure 6.4 shows a scenario of utilising the lotus blossom tool. Here, the tool is utilised to ideate solutions and options for the elders facility needs in a train station. The main facilities suggested are presented in the central lotus. Each of these facilities options can be expanded to another lotus as shown in the figure.

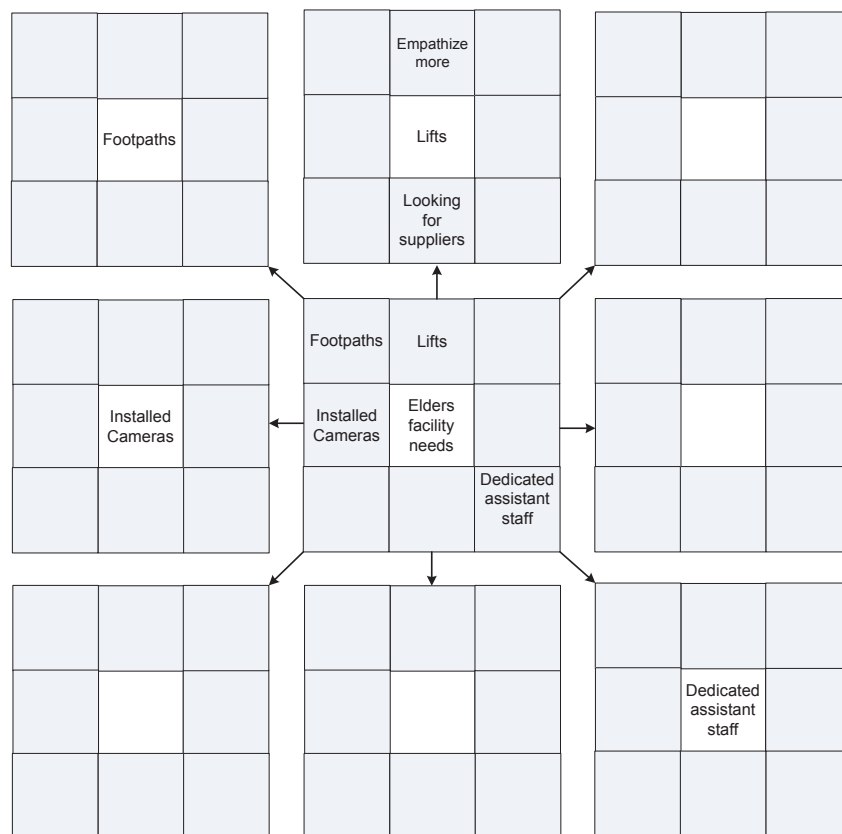


Figure 6.4: Lotus Blossom Tool

To utilise the lotus blossom tool in the prototype, a lotus blossom activity should be created first. The lotus blossom activity is defined by its purpose and the main central theme. The other themes can be defined later by using the lotus blossom tool when accessing the activity. The lotus blossom allows users to post ideas about each theme and modifying these themes accordingly to reach the proper solution for the problem.

In the next section we explain how the model components are designed by utilising Object Oriented Modelling (OOM). As mentioned previously, the prototype design and implementation is based on the Governed DAN-Space type.

## 6.4. Object Oriented Model (OOM) of the Research Model

To design and implement the model prototype we utilise Unifying Modeling Language (UML) for Object-Oriented Modeling (OOM). According to OOM concepts each

component is to be defined as an object of class type. This class is defined by its type, attributes and methods. The relationships between the different classes are defined as well.

The following classes are defined according to CoDAN defined components:

- User
- Role
- DAN-Space
- CoDesign-Space
- CoDesign Activity
- Creativity Tool
- Knowledge.

Figure 6.5 below shows the OOM design of our model based on OOM definitions in Appendix 5.

The relationships between the components are presented by the joint lines ending by arrows. The arrow refers to the direction of the relationship. For example, Role is assigned to User” and “User Creates Knowledge”. More than one relationship can be defined between two objects. For example, “User Assigned to DAN-Space” and “User Creates DAN-Space”. The relationship depends on the roles assigned to the User.

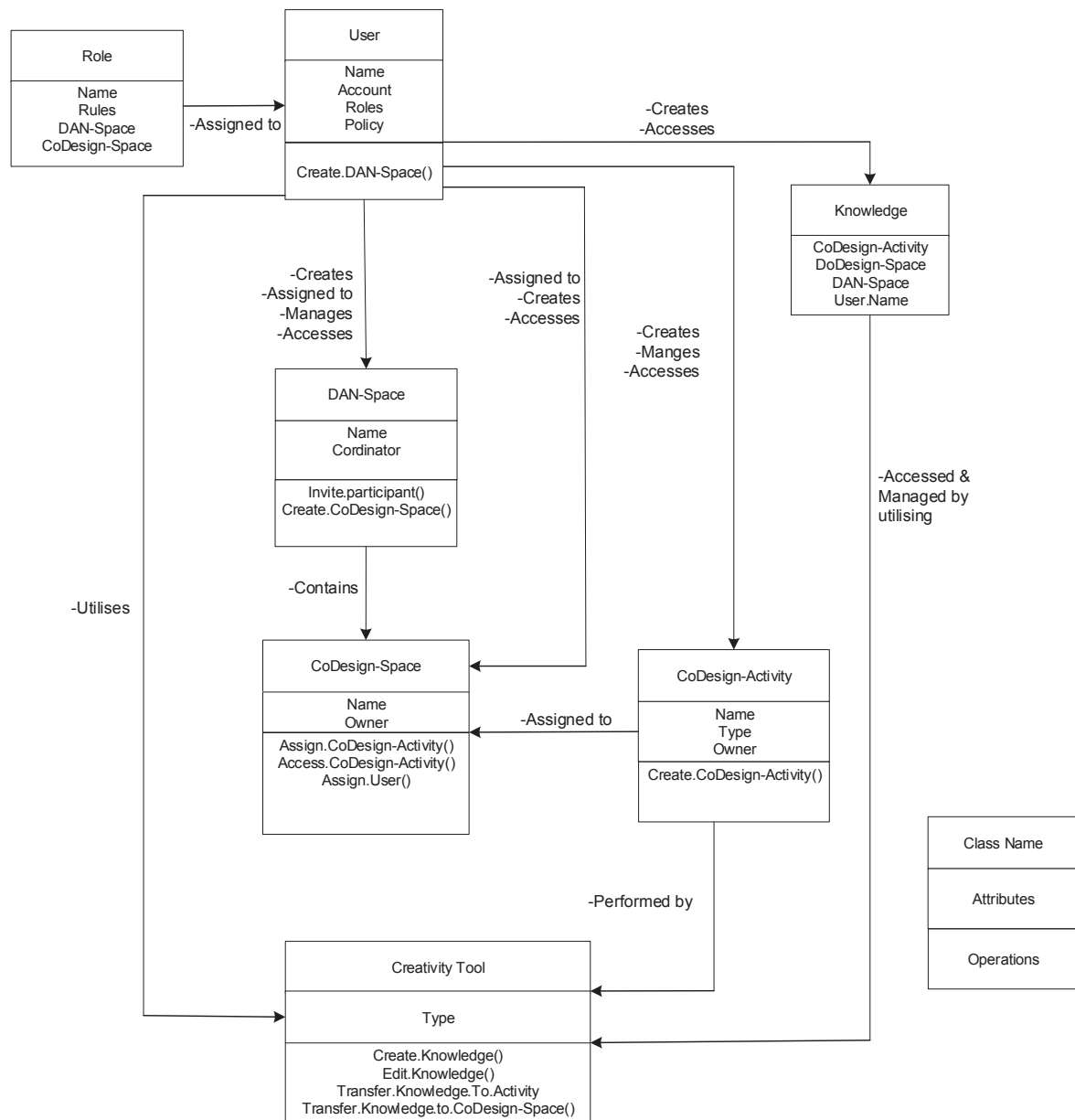


Figure 6.5: Object-Oriented Modeling of CoDAN

The OOM of the research model illustrated in Figure 6.5 can be described as following:

- The User object represents any person who creates an account and logs into the system.
- Once the user logs in he/she can create and manage DAN-Space(s). The type of DAN-Space here is Governed as the prototype demonstrates it.
- Once the user creates the DAN-Space he/she is assigned DAN-Space-Coordinator role to this DAN-Space.



- The DAN-Space-Coordinator is also created accordingly.
- DAN-Space-Coordinator can invite people from other businesses in DAN to participate in the DAN-Space.
- Once the user accepts the invitation he/she is assigned DAN-Space-Contributor role into the DAN-Space and the user's policy created.
- In the Governed DAN-Space the user with the DAN-Space-Coordinator role creates CoDesign-Spaces.
- DAN-Space-Coordinator user is assigned CoDesign-Space-Owner role in the created CoDesign-Space.
- The DAN-Space-Coordinator also creates CoDesign-Activities and assigns them to the CoDesign-Spaces.
- The DAN-Space-Coordinator assigns the people with DAN-Space-Contributor and DAN-Space-Participant roles in DAN-Space to the CoDesign-Space(s) as required.
- The person is assigned CoDesign-Space-Participant role once assigned to the CoDesign-Space.
- The user with CoDesign-Space-Participant role can utilise creativity tools to perform the CoDesign activities created in the CoDesign-Space.

Software development tools have been used to program the code modules of the prototype based on the object-oriented modeling. Next we provide an idea about these tools and explain the prototype software modules.

## 6.5. Software Development Tools

The tools used to develop the prototype are HTML, JavaScript, PHP and MySQL.

PHP server and MySQL server are installed on a virtual machine on the cloud which is accessed through the Internet. MySQL server contains the database schema accessed through PHP codes. The user interface is implemented with the combination of HTML, JavaScript and PHP. Functions which deal with accessing the database are implemented by PHP. The main purpose of using JavaScript is dynamically manipulating the data at the end user.

## 6.6. Prototype Modules

The Figure 6.6 below shows the block diagram design of our prototype modules.

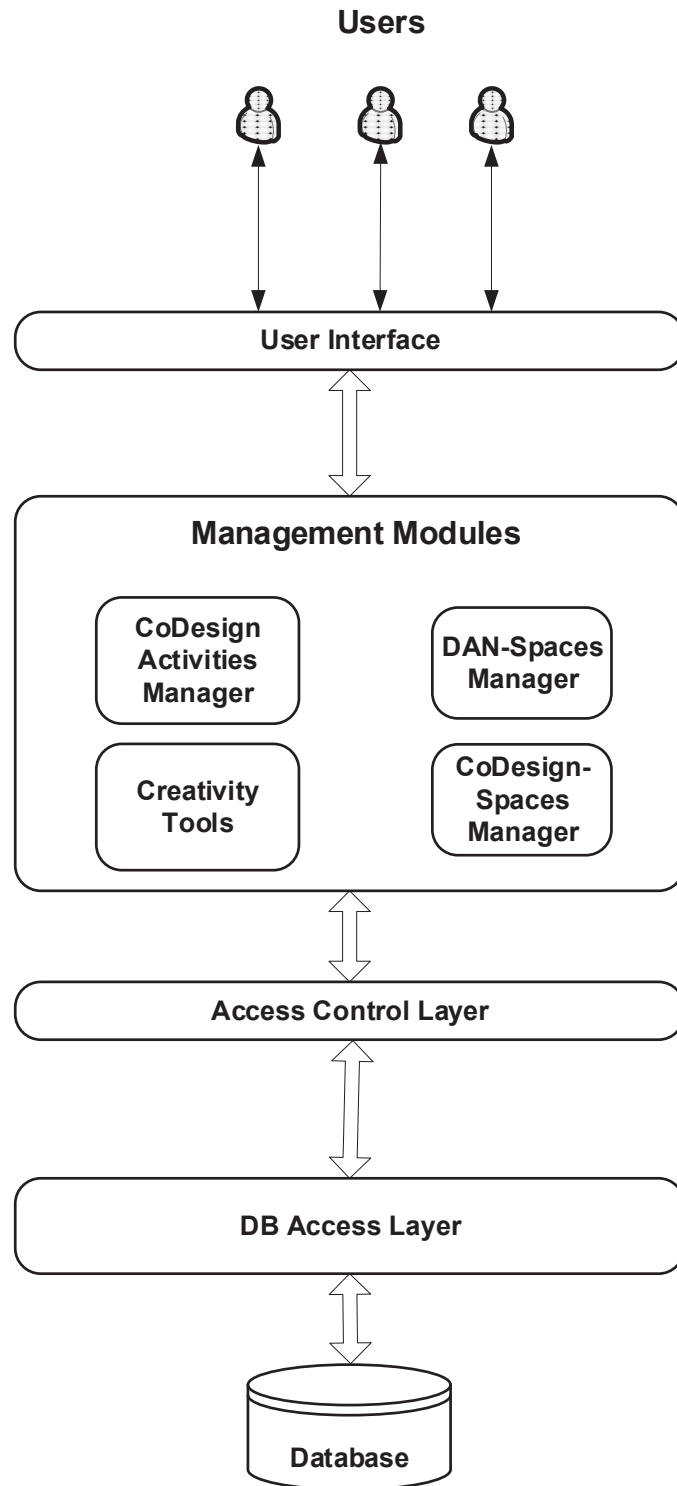


Figure 6.6: Prototype Block Diagram Design

According to Figure 6.6 the components of the prototype can be listed as following starting from the user side:

- User Interface.
- Management Modules:
  - DAN-Spaces Manager.
  - CoDesign-Spaces Manager.
  - CoDesign Activities Manager.
  - Creativity Tools.
- Access Control Layer.
- Database Access Layer.
- Database.

*Management modules* are a group of modules accessed by the user through the User Interface to perform different operations. These modules are PHP based and executed in the server side. These modules allow the user to retrieve and update the database records based on the operation performed. There are four types of managing modules in the prototype, DAN-Spaces Manager, CoDesign-Spaces Manager, CoDesign Activities Manager and Creativity Tools.

- **DAN-Spaces Manager:** a group of modules allow users to create and manage DAN-Spaces. That includes inviting people from businesses in DAN to participate in DAN-Space. CoDesign-Spaces are created by accessing the DAN-Space manager. CoDesign-Spaces Manager is then accessed through the DAN-Space Manager to access and manage CoDesign-Spaces.
- **Co-Design-Spaces Manager:** it is accessed through the DAN-Space Manager to access and manage CoDesign-Spaces. CoDesign-Spaces Manager is used to assign/resign CoDesign activities created through CoDesign Activities Manager to/from the CoDesign-Space.
- **CoDesign-Activities Manager:** a group of modules are utilised to create and manage CoDesign-Activities. Once created, the CoDesign Activity can be assigned to any CoDesign-Space by accessing the CoDesign-Spaces Manager. As mentioned earlier in this chapter CoDesign-Activities in the prototype are named according to the Design Thinking tools utilised. Accordingly, three types of activities can be

created by CoDesign-Activities Manager in the prototype; the storyboarding activity, the persona-map activity and the lotus blossom activity.

- **Creativity Tools:** Creativity Tools are the modules that represent the tools to be utilised for carrying out CoDesign activities. Three Design Thinking creativity tools are implemented in the prototype; storyboarding tool, persona-map tool and lotus blossom tool. Once the CoDesign activity is created and assigned to a CoDesign-Space it can be utilised by the corresponding tool. Creativity Tools are considered as management modules because they are utilised to manage knowledge creating, sharing and transferring in the CoDesign activities and among CoDesign-Spaces.

**Access control layer:** Access Control Layer is a group of implemented routines that test the policy in relation to the user roles. By applying the policies related to a specific user's role the following functions can be performed, for example:

- a. Retrieving and displaying the related DAN-Spaces that can be managed by the user.
- b. Retrieving and displaying the DAN-Spaces the user participates in.
- c. Retrieving and displaying the CoDesign-Spaces the user participates and accordingly the activities he/she can perform in relation to a specific CoDesign-Space.
- d. Finding if the user is allowed to transfer knowledge from one CoDesign-Space to another.

**DB Access Module** represents the layer from where all modules, including management modules, access the database to send and retrieve the data. This module opens the database for updating and retrieving. Once the operation is finished the access to the database is closed.

The database contains the tables where data and knowledge is stored.

**User Interface:** the User Interface is a group of modules graphically accessed by users. User Interface facilitates users to access the management modules based on the roles and policies assigned to the user. Generally User Interface can be divided into two areas, as in the screen shown of Figure 6.7 below, the main menu and screens area.

The main menu has four main buttons for quick browsing to the main screens. These buttons are:

- *Managing CoDesign Activities:* This button allows the user to display the screens from where he/she creates and manages CoDesign-Activities. The drop-down list, integrated with the button, allows directly choosing the type of CoDesign-Activity (Design Thinking activity) to be created.
- *Control Panel:* This button allows returning back the Control Panel screen any time. Control Panel is to be presented later.
- *Tools:* This button allows displaying the screen from where the tools for different activities can be accessed directly.
- *Logout:* it allows the user to logout off the system.

All the screens are displayed in the screens area below the main menu. These screens allow the user to access the different managing modules. The main screens will be presented while we are explaining the User Interface below.

To maintain consistency and to relate the prototype design and implementation to the model definition, presented in Chapter 5, we present the prototype according to the three aspects; supporting business networking, supporting creativity and maintaining privacy.

In the next section we explain how these three aspects are supported using the prototype by associating the User interface with the Management Modules presented previously.

## 6.7. User Interface

Once logged in to the system, the user will have an access to the Control Panel shown in Figure 6.7 below. As we mentioned previously the User Interface is the layer for accessing the management modules based on the type of operation to be performed.

In this section we explain the functionality of the User Interface based on the aspects we mentioned; supporting business networking, supporting creativity and maintaining privacy.

### 6.7.1. Supporting business networking

DAN-Spaces in CoDAN are considered as the facility for supporting business networking for DANs. Businesses in DANs can create DAN-Spaces and invite people to participate.

By accessing DAN-Space Manager through the Control Panel the user can perform the following functions:

1. Creating new DAN-Spaces.
2. Accessing existing DAN-Spaces and managing them.
3. Inviting people to join the created DAN-Spaces.
4. Confirming or denying invitations to join DAN-Spaces from other users.
5. Accessing DAN-Spaces the user participates in. These spaces are created by other users.

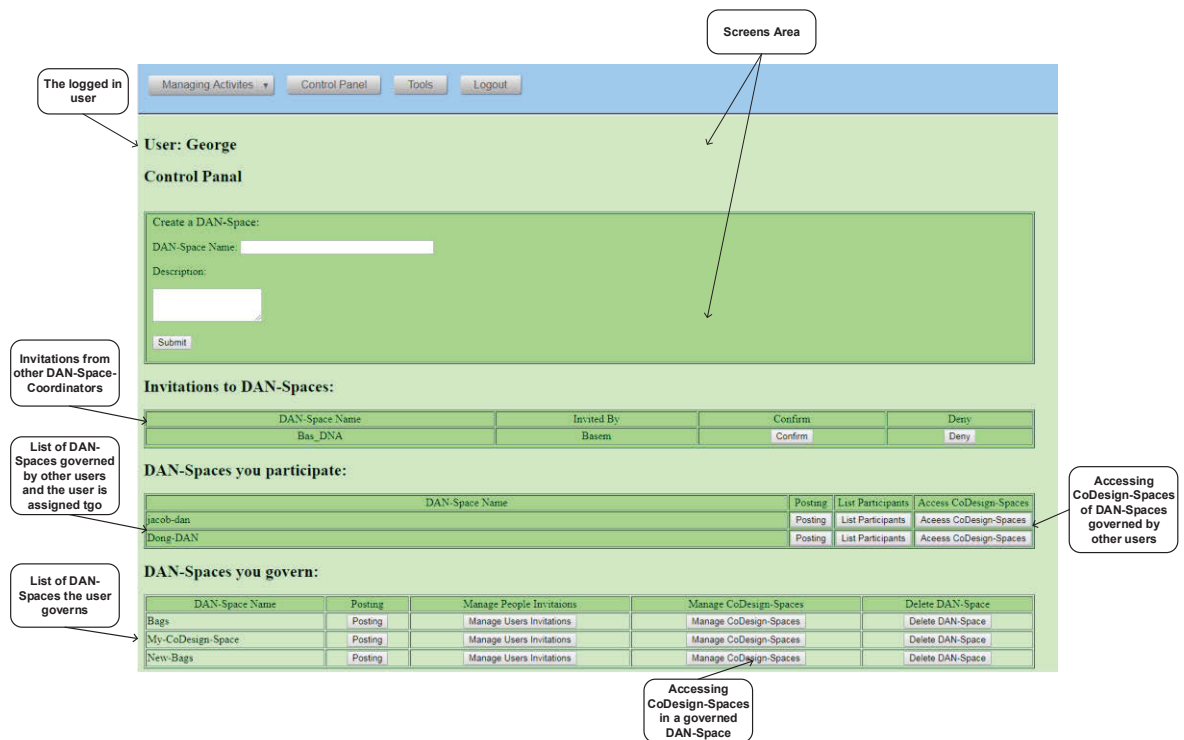


Figure 6.7: Control Panel Screen and Main Menu

Control Panel is divided into the following sections:

1. *The new DAN-Space form:* it is a form in the top of the screen which allows the user to create new DAN-Space(s).
2. *Invitations to DAN-Spaces:* If the user is invited by other users to their DAN-Spaces the invitation is listed in this section. The user has the option to either confirm the invitation or deny it. Once the user confirms the invitation he/she becomes a DAN-Space-Contributor or DAN-Space-Participant in the related DAN-Space.

3. *DANs you participate*: the DAN-Spaces the user participates in are listed in this section. These DAN-Spaces are created by other users. In this section the user accesses CoDesign-Spaces that he/she is assigned to under a specific DAN-Space.
4. *DAN-Spaces you manage*: Any DAN-Space which is created by the user is listed in this section. From this section the user can access a specific DAN-Space to manage it through the DAN-Space screen in Figure 6.8.

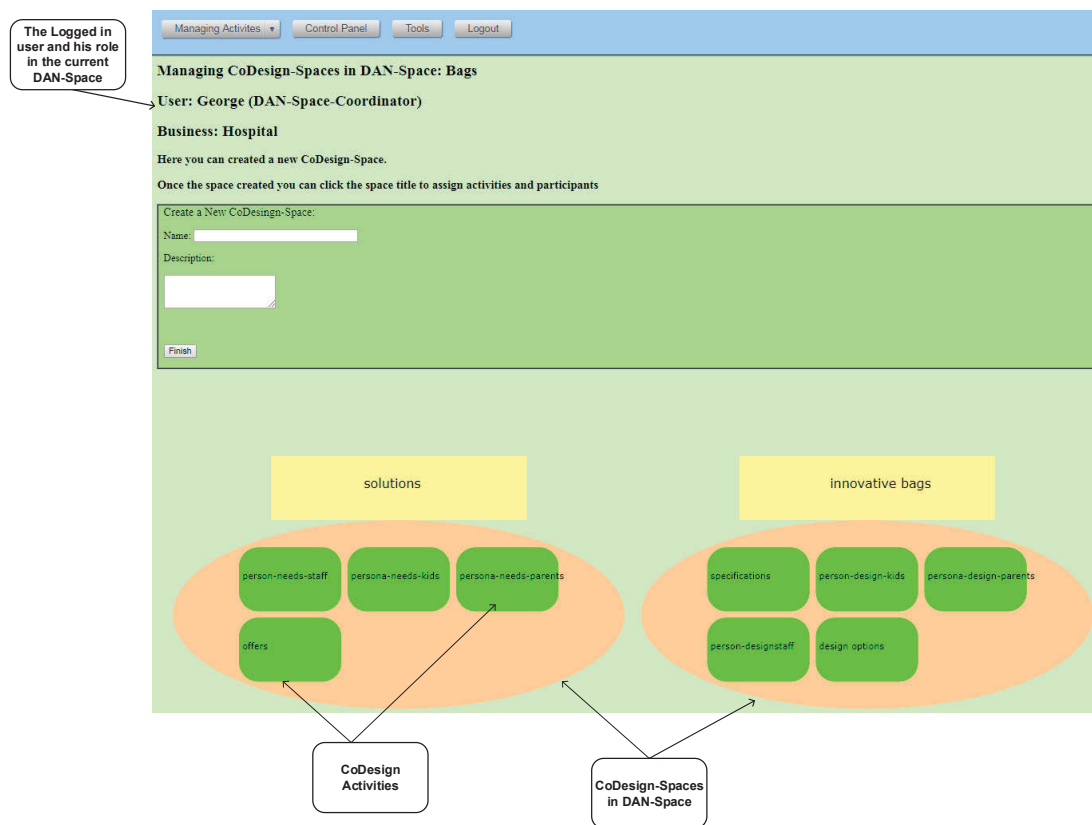


Figure 6.8: DAN-Space Screen

From the DAN-Space screen shown in Figure 6.8 the user can access DAN-Spaces Manager to create CoDesign-Spaces in the DAN-Space. The user can access CoDesign-Space Manager to manage any CoDesign-Space he/she owns in the DAN-Space. Also, through the DAN-Space screen the user can access the CoDesign-Spaces he/she has joined to perform the CoDesign activities.

### **6.7.2. Supporting creativity**

Creativity in the prototype is supported through the CoDesign-Spaces Manager, CoDesign Activities Manager and Creativity Tools.

Utilising these modules in creating and managing CoDesign-Spaces and CoDesign activities can be summarised as follows:

- The user creates CoDesign activities by accessing CoDesign Activities Manager through the Managing Activities button in the main menu.
- The user accesses the DAN-Space, to be managed, from the Control Panel through the DAN-Space screen shown in Figure 6.8.
- The user can create CoDesign-Spaces by accessing DAN-Spaces Manager through the DAN-Space screen.
- Once created, the CoDesign-Space can be accessed through CoDesign-Space screen shown in Figure 6.9 below. This screen allows the user to access CoDesign-Space Manager for managing the CoDesign-Space. Three main functions can be performed through the CoDesign-Space screen:
  - Assigning created CoDesign activities to the CoDesign-Space.
  - Assigning users to the CoDesign-Space from the related DAN-Space.
  - Accessing the tool corresponding to the CoDesign activity to be performed.  
By accessing the tool, the user can create and share knowledge accordingly.

Users create new Design Thinking activities through the Activities Manager. Once these activities are assigned to CoDesign-Spaces they can be accessed through the Design Thinking tools to create and share knowledge.



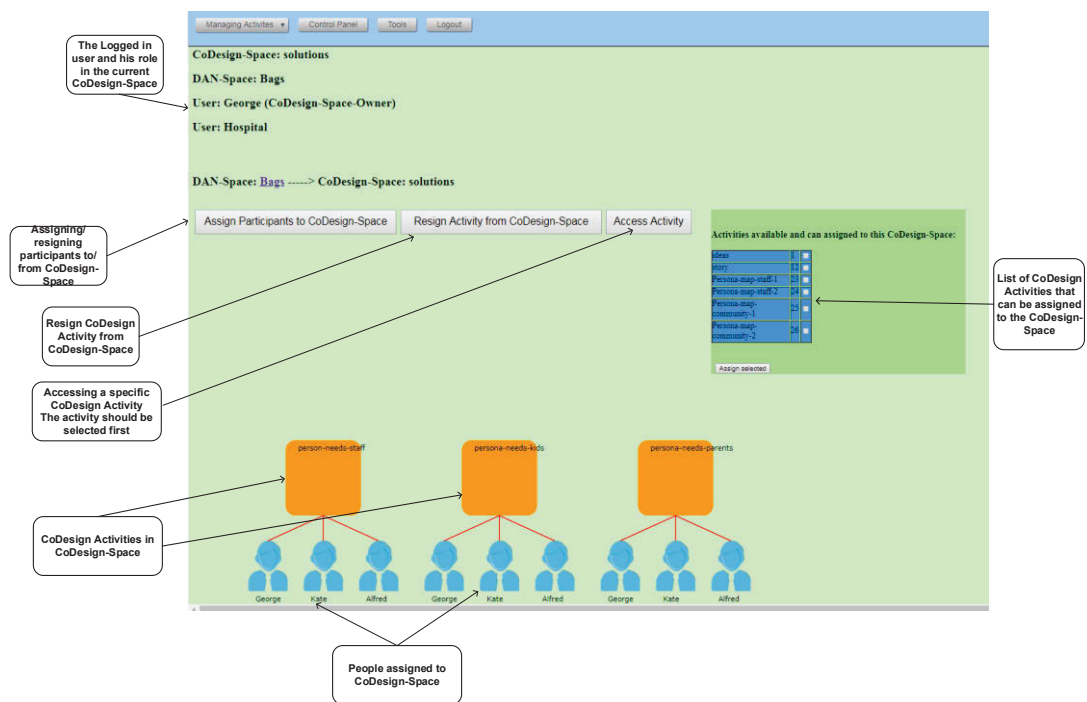


Figure 6.9: CoDesign-Space screen

### Managing CoDesign Activities

CoDesign activities are managed by CoDesign Activity Manager modules. In CoDAN prototype the three types of CoDesign activities which can be created and managed are; storyboarding, persona-map and lotus blossom. Creating a new activity is by selecting the type of activity from the drop-down list in the main menu. The drop-down list options allow access to the corresponding screens from where CoDesign Activity Manager modules are accessed. The screens to create each of the three activity types are shown in figures 6.10, 6.11 and 6.12 respectively. Once the activity is created it can be assigned later to the CoDesign-Space from the CoDesign-Space screen shown above in Figure 6.9. These screens, shown in figures 6.10, 6.11 and 6.12, also list the existing CoDesign activities as they can be edited and modified.

Alternatively, modifying any created activity can be done through the screen shown in Figure 6.13 as well. This screen can be accessed by clicking “Managing Activities” button in the main menu where all the existing created activities are listed.

Managing Activites Control Panel Tools Logout

User: George

Creating Storyboarding Activity:

Activity Name:

Enter Description/Question:

Descriptions/Questions List:

Add Edit Delete

Finish

ideas	Delete	Edit
specifications	Delete	Edit
story	Delete	Edit
Storyboard	Delete	Edit
Storyboard-Design-1	Delete	Edit
Storyboard-Design-2	Delete	Edit

Figure 6.10: Creating and Managing Storyboarding Activity screen

Managing Activites ▾ Control Panel Tools Logout

**User: George**

**Creating Persona-map Activity:**

Activity Name:

Enter Description

Submit

person-needs-staff	Manage questions
persona-needs-kids	Manage questions
persona-needs-parents	Manage questions
person-design-kids	Manage questions
persona-design-parents	Manage questions
person-designstaff	Manage questions
Persona-map-staff-1	Manage questions
Persona-map-staff-2	Manage questions
Persona-map-community-1	Manage questions
Persona-map-community-2	Manage questions

Figure 6.11: Creating and Managing Persona-Map Activity screen

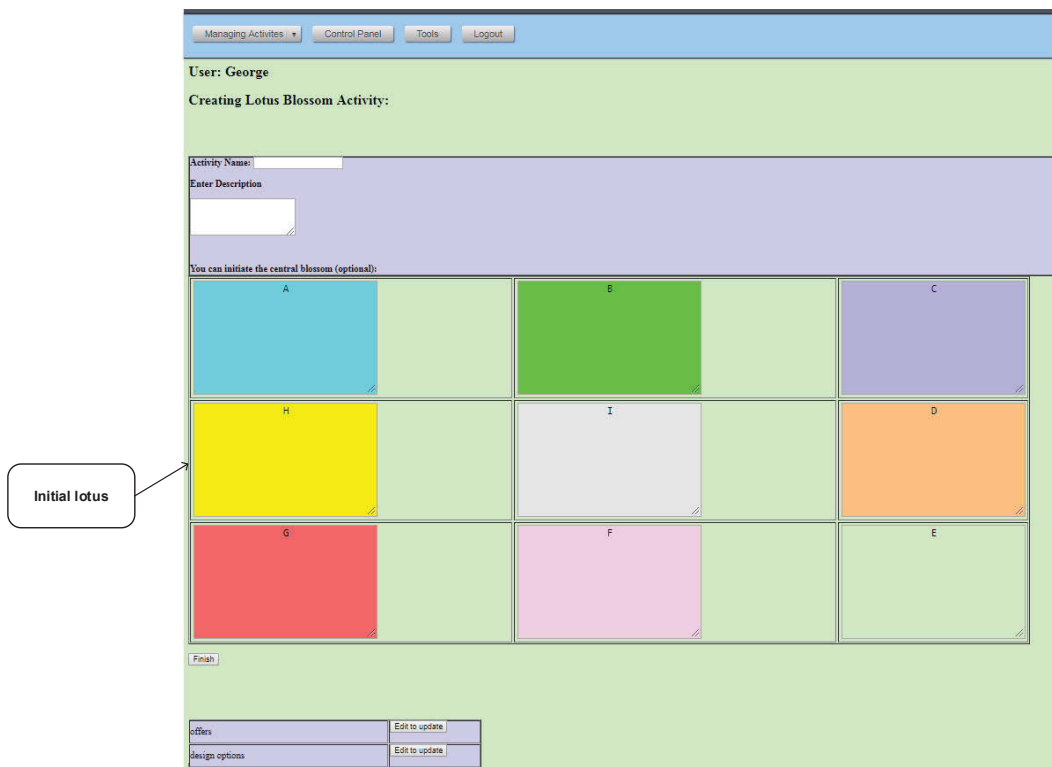


Figure 6.12: Creating and Managing Lotus Blossom Activity screen



Figure 6.13: Managing All Activities screen

***Creativity Tools:***

Creativity Tools are a group of modules utilised in CoDesign-Spaces to carry out the CoDesign Activities. We consider them as managing modules because these tools are

used by the users to manage the knowledge. Through these tools, users create and share knowledge by different ways. There are three different tools according to the three different defined and implemented types of activities in the prototype. These tools are the storyboarding tool, persona-map tool and lotus blossom tool. The screens from where the user accesses these tools are shown in figures 6.14, 6.15, 6.16, 6.17 and 6.18. The tools can be accessed from the CoDesign-Space screen shown previously in Figure 6.9). Alternatively, these tools can be accessed from the Tools screen shown in Figure 6.19. Tools screen can be displayed by clicking the “Tools” button in the main menu.

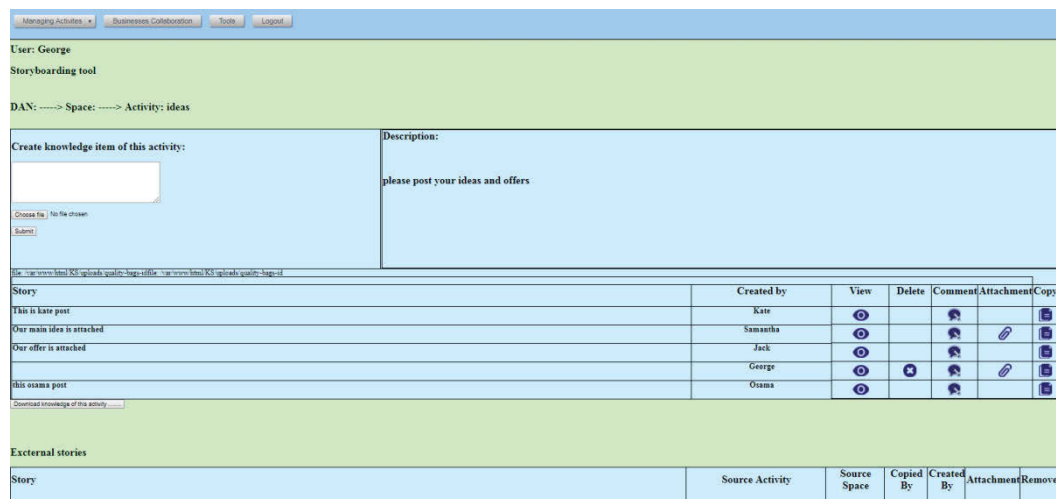


Figure 6.14: Storyboarding Tool

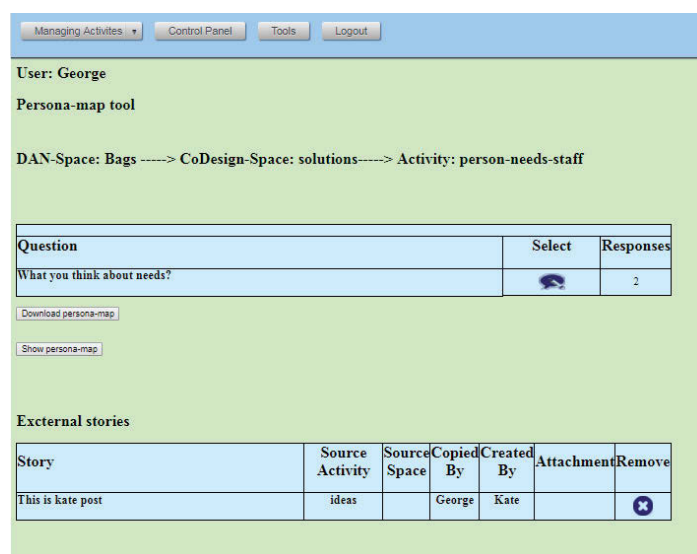


Figure 6.15: Persona-Map Tool Main Screen

Questions are listed in this screen

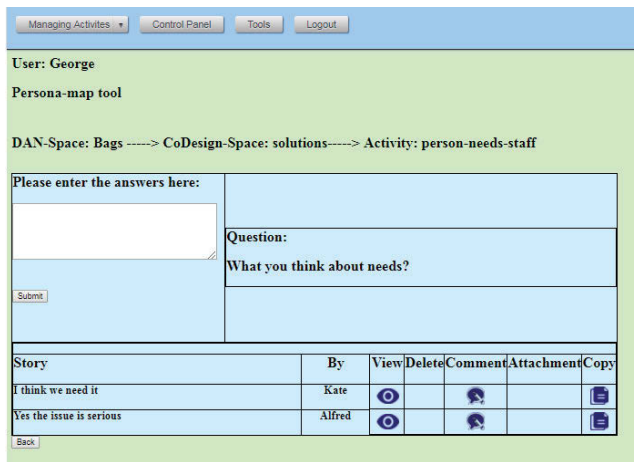


Figure 6.16: Persona-Map Tool (Answering the selected question)

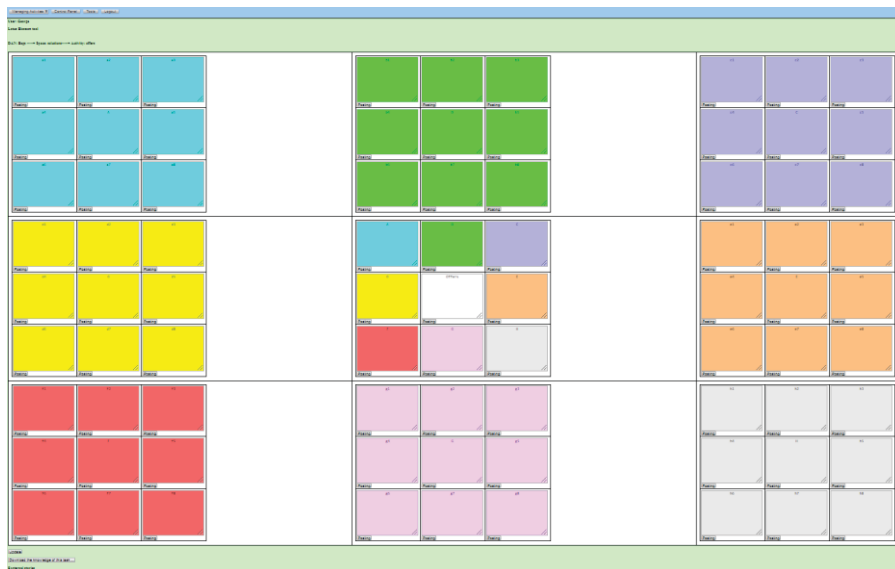


Figure 6.17: Lotus Blossom Tool (Main Screen)

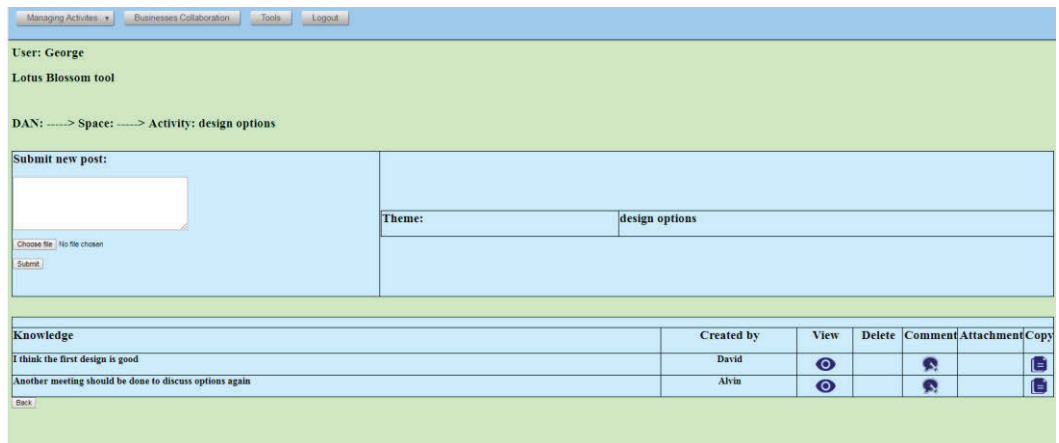


Figure 6.18: Lotus Blossom Tool (Posting Screen)

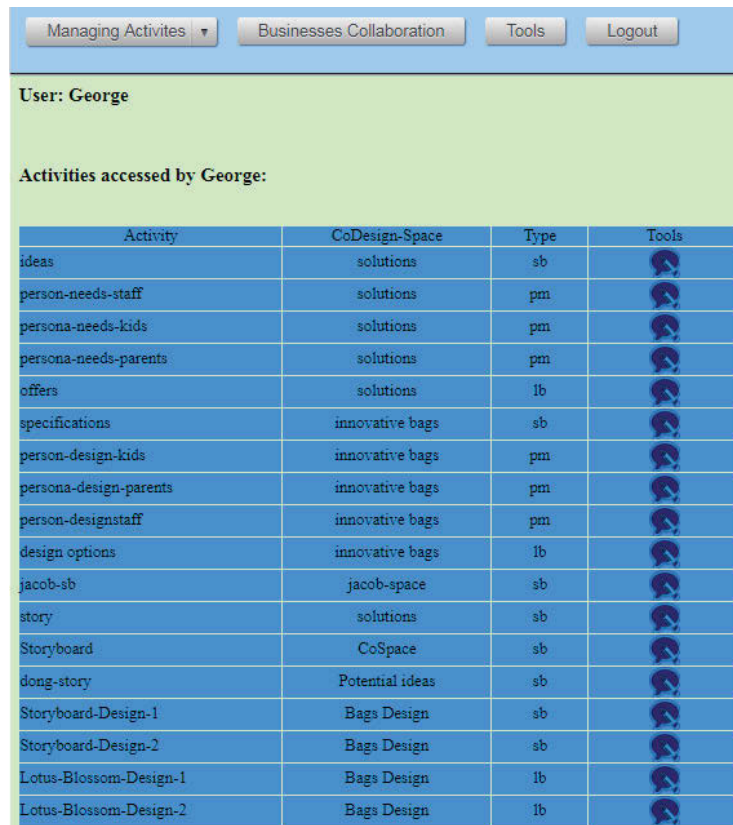


Figure 6.19: Accessing All Activities screen

sb=storyboarding - pm=persona-map - lb=lotus blossom



### 6.7.3. Maintaining privacy

There is no a specific section in the control panel from where privacy can be managed at this stage in the prototype. However, all the functions that were explained previously in relation to the User Interface and Management Modules are implemented while privacy is maintained.

By referring to our research framework, presented at the end of Chapter 2 and the beginning of Chapter 3, CoDAN should support the following enablers to maintain the privacy:

- Components privacy
- Knowledge ownership
- Access Control

Here, we show how these enablers are implemented or can be implemented in the prototype.

#### **Components Privacy**

- In the prototype, once the user logs in, he/she can access only the components that they are allowed to. These components can be categorised to those of full access and those of limited access.
- The components that are fully accessed are those created by the user including DAN-Spaces, CoDesign-Spaces and CoDesign activities.
- As mentioned in Chapter 5 that the full access to the DAN-Space and other components can be provided to a person from the dominant business in DAN. This can be done by assigning a DAN-Space-dominant role to the person.
- The components of limited access are those created by other users and the logged in user is assigned to these components.
- In the prototype we demonstrate the Governed DAN-Space type. The user logging in can only participate in the DAN-Space that he/she does not create by the invitation of the person who creates the DAN-Space. The logging in user, through the DAN-Space in which he/she participates can access the CoDesign-Spaces

he/she assigned to. The user then can perform the CoDesign Activities by utilising the creativity tools in these CoDesign-Spaces.

### **Knowledge ownership**

Knowledge is created by the users once they access the CoDesign activities throughout the creativity tools.

Knowledge ownership as implemented in the prototype can be described as follows:

- The user who creates the knowledge is the owner of the knowledge.
- The knowledge owner has the full access to the knowledge he/she creates. The knowledge owner can delete and modify the knowledge item he/she creates.
- For the knowledge that the user did not create he/she can only view and comment on this knowledge item.
- The CoDesign-Space-Owner has the full authority on all the knowledge created in the CoDesign-Space by other users except the knowledge modification. Knowledge can only be modified by the user who creates it.
- Knowledge can be transferred between the CoDesign activities in the same CoDesign-Space. This kind of transfer can only be performed by the knowledge owner or CoDesign-Space-Owner of the CoDesign-Space.
- Knowledge also can be transferred between the CoDesign-Spaces in the same DAN-Space. This kind of transfer can only be performed by the CoDesign-Space-Owner in the Governed DAN-Space type. Figure 6.20 shows an example of a storyboarding activity screen. Any knowledge transferred from another activity or CoDesign-Space is listed in the section titled by “External Stories”.
- As shown in the same screen of Figure 6.20, any knowledge item can be transferred through the copy icon. The copy icon is active once the logged in user has the authority to transfer the knowledge. The user then can select the activities for which the knowledge is to be transferred to.

Story	Created by	View	Delete	Comment	Attachment	Copy
This is kate post	Kate					
Our main idea is attached	Samantha					
Our offer is attached	Jack					
	George					
this osama post	Osama					

Download knowledge of this activity .....

**External stories**

Story	Source Activity	Source Space	Copied By	Created By	Attachment	Remove
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Figure 6.20: Knowledge transfer to and from CoDesign activity

### Access Control

Access control is the methods and rules implemented to control accessing knowledge and other components. Knowledge ownership and components privacy have been supported by routines to test the users' policy against these components and deciding what can be accessed by the user. These routines are represented by the Access Control Layer in the prototype block diagram shown previously in Figure 6.6.

In the prototype these access control procedures are implemented in a logical and easy way to encourage people to utilise the system. One of the approaches is avoiding the restrictions when they are not needed. The many of restrictions and privacy management options may result in making people uncomfortable and avoid the system utilisation according to the literature. For example, we have avoided the restrictions in CoDesign-Spaces. When the user is assigned to the CoDesign-Space he/she can perform any activity in the CoDesign-Space. That provides a kind of freedom and allow the users in the CoDesign-Space to be fully involved in the CoDesign process. Restrictions can be managed by creating different CoDesign-Spaces for the different design purposes and teams if required.

The implemented prototype demonstrates the Governed DAN-Space with limited functionality. One of the reasons is the time constraints. The other reason is because our focus in this research is on the research model not on the prototype. The main reason of implementing the prototype is to structure the interview questions. Also, the prototype

provides a tangible application to the experts who participate in the evaluation process to have a better idea about the model.

In the next chapter, Chapter 7, we present our evaluation process and evaluation findings. The evaluation process is based on the methodology explained in Chapter 3, the model definition in Chapter 5 and the prototype implementation explained in this chapter.

### 6.8. Chapter Summary

In this chapter we have presented CoDAN prototype design and implementation. In the beginning of the chapter we have re-presented the CoDAN components defined in Chapter 5. We have shown how these components are to be designed and implemented in the prototype. The components are presented based on the Governed DAN-Space type. We have also presented the three Design Thinking tools, storyboarding, persona-map and lotus blossom, and explained how they are implemented in the prototype. Object-Orient Modeling method has been used to design the object-oriented model of the prototype based on the defined components. The object-oriented model was implemented by developing the software modules. The software modules block diagram of the prototype has been illustrated and explained. These modules have been presented in combination with the User Interface. We have explained how these modules support the three aspects; business networking, creativity and maintaining privacy. The corresponding prototype screens of the User Interface have been shown and explained accordingly.

# Chapter 7

## Ch7: Model Evaluation

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### 7.1. Introduction

The aim of our research is to develop a generic model to support CoDesign in Dynamic Alliance Networks (DANs). In chapter 3 we have described our methodology to develop and evaluate our model, CoDAN. Based on Cronholm and Goldkuhl (2003) we adopted the *goal-based/system as such* method to evaluate the model. We have selected the *goal-based* approach as we focus on goals in our research by involving experts in the evaluation process. Experts are provided with the model documentation and access to our online prototype to be interviewed later.

In Chapter 4 we have explored the literature for more investigation about the DAN types and their practical features. 15 types of DANs have been presented as a result. These types have been categorised into four categories based on the concepts of our conceptual framework defined in Chapter 4. The aim is to develop the best way in supporting these DANs based on their features.

The research model, CoDAN, has been defined in Chapter 5 based on the findings presented in Chapter 5. The components of the model and the relationships between these components have been defined in a way to support the four categories of DANs defined in Chapter 4. In Chapter 5 we have shown our idea of DAN-Spaces and CoDesign-Spaces to support DANs for CoDesign. Governed and Not-Governed DAN-Spaces types and how they are used to support the different categories of DANs have been explained.

The prototype of our model has been presented in Chapter 6 in terms of design and implementation. We have presented the object oriented model of the prototype and the software modules implemented based on the object oriented model. We have explained how the business networking, creativity and privacy have been supported in DANs by utilising the prototype.

In this chapter, Chapter 7, we present our evaluation process to evaluate the research model, CoDAN.

We focus on the model evaluation according to the enablers defined in the research framework presented at the end of Chapter 2 and the beginning of Chapter 3.

Our evaluation process, as defined in Chapter 3, is based on the model documentation and the model prototype.

The model documentation includes the model definition and the semi-structured interview. The model prototype represents the model implementation with a limited functionality. The prototype supports the evaluation process in defining and constructing the semi-structured interview questions. Also, the prototype provides the evaluating experts with a tangible application and shows that the model can be implemented.

In this chapter we show how the model has been evaluated. The topics of this chapter are presented as follows:

- Participants Selection (Section 7.2).
- Hypotheses and Testing Strategy (Section 7.3).
- Conducting Semi-Structured Interviews (Section 7.4).
- Data Analysis Method (Section 7.5).
- Findings (Section 7.6).
- Communicating Research Hypotheses (Section 7.7).
- Discussion (Section 7.8).

## 7.2. Participants Selection

We mentioned in the methodology chapter, Chapter 3, that our model is to be evaluated by experts through semi-structured interviews based on the strategy that has been selected.

Participants have been selected according to the following criteria:

1. They should have enough knowledge in relation to information systems, design and implementation.
2. This knowledge is acquired based on industry experience, academic experience or both.
3. If the participant is from the academic discipline he/she should have PhD degree or working on PhD research related to our research.
4. If the participant is from the industry discipline, he/she should be in a managerial, leadership or executive position. In addition, the participant should have an experience in working with information systems, design, implementation, administration and/or operation.
5. Experience in CoDesign or Design Thinking tools is an advantage.

Six experts have been selected and contacted according to the selection criteria. These participants are referred as P1, P2, P3, P4, P5 and P6 codes respectively. Qualifications and experience of each participant are shown in Table 7.1.

Table 7.1: The participants in evaluation process, their qualifications and experience

<b>Participant</b>	<b>Qualification and Experience</b>
P1	<ul style="list-style-type: none"> <li>- PhD in software engineering</li> <li>- Academic experience</li> <li>- Research of interest: Agile governance</li> </ul>
P2	<ul style="list-style-type: none"> <li>- Academic and industrial experience</li> <li>- PhD candidate / Agile governance research</li> <li>- Project management in IS design and implementation</li> <li>- Leading teams from different business units to collaborate in software applications development</li> </ul>
P3	<ul style="list-style-type: none"> <li>- Academic experience</li> <li>- PhD in Information Systems</li> <li>- Academic lecturer</li> </ul>
P4	<ul style="list-style-type: none"> <li>- Academic and industrial experience</li> <li>- PhD candidate / knowledge sharing barriers</li> <li>- Knowledge management systems design and implementation experience.</li> </ul>

P5	<ul style="list-style-type: none"> <li>- Academic and industrial experience</li> <li>- PhD in software engineering</li> <li>- Academic lecturer in Information Systems</li> <li>- Expert in collaboration systems</li> </ul>
P6	<ul style="list-style-type: none"> <li>- Academic and industrial experience</li> <li>- PhD in systems and software engineering</li> <li>- Academic lecturer</li> <li>- Expert in information systems design and implementation</li> </ul>

The table shows that the experience of participants in relation to information systems is major, either academic and/or industrial. While P1 and P3 are with academic experience and qualifications the other 4 participants (P2, P4, P5, P6) are with academic experience and qualification as well as industrial experience. Participants with academic and industrial experience provide an advantage in the model evaluation.

### 7.3. Hypotheses and Testing Strategy

In this section we provide more about the research hypotheses focusing on the testing strategy for the model evaluation.

***H1: The model enables businesses in DAN to self-organise in their environment.***

This hypothesis is tested for supporting self-organising in DANs by CoDAN. Businesses operate in emergent environments. That means they should respond to environment emergences and changes when required. The emergence can be, for example, a change in the market such as introducing a new product or service by a competitor that requires bringing in new knowledge. Also, it can be a potential idea that can lead to a business opportunity. Responding to such emergences needs businesses to be self-organised. Requirements of self-organisation include arrangements and new knowledge needed to respond to an emergence.



This new knowledge is created by evolution of teams to collaborate. These teams are facilitated through creating new DAN-Spaces, creating new CoDesign-Spaces and inviting people from DANs to participate in these spaces. Participants carry out CoDesign activities by utilising creativity tools to create and share the new knowledge.

DAN-Spaces and CoDesign-Spaces are considered as the creativity environment in our model.

These teams are modified for any emergence and changes. The model should provide the feature of modifying DAN-Spaces and CoDesign-Spaces when required.

In our research to show if self-organisation is supported the following enablers are to be tested:

- Bringing in new knowledge.
- Supporting Team Evolution.
- Supporting Team Modification.

***H2: The model maintains privacy in the creative CoDesign environment for collaboration between businesses in DAN.***

CoDesign creativity environment is a collaborative environment. Different people from different businesses in DAN join the environment to create and share knowledge. In the case of business collaboration the concern is about accessing the knowledge by the competitors. The knowledge and spaces owners should have the ability to decide who accesses the knowledge created by them in the CoDesign environments.

To support the privacy based on the levels of concern the Governed DAN-Space and Not-Governed DAN-Space types are facilitated by CoDAN.

The Governed DAN-Space is governed by the DAN-Space-Coordinator. The DAN-Space-Coordinator role is usually assigned to the project governor in the DAN. In the Not-Governed DAN-Space there is no full governance on the DAN-Space. CoDesign-Space is controlled by CoDesign-Space-Owner in both the DAN-Space types.

The model should support the following enablers for maintaining privacy:

- Knowledge Ownership.
- Components Privacy.

- Access Control Rules and Procedures.

These enablers are supported by the model through the following functions:

- Creating Governed DAN-Spaces
- Creating Not-Governed DAN-Spaces
- Authorisation

***H3: The model facilitates participants to learn from each other to enhance expertise.***

Expertise is referred to any knowledge and skills that a person has and can apply to address a problem and solve it. Expertise can be enhanced by exploring the domain knowledge in context. Domain knowledge is developed by collaboration between people in teams and groups and by learning from each other.

By testing this hypothesis the model is evaluated if expertise for developing creativity is supported.

Expertise is considered as one of the creativity descriptors in the evaluation model and it is supported throughout by the following enablers:

- Supporting Networking.
- Facilitating Collaborative Activities.
- Supporting Multidisciplinary. Facilitating multidisciplinary collaboration where different participants of different skills and knowledge can be invited.

The model should support these enablers by utilising the following functions:

- Creating CoDesign-Spaces.
- Creating CoDesign activities.
- Inviting people of different skills and knowledge to participate

***H4: The model implements creativity tools where creative thinking skills can be developed.***

By testing this hypothesis, the model is evaluated for supporting creative thinking skills development.

Creative thinking skills include the ability to address and solve the problem. Creative thinking skills are the application of expertise and knowledge to solve the problem.

Creative thinking skills are developed by bringing in new knowledge resources and using ways such as brainstorming that lead to ideas for addressing the problem.

Enablers supported by the model to develop creative thinking skills are:

- Creativity Tools.
- Supporting brainstorming.

These enablers can be facilitated throughout the following functions in our model:

- Creating CoDesign-Spaces and activities.
- Utilising Design Thinking tools.

By testing this hypothesis the model is evaluated for supporting creative thinking skills development.

***H5: The model enables groups and teams in DAN to collaborate.***

Work group is where people work in groups and teams. According to the literature there is evidence that working in groups and teams provides better creativity outcomes than working as individuals. Our model provides other dimensions to teams and groups workplace to collaborate. These teams and groups can work together regardless of their geographic distances, anywhere any time by implementing the model, CoDAN, online.

Enablers supported by the model to support work group and collaboration are:

- Supporting Networking.
- Facilitating Collaborative Activities.
- Facilitating Stakeholders Participation.

These enablers can be facilitated throughout the following facilities in our model:

- Creating DAN-Spaces.
- Creating CoDesign-Spaces.

***H6: The model facilitates creativity by creating, filtering and sharing knowledge across CoDesign activities and spaces to develop knowledge domain and creative skills.***

CoDesign is knowledge management processes based. Knowledge management processes are involved when performing CoDesign and utilising the creativity tools. These processes include knowledge creating, capturing, filtering and sharing. However knowledge management in CoDesign by utilising the creativity tools is considered iterative compared to KM processes in the traditional models of KM.

Enablers supported by the model to support KM processes are:

- Supporting Knowledge Management Processes.

These enablers can be facilitated throughout the following functions in our model:

- Posting knowledge in the CoDesign activity.
- Commenting on posts.
- Transferring knowledge between the different CoDesign activities and CoDesign-Spaces.

***H7: The model supports businesses in DAN to capture both tacit and explicit knowledge for domain knowledge development.***

Knowledge is classified into two types, tacit and explicit. Tacit knowledge refers to the experience and skills which reside in the brains of people. Explicit knowledge is the knowledge presented in the various types of artefacts. Both of the two types of knowledge should be captured in CoDesign based on the context and domain. Tacit knowledge should be converted into explicit knowledge to be applied and shared.

Our model supports capturing both types of knowledge.

Enabler supported by the model to support the two types of knowledge is:

- Tacit and Explicit Knowledge Support.

This enabler is facilitated throughout the following functions in our model:

- Creating DAN-Spaces and CoDesign-Spaces to create and share both types of knowledge.
- Posting knowledge

- Commenting on knowledge
- Attaching files of different formats.

To acquire the feedback of the participants involved in the evaluation process about supporting the enablers by CoDAN, semi-structured interview have been conducted with them.

The next section presents how semi-structured interviews have been conducted.

## 7.4. Conducting Semi-Structured Interviews

Semi-structured interviews involve two phases; preparation phase and conduction phase:

### *Preparation Phase Steps:*

- The participant is contacted and asked to contribute to the evaluation process.
- Once the participant agrees, the first session with the participant is conducted. In this session the participant is provided with the model documents and the link (IP address) to access the online prototype.
- The documents include the following:
  - Model description.
  - A step-by-step explained scenario.
  - Semi-structured interview questions.
  - Ethics information sheet for participants.
  - Consent form to be read and signed by the participant.
- In this session the model is explained to the participant.
- Also, a demonstration based on the explained scenario is presented through the online prototype.
- Participant is given a time to be prepared for the face-to-face interview.

### *Interview Conduction Phase Steps:*

- Interview starts with a greeting to the participant by the interviewer.
- The participant is asked to read and sign the consent form.
- The participant is informed that the interview is voluntary and recorded.

- The participant is informed that if he feels uncomfortable at any stage he can ask to stop the interview and the recording as well.
- Once the participant agrees to going ahead he/she is asked to introduce himself/herself.
- Questions are asked to the participant section by section.
- The interviewer introduces the section according to the main theme. In this introduction the interviewer refreshes the information provided to the participant in the preparation phase.
- Questions of the section are then asked one by one.
- Dialogue and more questions may be created based on the original question.
- After finishing all of the sections the participant is asked about the model overall. He may provide more feedback from the questions asked.
- The interview is then typed into a Word file.

Semi-structured interviews have been conducted with the six participants listed in Table 7.1. The time of length of the interviews according to each participant are as following:

- P1: 51 minutes
- P2: 57 minutes
- P3: 47 minutes
- P4: 75 minutes
- P5: 120 minutes
- P6: 43 minutes
- **Total: 393 minutes (6 hours and 33 minutes)**

After finishing the interview, the recording is converted to text by listening to the interview again.

In the next section we explain the method we followed to analyse the data collected from these interviews.

## 7.5. Data Analysis Method

Data collected from the interviews have been analysed by following what is called content and thematic analysis.

Content and thematic analysis are ways to analyse the qualitative data (Vaismoradi et al., 2013).

The NVivo software has been utilised to organise the content of the interviews. NVivo (QSR, 2014) has been developed to support qualitative analysis for researchers who evaluate or explain social phenomena. In our situation we have used NVivo to code the content of the interviews and relate them to our themes.

In content analysis the method followed can be illustrated in the Figure 7.1 below as absorbed from (QSR, 2014).

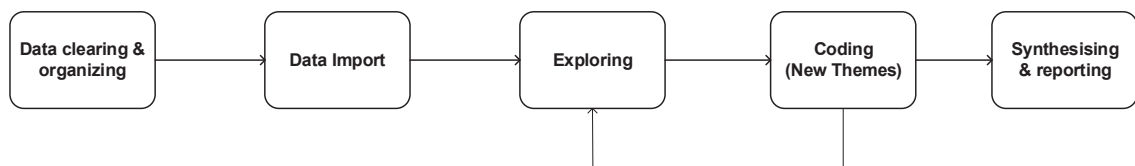


Figure 7.1: Qualitative Analysis by NVivo

- **Data clearing:** In this stage the data produced from interviews is revised to fix any errors such as linguistic and spelling mistakes. The data is organised in a way to make the exploring and coding easier later.
- **Data importing:** In this stage data files are imported into NVivo. NVivo has the ability to import data of different formats including text and pdf.
- **Exploring and Coding:** In this stage the data files imported are explored one by one. The main step here is the coding. The paragraphs of the text are selected then related and linked to what are called themes. The data is explored again and again until the coding process is finished.
- **Synthesising and Reporting:** In this stage the perceptions of participants based on the themes are organised to make the whole story of the report.

In our research we consider that themes are pre-prepared. However, new themes can be created if necessary. For this reason, the method illustrated previously has been modified as in Figure 7.2.

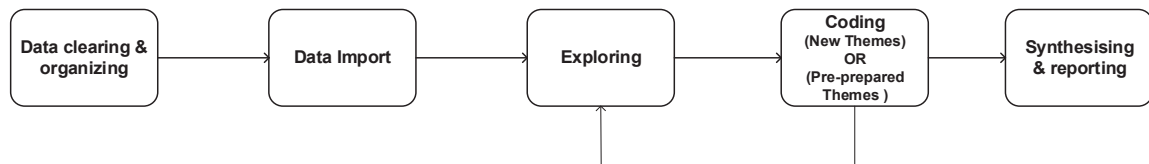


Figure 7.2: Qualitative Analysis by NVivo (Pre-prepared themes)

The only difference here is that in the coding stage the coding can be according to existing pre-prepared themes or new themes can be created.

In our model we have defined what are called enablers to enable creativity in DANs to perform CoDesign based on our research framework. These enablers are considered as pre-prepared themes. Throughout the semi-structured interviews we seek the perception of the expert participants if the enabler is supported by the model and what is their feedback and advice. During the discussion we ask if there are any comments and ideas that can represent new themes to enrich the output of our evaluation process.

According to the above method the data collected from interviews has been analysed as following by utilising NVivo:

1. The recorded data has been converted to text. Each interview has been treated individually by converting it into a Word file.
2. Each Word file, that represents an interview of an individual participant, has been revised to correct any linguistic and spelling mistakes. In this stage the data is prepared for importing to NVivo.
3. The files then have been imported into NVivo one by one.
4. According to our method of analysis we created themes of seven categories in NVivo. We create sub-categories of the main themes as needed.
5. These themes (categories) with their sub-categories (sub-themes) are as following:
  - a. Self-Organising:
    - i. Bringing in new knowledge
    - ii. Teams evolution.



- iii. Modifying teams.
  - b. Maintaining Privacy:
    - i. Knowledge Ownership.
    - ii. Components Privacy.
    - iii. Access Control.
  - c. Developing Domain Knowledge to Enhance Expertise:
    - i. Supporting Networking.
    - ii. Facilitating Collaborative Activities.
    - iii. Supporting Multidisciplinary.
  - d. Creative Thinking Skills Development:
    - i. Creativity Tools.
    - ii. Supporting Brainstorming.
  - e. Collaboration:
    - i. Supporting Networking.
    - ii. Facilitating Collaborative Activities.
    - iii. Supporting Stakeholders Participation
  - f. Knowledge Management Processes.
  - g. Tacit and Explicit Knowledge Support.
- 6. In the coding process we have linked the perception of the participant to the related themes and sub-themes. These themes and their sub-themes are represented by nodes and sub-nodes in NVivo.
- 7. A separated file has been created to collect the perceptions and feedback for all participants for each theme. In this way we prepared the data for synthesising and creating the report of findings.
- 8. Synthesising and reporting. The observations and perceptions for each theme and related sub-themes are synthesised to create the findings report, communicating the hypotheses and creating the discussion.

Semi-structured interviews findings are presented in the following section according to the themes and the related sub-themes.

## 7.6. Findings

In this section we present the perceptions of participants by combining their feedback and inputs.

### 7.6.1. Self-Organising

#### *a. Supporting Team Evolution:*

P2, P4, P5 and P6 have a similar opinion that the model supports team evolution in DANs. P2 reports that the model enables what is called virtual teams. P2 mentions that traditional teams resemble the virtual teams where it offers a place for teams to collaborate. The advantages of the virtual teams supported by tools such as in our model are; participants involvement anytime, teams continue to collaborate and encouragement of participants to collaborate as stated by P2. P4 and P2 both consider that the model provides the feature of teams' involvement anytime regardless of the geographic locations.

P5 states that the model can be utilised to collaborate between teams not only across businesses but even across the business units. Also, P5 mentions that evolving teams in this way allows businesses in DANs to organise the created knowledge. P5 compares supporting teams evolved by utilising CoDAN with the teams supported by SAP software. He reports that in SAP the collaboration is usually performed by ways such as face-to-face meetings or emails, but the model provides a better solution and flexibility.

*P5: "We have at SAP our own collaborative spaces and environments does not provide us with all the tools that mentioned in this model (CoDAN) but it helps us in some way".*

#### **Summary:**

- The model supports team evolution to enable self-organising (P2, P4, P5, P6).
- In terms of team evolution, the following features can be provided:

- Team evolution and participants involvement any time anywhere.
- Continuity of collaboration even after team evolution.
- Encouragement of people to collaborate.

**b. Supporting Team Modification:**

P1, P2, P4, P5 and P6 have the same perspective that teams can be modified once created by utilising the model to respond to the new changes and emergences. P2 emphasises the fact that creativity is changing continuously.

*P2: “Creativity is to keep changing, because creativity does not stop. So we have some sort of way to change what you are doing. If the model providing the teams to keep adapting to the new change so obviously it is very helpful for the companies in making adjustments based on their project teams”.*

P4 reports that the way of modifying teams in the model provides the feature of flexibility which is required in this case. Also P4 considers the model as a creative work.

*P4; That is a creative work. The idea is to give a permission to modify the design space at any time at any stage. DAN-Space should keep tracks in the systems that helps people can come back with their ideas at any stage”.*

P5 refers to the feature of modifying teams without influencing each other as provided by the model. He states that this makes teams more effective and efficient.

*P5: “they (the teams) can utilise the existing work spaces and the existing knowledge generated and information as well”.*

**Summary:**

- The model supports team modification to enable self-organising (P1, P2, P4, P5, P6).
- In terms of team modification, the following features are provided:
  - The teams could be modified upon changes.
  - Providing flexibility.
  - Utilising the existing work spaces and the created knowledge.

*c. Bringing in New knowledge:*

P1, P2, P3 and P4 see that the model supports bringing in new knowledge enabler. They refer to the reason of such support by allowing new people to be involved anytime. P1 mentions that the new knowledge is brought through exchanging ideas between participants as well. P2 argues that concealing the knowledge in one place is not more valid, it is now about sharing and exchanging and that opens new horizons and brings in new ideas and feedback to be shared. P3 and P4 consider creating new spaces and activities helps involving more people to participate and then brings in new knowledge as well.

***Summary:***

- The model supports bringing in new knowledge to enable self-organising (P1, P2, P3, P4).
- In terms of bringing in new knowledge the following features are provided:
  - New people are allowed to participate.
  - Tools support these people to create new knowledge.

*d. Future Work:*

Participants have different views and advice for the future work to develop supporting self-organisation. Their input focuses on other ways to bring in new knowledge. They recommend designing and implementing new tools to support such enabler.

P1 advises to consider a kind of intelligence to detect potential ideas. Applying semantics may help to do that.

To bring in new knowledge P2 advises to define tools to gather the related public existing knowledge to start with.

P4 mentions that the model may be integrated into existing knowledge management systems to utilise the knowledge created in both ways.

P6 has raised the question, “can we detect the business is self-organised or not? And under what criteria and condition?”. He sees this question should be addressed and investigated as a future work.

### 7.6.2. Maintaining Privacy

P2 states that as we open ourselves we need to consider the privacy when designing or implementing such models. P2 and P3 see that maintaining privacy is taken care of in the model. Policies implemented allow customising the privacy as mentioned by P3.

#### *a. Knowledge Ownership Control:*

P1 considers the governed DAN-Space is with a high level of security as the DAN-Space-Coordinator is the only person who governs the knowledge and invites people to participate. Here the Governed DAN-Space is more controlled than the Not-Governed DAN-Space.

P2 mentions that the Not-Governed DAN-Space is more open and that results in a risk to privacy. However, P2 reports that there is a need to the both types of DAN-Space. As the Not-Governed DAN-Space is considered open, P2 advises that there should be something such as disclaimer or warning to provide a kind of control.

*P2: “It (the Not-Governed DAN-Space) should not be governed, should not be restricted and monitored. Otherwise, you are defeating the purpose”*

That has been reported by P3 as well. P3 advises that the not governed DAN-Space may be managed through a checklist for example. This checklist shows how people utilise the space in terms of maintaining privacy and knowledge ownership regulations as explained by P3.

P6 mentions the privacy issue in collaboration between businesses according his experience.

*P6: “from my experience with National IT Australia in many projects contribute with other companies they may concern when they meet to collaborate or discuss ideas or knowledge or prototypes, their main*

*concern is about privacy. They want to make sure that information will not go to the competitors”.*

Considering the privacy maintaining in the model provides good control and results in confidence as reported by P5.

P6 considers privacy maintaining as the way to tackle the intellectual property issue. From his opinion the model provides a level of control on knowledge ownership.

***Summary:***

- Knowledge ownership is controlled by designing two types of DAN-Spaces, Governed and Not-Governed.
- Governed DAN-Space is more secured and controlled while the Not-Governed is less secured and more open.
- The openness of the Not-Governed DAN-Space can be controlled by ways such as checklist implementation.

***b. Components Privacy:***

P1, P2, P5 and P6 recognise that components privacy is implemented in the model. P2 advises that the participants in the Governed DAN-Space should have an ability to create their CoDesign-Spaces as in the Not-Governed DAN-Space.

*P5: “I think it does allow when you say it is only the DAN-Space-Coordinator can authorise other people to control CoDesign-Spaces”.*

***c. Access Control:***

P1 mentions that as long as the DAN-Space-Coordinator in the Governed DAN-Space controls the space and the CoDesign-Spaces-Owner controls the CoDesign-Space the access control is supported in the model. P2 advises that in the Not-Governed DAN-Space someone should be responsible to control the access. Checklist can be implemented as he mentioned previously.

For the future work P1 advises that the DAN-Space-Coordinator of the Not-Governed DAN-Space should have a sort of control. Also, participants should be allowed to expand their own work spaces (CoDesign-Spaces) according to P4. In addition, P2 advises that we should keep updated with the privacy as things change by the time.

### **7.6.3. Developing Domain Knowledge to Enhance Expertise**

#### ***a. Creating CoDesign-Spaces and CoDesign Activities:***

P1 agrees that creating CoDesign spaces and activities and assigning participants to them support creating new ideas and knowledge where expertise is enhanced. P3 refers to the advantage of creativity tools such as defined in Designed Thinking tools. P3 reports that utilising these tools within CoDesign-Spaces helps to create innovations and support creativity. Domain knowledge here is developed through involving different people from different backgrounds and disciplines to utilise creativity tools. P2 states that expertise here is enhanced as the tools encourage people to do things not just share the knowledge. Doing means performing the job and adding those skills as mentioned by P2. P4 emphasises the idea that the model allows people of different skills to develop a wide range of domain knowledge. That is because these people are working together through the CoDesign spaces and activities. The CoDesign spaces and activities facilitate collaboration and communication between people and that of course enhances expertise as reported by P5 and this is acknowledged by P6 as well.

#### ***b. Multidisciplinary:***

P2 agrees that the model can support even the less skilled people to participate in sharing knowledge for CoDesign. P3 reports that this kind of support leads to better design outcomes. P4 sees considering

multidisciplinary in the model helps in defining the real problem. He sees that the model can support different people with different levels of skills and knowledge. In supporting the multidisciplinary P5 raises the issue of people coming from different backgrounds and cultures. That makes it difficult to communicate and this should be addressed as advised by P5.

*c. Future Work:*

Tools for visual description such as drawing tools should be facilitated when implementing the model as advised by P2. P4 advises to add an intelligence for synthesising the knowledge created by different expertise and experiences. P5 advises that the intellectual property protection should be considered to encourage people to participate and share knowledge.

#### **7.6.4. Creative Thinking Skills Development**

*a. Implementing Creativity Tools & Facilitating Brainstorming:*

Creativity tools such the tools of Design Thinking provide the opportunity to utilise the brain to share ideas as per the opinion of P2. That is clarified by P2 as when someone shares with others his idea they may look at it from different angles and build on it. Allowing the less skilled people to be involved is an advantage as mentioned by P2. P2 advises that new creativity tools should be defined. P3 sees that Design Thinking tools support brainstorming because of the team involvement. P4 reports that Design Thinking tools are considered as one of the best in solving the problems. One of the reasons from his opinion is that these tools facilitate brainstorming and sharing for creativity in CoDesign. P4 and P5 see that the online implementation of creativity tools provides an advantage to these tools. That allows accessing these tools anytime anywhere. P5 relates the advantage of accessing the model tools by different users to the simplicity and flexibility of the model. P5 agrees that through the model businesses



can involve more participants from different disciplines for brainstorming. That will cost time and effort if it is done physically through the traditional approaches. P5 also mentions the advantage of motivating the shy people to participate. P6 sees that the model can be utilised to create what is called multiple user environment where brainstorming can take place.

***b. Future Work:***

P3 and P5 see that more types of tools need to be defined to implement by utilising the modern technology. Example of these is the tools facilitating to summarise the posts and ideas as mentioned by P1. This is emphasised by P4 where he advises facilitating the themes analysis to define the critical problem. As the tools are utilised by different people of different levels of skills, P2 advises to focus on the user interface in implementing the prototype to facilitate better testing for the model. P6 comes with the idea of providing some effort to evaluate the creativity tools such as those defined by Design Thinking in terms of the tools' impact on the design process and outcomes.

### **7.6.5. Collaboration**

P1, P2, P3, P4, P5 and P6 have a similar perspective that facilitating DAN-Spaces and CoDesign-Spaces support collaboration between businesses in terms of sharing knowledge for CoDesign in DANs. P2 states that collaboration is more about sharing, working together and giving feedback, and these spaces help to perform that. By creating such spaces and inviting people in DANs to participate that of course leads to team building and collaboration as per P3.

*P3: "Because I think you are not restricted to a position or a location so you can join at your convenience and that enhances the outcomes".*

P4 refers to the fact that there are lots of limitations by working through the traditional teams facilities. He mentions that knowledge created through these teams is limited by the number of members in the team. He reports

that virtual teams overcome the limitations of the traditional teams setup. The facility provided by the model saves time, money and is not limited to the geographical location as seen by P4, P5 and P6.

*P5: “By having collaborative spaces online anytime anywhere you can get people involved, contributing based on their time, based on their availability”.*

P5 mentions that creating DAN-Spaces and CoDesign-Spaces provides flexibility as collaboration can happen any time anywhere. P5 sees that having knowledge in one place helps collaboration in terms of tracking people and knowledge.

- ***Future Work:***

P3 advises to define and implement tools to support communication in the real time such as audio and video conferencing. P4 advises to implement what is called transactive memory. P6 advises to investigate what is called group dynamics.

### **7.6.6. Knowledge Management Processes**

P1, P2, P3, P4, P5 and P6 all have a similar opinion that the posting facility implemented in the prototype supports knowledge creating and sharing. P1 agrees that transferring knowledge from one activity to another supports knowledge filtering and sharing. That is seen by P3 and P6 as well. P4 states that Design Thinking tools implemented allow participants to group and theme their knowledge. P5 reports that the model does not completely support knowledge filtering. P6 refers to the reason that posting facilitates knowledge creation and sharing as participants respond to each other.

- ***Future Work:***

P1 advises to systemise the filtering process. P5 proposes that knowledge filtering and synthesising can be facilitated by implementing ontology for knowledge filtering and synthesising. P2 advises to think more about facilitating knowledge sharing between spaces. P6 advises to facilitate people motivation to share the knowledge.

### **7.6.7. Supporting Tacit and Explicit Knowledge**

P1, P2, P3, P4, P5 and P6 all have similar views in that the model supports tacit and explicit knowledge creation and sharing in some way. P1 sees that the model provides the social environment to create and share both types of knowledge. He considers facilities such as posting, commenting and file attaching within the prototype support social interaction between people in DANs. Also, P1 agrees that Design Thinking tools implemented support getting knowledge from different sources of knowledge types. P2 agrees that both types of knowledge are supported but limited. Other facilities such as voice, video conferencing and communication should be considered as per his advice. P3 states that tacit knowledge is supported by providing the social environment where people can join and collaborate. The explicit knowledge is supported by providing the different tools for posting and transferring knowledge. P4 sees the model supports tacit more than explicit knowledge because DAN-Spaces are more social environments. P4 also agrees that the model supports utilising different sources of the two knowledge types. P5 agrees that the model facilitates creating a social environment where people come together to collaborate and share knowledge. However, P5 sees explicit knowledge is definitely facilitated but for the tacit it depends. That is because the tacit type is represented by skills and experience and is not easy to be captured. P5 realises that tools support social interaction to share both types of knowledge. P5 mentions that there is a lack in supporting the physical interaction in real time. P6

also has the same opinion as P5 that the explicit type is supported but the tacit is supported somehow. Regarding supporting knowledge sources P6 sees the model supports more what is called the human knowledge sources.

- ***Future Work:***

P3 advises to support the explicit knowledge by building repositories to store this knowledge to be available for the next projects. P4 again mentions his advice of integrating the model with the intelligent management systems to benefit from the available knowledge. P5 advises to support the physical interaction in the real time.

## 7.7. Communicating Research Hypotheses

In this section we discuss the perceptions of the participants against the hypotheses we set for testing to evaluate our model.

***H1: The model enables businesses to self-organise in their complex environment.***

To test this hypothesis three enablers have been investigated through participants, supporting teams evolution, modifying teams and bringing in new knowledge. The perceptions of the participants have been extracted in relation to supporting these three enablers by our model. P2, P4, P5 and P6 see that teams evolvment is supported by the model. P2 sees the model makes it easy for teams to continue to collaborate after they evolve. P2 and P4 think that the model provides the advantage for teams to evolve anywhere any time. P5 considers that evolving teams by utilising the model tools allows the knowledge to be organised. P1 and P3 were not clear in regarding their perception about this enabler, supporting team evolution.

P1, P2, P4, P5 and P6 see that modifying teams enabler is supported by the model. P4 reports that supporting teams modification provides flexibility to the model where that is considered a creative work. P5 reports that modifying teams by the way defined in the model makes teams more effective and efficient.

P1, P2, P3 and P4 see that bringing in new knowledge is supported by the model by joining people through the spaces.

***H2: The model maintains privacy in the creative CoDesign environment for collaboration between businesses.***

This hypothesis is for evaluating maintaining privacy in our model. Three enablers have been considered to be supported by our model to maintain the privacy; knowledge ownership control, components privacy and access control.

All the participants have a similar perspective that privacy has been maintained and taken care of in the model. However, they have different opinions on supporting the privacy enablers. P1, P2, P3, P5 and P6 see that knowledge ownership is controlled by designing the two types of DAN-Spaces, Governed and Not-Governed. However, the governed type is considered more secure than the Not-Governed type. P1, P2, P5 and P6 recognise that components privacy is implemented in the model.

In regard to access control P1 agrees that access control is enabled as long as the DAN-Space-Coordinator controls the Governed DAN-Space and the CoDesign-Space-Owner controls the CoDesign-Space. P3 and P4 see that there should be a kind of access control on the Not-Governed DAN-Space as well.

***H3: The model facilitates participants to learn from each other to enhance expertise.***

All the participants have a similar opinion that creating CoDesign spaces and activities allow participants with different skills to create and share new ideas and knowledge. P3 and P2 see that Design Thinking tools play a big role to facilitate such kind of collaboration. These creativity tools support multidisciplinary in a way where even the less skilled people can participate to build the domain knowledge as emphasised by P2, P3 and P5.

***H4: The model defines creativity tools where creative thinking skills can be developed.***

Creative thinking skills as shown in our model are enabled through the creativity tools and brainstorming. In the prototype, Design Thinking tools have been implemented to facilitate brainstorming between participants from DANs.

As recognised by P2, P3, P4, P5 and P6, creativity tools implementation provides an advantage in supporting CoDesign. P3 sees that creativity tools support brainstorming because of team involvement. P5 sees that implementing creativity tools such as those defined in Design Thinking provides simplicity and flexibility. Online implementation of these tools allows accessing them anytime anywhere, which is considered another advantage as reported by P5.

***H5: The model enables groups and teams to collaborate.***

Collaboration in our model is enabled through creating and utilising DAN-Spaces and CoDesign-Spaces.

All the participants see that the model facilitates collaboration between businesses in terms of knowledge sharing by utilising DAN-Spaces and CoDesign-Spaces. Utilising the model overcomes the limitations of the traditional collaboration facilities as per P4. That saves time, cost and is not limited to geographical location as stated by P4 and agreed by P5 and P6. In this way the model provides the flexibility as well as having the knowledge in one place for easy access and utilise as emphasised by P5.

***H6: The model facilitates creating, filtering and sharing knowledge across DT thinking activities and spaces to develop knowledge domain and creative skills.***

All the participants see that the posting facilities implemented in the prototype supports knowledge creation and sharing. There is not enough evidence that knowledge filtering is supported in a satisfactory way in our model according to the participants' feedback. That has been clearly reported by P5. However, P1 agrees that transferring knowledge between activities represents a kind of filtering when selecting a specific knowledge to transfer. This is agreed by P3 and P6 as well.

***H7: The model supports businesses to capture both tacit and explicit knowledge for domain knowledge development.***

Generally, all the participants have a similar perspective that the model supports both tacit and explicit knowledge to build the domain knowledge. However, there is a contrast in their opinions and perceptions regarding this kind of support. P1 and P3 see that the model supports both types of knowledge without concerns. P2 sees that both types are supported but there are limitations and more tools are needed to be defined and implemented. P4 sees that the tacit type is supported more than the explicit while P5 agrees that explicit type is supported but the tacit is not so much. P6 has the same opinion as P5.

## 7.8. Discussion

In this chapter we have explained how we evaluated our model by applying the methodology explained in Chapter 3. In this section we discuss the findings which are represented by the perceptions and feedback of the participants who contributed in our evaluation process. Our discussion also includes our inputs regarding the hypotheses which have been tested against these findings.

The interviews and discussions with participants were conducted individually. However, the same questions mostly have been asked to the participants. Although interviews are conducted individually there were similarities many times between answers delivered by participants. Also, the similar perceptions or statements sometimes do not fall under the same question or even the same section. That is because the discussions and dialogues were open although they were guided by themes and specific questions.

In this section we would like to recall the findings again according to the themes which have been defined in the findings section including the hypothesis related to this theme.

***Self-Organising:***

Enabling self-organisation was focusing on bringing in new knowledge by facilitating DAN-Spaces and CoDesign-Spaces. DAN-Spaces facilitate networking between businesses in DANs. CoDesign-Spaces are where teams are created to collaborate and share knowledge by utilising creativity tools. Participants have different inputs from different points of view in relation to supporting and enabling self-organisation. One of the aspects mentioned by P2 is what is called virtual teams. Although we did not mention the virtual teams concept in our research, P2 has mentioned this concept. P2 reports that the tools can support virtual teams. However, in our opinion that may open a new dimension to our research. That of course needs more investigation throughout the literature about virtual teams, their characteristics and features, and the role of technology to support such sort of teams. That will provide an idea about how the model could support and provide an advantage to such teams.

Although our terminology in the thesis focuses on businesses and supporting collaboration between businesses in DANs, P5 refers to supporting business units. We agree with P5 as the model can be utilised for collaboration in CoDesign between business units as well, although the model was developed to support CoDesign in DANs.

P5 was comparing the model with the SAP system he was working with. That provides an alert to look at the systems utilised in the industry to investigate. That usually cannot be done by investigating the literature only. It needs talking to people in the industry themselves to know their perceptions about our model compared to the systems they utilise.

In regard to bringing in new knowledge a number of participants report that the model supports this enabler as more people can be invited to participate. However, participants such as P1 and P4 advise to allow benefiting from the existing knowledge. This existing knowledge is either in the public domain or created through knowledge management systems. That encourages us to re-define the new knowledge. We need to provide a precise definition to the new knowledge to be brought in. Does the new knowledge mean the new sources of knowledge? Does it mean the existing knowledge that can be utilised and explored to create new knowledge? Does the new knowledge mean the knowledge that has



not been created or does it mean the knowledge that has been newly brought to the spaces? We think by providing the right definitions that would help in developing the model in the right way.

***Maintaining Privacy:***

In our model we have defined two types of DAN-Spaces, Governed and Not-Governed. In the Governed DAN-Space, DAN-Space-Coordinator controls the privacy. In the Not-Governed DAN-Space there is no control by the DAN-Space-Coordinator, however CoDesign-Space-Owners have the control on the CoDesign-Spaces that they create. From our interviews some participants suggest that there should be a kind of control by the DAN-Space-Coordinator on the Not-Governed DAN-Space. This has been suggested by P2, P3 and P5. These three participants have advised examples of some solutions. In general, we agree with the main idea of having a control on the not-Governed DAN-Space somehow and that can be considered as a future work.

P4 suggests that the participants of the Governed DAN-Space should have the ability to create their own CoDesign-Spaces. P4 suggests that as this participant may need to work with his team within his business. We see considering this idea provides a kind of flexibility and worth thinking about. Governed DAN-Space is considered secured and under control. Providing such an option needs careful study and design.

***Developing Domain Knowledge by Utilising Design Thinking Tools:***

The idea is to support developing domain knowledge through creativity tools. Participants P1, P2 and P3 consider utilising creativity tools facilitates knowledge creating and sharing. However, in our research we see tools are not limited to Design Thinking tools. We have chosen Design Thinking tools for the prototype as they have started to be used widely in CoDesign and creating solutions. Other tools can be designed and implemented as required.

P4 considers supporting the less skilled and non-professional people as an advantage in our model. However, such kinds of people were not considered in our evaluation process at this stage.

P4 also sees that Design Thinking tools are one of the best to develop domain knowledge from his opinion. In our opinion this argument requires support from evidence, in terms of academic research and investigation.

### ***Collaboration:***

P3 and P4 consider implementing the model online as an advantage where people can easily join and have access for collaboration. In our opinion online implementation does not mean that the model is perfect especially when supporting collaboration. Culture differences, and the lack of face-to-face communication can be issues as was mentioned by P5 and P6.

### ***Knowledge and Knowledge Management Processes:***

The model has been evaluated for supporting knowledge management processes as well as the types of knowledge, tacit and explicit. Participants have the same perspective that the model supports people in creating and sharing knowledge through the tools provided. In regard to the other processes such as filtering, for example, participants seem to have some concern. For example, P5 describes that the model does not completely supports filtering. The reason behind this observation may be in the model we did not define tools which were dedicated to a certain process such as filtering, discovery from example. That is clear in the case of creating and sharing knowledge processes.

Our idea in this research is to evaluate the model not the prototype. For the future work the prototype can be developed by considered the knowledge management processes such as filtering for better testing.

## 7.9. Chapter Summary

In this chapter, we have presented our evaluation process. We have explained our strategy to select the experts to participate in the evaluation process. Also to have presented the processes and steps we followed to conduct the semi-structured interviews. The method of analysing the data by using NVivo software has been explained. In the evaluation process we performed thematic analysis of the interviews conducted. The findings of our interviews have been presented based on the themes defined. Then we have shown how the hypotheses have been connected to the findings. At the end of the chapter we have presented our discussion about the findings.



# Chapter 8

## Ch8: Conclusion and Future Work

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### 8.1. Introduction

Our research is to develop a model to support Dynamic Alliance Networks (DANs) for CoDesign. In our research journey we have started with the literature review. Our literature review and investigation were through different perspectives and disciplines. These included business networks, CoDesign concepts, CoDesign supporting systems, Knowledge Management and knowledge management supporting systems. The aim of the literature review is to have a background understanding of the related work in order to state the research key issues and research framework. At the end of the literature review chapter we have concluded with our research framework. This framework is our guidance to develop our research model. In Chapter 3 we have defined our methodology for developing and evaluating our research model. One of the main steps to develop the model is to know the types of DANs and their practical features to develop the best model to support these networks. In Chapter 4 we have explored more literature to investigate types of DANs in practice. 15 types of DANs have been presented accordingly. In Chapter 4 we have developed our conceptual framework and categorised the 15 types of DANs into four categories based on the conceptual framework. The research model has been defined in Chapter 5 based on the concepts of the conceptual framework. According to the methodology of evaluation the prototype of the model has been designed and implemented. Chapter 6 presents how the model prototype has been designed and implemented. Our model evaluation and findings followed by discussion of these findings are presented in Chapter 7, Mode Evaluation.

In this chapter, Chapter 8, we conclude our work in this research. We start with presenting a summary of the research findings detailed in Chapter 7. We then describe the contribution of our research through the three aspects, academia and theory, practice and teaching, and learning. Finally, we present the directions of future work and research.

## 8.2. Summary of Research Findings

The research has been evaluated by utilizing a qualitative research method. Semi-structured interviews have been conducted with six experts. Out of these interviews we summarise our findings according to our three constructs in this research; complexity, privacy and creativity.

### *Complexity (self-organising & emergence)*

As we mentioned previously, in our research we do not address the complexity theory. However, we focus on self-organizing and emergence properties. The model has been evaluated for supporting businesses in DANs to be self-organized in case of emergence. Three enablers have been suggested and evaluated to be supported by the model to facilitate self-organizing. These enablers are supporting team evolution, modifying teams and bringing in new knowledge. In summary we can highlight the findings of evaluating the support of these three enablers:

- Four participants have a similar opinion that the model supports team evolution.
- Five participants have a similar opinion that the model supports modifying teams.
- Four participants have a similar opinion that the model supports bringing in new knowledge.

### *Privacy*

Our aim is to develop a model to support DANs for CoDesign by maintaining privacy. Based on the theory and literature review three enablers have been suggested to be supported by the model to maintain privacy. These enablers are knowledge ownership

control, components privacy and access control. In summary we highlight the following in regard to maintaining privacy in our model:

- The participants P2 and P3, P5 and P6 consider maintaining the privacy has been taken care of in the model.
- The policies implemented in the support the privacy options as mentioned by P3.
- P6 reports that maintaining privacy in the model tackles the issue of intellectual property.
- Participants such as P1 consider that the governed DAN-Space is more secure while the not governed DAN-Space is more open. That is in terms of knowledge ownership and control.
- The participants P1, P2, P5 and P6 see that components privacy is supported in the model.
- Roles such as DAN-Space-Coordinator and CoDesign-Space-Owner with the related policies implemented allow the access control as mentioned by P1.

### *Creativity*

Our model is to support people in businesses to construct their creativity environments to create and share knowledge in CoDesign. The aim is to implement creativity tools to be utilised by people. The tools suggested in this research are the Design Thinking tools; three of them have been implemented in the model prototype.

According to the creativity theory the following theory components are suggested to be supported through our model:

- Developing the domain knowledge.
- Developing the creative thinking skills.
- Collaboration and work-group.
- Knowledge and knowledge management processes.

To develop the domain knowledge the enablers which are to be supported by the model are; creating collaborative spaces and activities and multidisciplinary should be supported.

All participants agree that the tools provided by the model support developing the domain knowledge in order to enhance expertise. P3 and P4 see considering multidisciplinary and less skilled people to be supported by the model is an advantage.

In our model creative thinking skills are enabled through brainstorming and creativity tools. P2, P3, P4, P4, P5 and P6 see that the model facilitates brainstorming through the utilisation of creativity tools from different perspectives. Involving people and implementing these tools online encourages brainstorming according to the opinion of P4, for example.

Collaboration is enabled by supporting creating DAN-Spaces, CoDesign spaces and involving stakeholders. All participants agree that the model supports creating DAN-Spaces and CoDesign-Spaces to facilitate collaboration.

All participants agree that the model supports knowledge and knowledge management processes in order to facilitate creativity.

In the next section we present and describe our research contributions to academia, practice, and teaching and learning.

## 8.3. Contributions of the Research

We see that our research has contributions to three aspects, academic and research theory, practice and teaching and learning.

### 8.3.1. Contribution to the Academic Research and Theory

The contribution of our research to academic and research theory can be seen through two perspectives, the literature review and the methodology.

In our literature review we have investigated the previous work through business networks and collaboration, CoDesign, knowledge management and creativity tools. Bringing these



aspects together in one research is seen as a new approach to develop the research in supporting CoDesign in DANs.

The main contribution of our research is the investigation of the different types of dynamic alliance networks (DANs). This investigation is presented in Chapter 4 where 15 types of DAN have been categorised based on our conceptual framework. Chapter 4, The Types of Dynamic Alliance Networks, is considered as the main contribution of this thesis.

As our research is to develop a model to support CoDesign in DANs, knowledge management and creativity tools such as defined in Design Thinking should not be overlooked. In this research CoDesign process is seen as intensive knowledge and knowledge management processes. Although there is a lack of research to relate these disciplines together we did not find issues with participants to understand this fact. An example of that is when we talk to them about supporting knowledge and knowledge management through the Design Thinking tools.

In Chapter 4 we developed our conceptual framework to categorise the DAN types based on the concepts defined by this conceptual framework. The conceptual framework represents a theoretical approach to study the features of business networks when they are supported for CoDesign, collaboration and knowledge management.

Also, and from the theory point of view, the research brings self-organization and emergence as properties of complexity together with privacy and creativity. By bringing these theories together that provides a theory background to those who develop research in CoDesign. Although these theories are considered different lines of research, in our research they are considered as related when developing the research for CoDesign.

In terms of CoDesign concepts and principles our research provides other dimensions of the CoDesign process. According to the literature CoDesign and its supporting models and systems only focus on supporting products design. Also, these systems are sophisticated and dedicated. CoDesign in our research involves and includes designing processes and services as well. Also, people of different skills including users and consumers become involved in the CoDesign process. That of course provides new dimensions for people who develop researches in CoDesign and CoDesign support.

The other contribution to academic research and theory is through the research methodology followed in this research. In our research we utilized an empirical method for qualitative research. This method is based on defining the model and implementing a prototype for evaluation. For the researchers that gives a practical example for evaluating such methodology for further research.

### **8.3.2. Contribution to Practice**

Our research develops a model to support CoDesign in DANs. The aim is that this model is to be designed and implemented for utilisation by businesses in DANs. As contribution to practice we see that our model adds new experience for performing CoDesign. This sort of contribution can be described from different perspectives as well.

From the business and business networking perspective the model can be implemented and customised to support the different types of DAN structures. Businesses which utilise CoDAN can be in different industries and with different sizes, including small, medium and large enterprises. Developing the model in this way makes the small size businesses and medium size businesses of low budget able to benefit from this innovation. That of course provides a large size of domain in using the model. This of course plays a big role in enhancing the model and coming up with new tools to be implemented when required.

From the users' perspective the aim of developing the model is to be utilised by professionals as well as other users such as consumers. DANs may involve users and consumers as they became an effective part in the CoDesign process as per literature. That of course contributes crucially in developing domain knowledge and leads to enhanced business outcomes.

### **8.3.3. Contribution to Teaching and Learning**

This sort of contribution has a relation with the first one, academic research and theory. In regard to teaching and learning the research provides the teaching and learning community with new directions and ideas to develop training and learning materials. Courses and workshops that deal with creativity in CoDesign and Design Thinking training and teaching can adopt the new concepts presented in the research. These concepts can be integrated into courses such as those which deal with collaboration in DANs and business solutions and modeling. People who develop courses related to collaboration and CoDesign now can deliver CoDesign with its new dimensions and concepts.

## 8.4. Directions for Future Work

Like any other research, our research guides future directions of work and new research as well.

Firstly, the research model can be evaluated and tested by using new methods and strategies. We have chosen the qualitative method to evaluate the model. Also, we have chosen the *system as such* strategy as mentioned in Chapter 3. This strategy focuses on evaluation by experts and utilising qualitative methods. For further testing and evaluation *user as such* can be used. In this case users who supposed to utilise the model can be involved. Then more input and feedback can be obtained by conducting both of the research methods, the qualitative and quantitative.

Secondly, also in relation to model evaluation, the model has been developed based on the features of DANs defined by the concepts of the conceptual framework. The model, CoDAN, has been evaluated based on the enablers defined in the research framework derived from the literature review. For the future work, the model can be evaluated by utilising it through different DANs of different features and structures.

Thirdly, the goal of the research is to develop a model for businesses in DANs to manage their creativity environment. Creativity theory through its descriptors has been used to create our hypotheses. However, other descriptors such as creativity motivation should be considered in evaluating the model for the future work. Enablers supporting the motivation, for example, should be defined and incorporated in the model and evaluated as well.

Fourthly, Creativity tools have been defined as one of the main components in the model. Three of these tools, as defined by Design Thinking, have been implemented in the prototype. More tools including Design Thinking tools can be investigated throughout the literature and prototyped as well. As mentioned in the Chapter 2, literature review, and in Chapter 5, Model Definition, there is a lack of research in testing and evaluating the creativity tools such as those defined in Design Thinking. The model is seen as a way to design these tools and models and evaluate them. These tools should be evaluated in terms of their impact on the design process and outcomes.

Fifthly, the model has been evaluated in relation to supporting knowledge management processes. Dedicated tools to perform processes such as knowledge filtering, knowledge discovery and knowledge organisation can be defined and implemented for evaluation and testing. Approaches such as ontology and artificial intelligence methods can be considered and implemented to support various knowledge management processes.

Sixthly, in terms of supporting self-organisation more investigation is needed through the literature and research. One of aspects here is to define the criteria and conditions under which the business is considered self-organised. Defining such conditions and criteria helps in developing the model defining tools to support the self-organisation feature for businesses in DANs.

Seventhly, evaluating privacy in our research was through a scenario. Experts applied the scenario and observed their perceptions and provided their feedback accordingly. To evaluate privacy rules and functions in a more effective way, again, the *user as such* strategy can be utilised here. More detailed scenarios can be created and more users can be involved. As much as more teams and spaces created and more users involved in utilising the model leads to better feedback and evaluation outcomes. Taking care with privacy has a relationship with the intellectual property where people can be encouraged to utilise the model.

Eighthly, to focus on the model testing more attention should be paid to prototype implementation. One of these aspects is to make the user interface more easy and friendly for use and learn from the various users of different skills and experience. In this case more users of different skills can be involved in evaluating the model.

## 8.5. Chapter Summary

In this chapter we have presented our conclusions from this research. The conclusions are based on the findings out of the literature review, the model design and implementation and the model evaluation. We have started by summarising our findings from the evaluation process based on the three constructs; complexity, creativity and privacy. Then we have explained the contribution of our research according to the three perspectives; academia, practice, and teaching and learning. Finally, we have explained our directions

for the future work and research based on this research. That includes future directions in developing the evaluation process and developing the research model itself.



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# Appendices

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## Appendix 1: Full Scale Consent and Information Form (The Ethics Form).



### CONSENT FORM FOR PARTICIPANTS IN INTERVIEW

**Project title:** Managing CoDesign in Dynamic Alliance Networks.

**Investigators:** Prof. Igor Hawryszkiewicz (Supervisor)

Abdussalam Ali (research student), PhD student - Information Systems

**The aim of research:**

The main goal of this research is to design a model to enable creativity for business networks when they perform CoDesign. The model provides these networks with Design Thinking tools to create and share knowledge. The research carries the following objectives:

1. Investigating the current research in the context of CoDesign support through technology.
2. Exploring the creativity tools and see how to develop it by technology to support CoDesign.
3. Maintaining privacy to control accessing the knowledge created and shared within the system.
4. Facilitating CoDesign teams to flexibly create and modify their business models as required.

**Please complete the following:**

- (a) I \_\_\_\_\_ (*the participant*) have read and understood the information provided in the Information Sheet, and any questions I have asked have been answered to my satisfaction.
- (b) I agree to participate in the interview, realising that I may withdraw at any time up until four weeks after the interview has been completed. I understand that the interview will be conducted face-to-face or by phone and will be audio-recorded. I also understand that any personal data about me that is collected in the interview will be available to me on request by email to Abdussalam.M.Ali@student.uts.edu.au
- (c) I agree that research data provided by me in this interview may appear in publications such as a thesis, a report, a journal article, and a conference paper, etc., or may be used in similar future projects on the condition that neither my name nor any other identifying information is used.
- (d) I understand that only pseudonyms will be used and confidentially will be maintained at all times. I understand that my contact details will be securely stored by the researcher.
- (e) I understand that a copy of this Consent Form will be provided for me to keep.

\_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_  
Signature (participant)

\_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_  
Signature (researcher or delegate)

**NOTE:**

This study has been approved by the University of Technology, Sydney Human Research Ethics Committee. If you have any complaints or reservations about any aspect of your participation in this research which you cannot resolve with the researcher, you may contact the Ethics Committee through the Research Ethics Officer (ph: +61 2 9514 9772 Research.Ethics@uts.edu.au), and quote the UTS HREC reference number. Any complaint you make will be treated in confidence and investigated fully and you will be informed of the outcome.

## Appendix 2: Information Form



### INFORMATION SHEET FOR PARTICIPANTS

**Project title:** Managing CoDesign in Dynamic Alliance Networks.

**Who is doing the research:**

- Abdussalam Ali: PhD student - Information Systems, Faculty of Engineering and Information Technology, University of Technology, Sydney, Australia.  
Phone: +61 4 20775771; Email: Abdussalam.M.Ali@student.uts.edu.au.
- Prof. Igor Hawryszkiewicz: Principal supervisor, Faculty of Engineering and Information Technology, University of Technology, Sydney, Australia.  
Email: Igor.Hawryszkiewicz@uts.edu.au

**What is this research about?**

This project ‘Supporting Creativity in CoDesign’ is conducted by Mr Abdusslam Ali, PhD candidature under the supervision of Professor Igor Hawryszkiewicz, Faculty of Engineering and Information Technology, University of Technology, Sydney, Australia.

The main goal of this research is to develop a model to enable creativity for business networks when they perform CoDesign. The model provides these networks with Design Thinking tools to create and share knowledge. The research carries the following objectives:

1. Investigating the current research in the context of supporting CoDesign through technology.
2. Exploring the creativity tools to develop them by technology to support CoDesign.
3. Maintaining privacy to control accessing the knowledge created and shared within the system.
4. Facilitating CoDesign teams so they can flexibly create and modify their business models as required.

**If I say yes, what will it involve?**

You have been contacted as your position indicates that you are able to evaluate this implemented model. Evaluation will be done through a pre-designed scenario. Then I will interview you and ask questions related to our evaluation hypotheses. We invite you to take a part in the research project and we highly appreciate your participation.

We will submit to you the guided scenario where you can work it online by utilising our implemented model. Then we invite you to participate in a 30 minutes to one hour

interview. The interview is planned to take place sometime in October or November 2017 and will be audio recorded for the purpose of the research only. During the session, we would like to hear your ideas and inputs about our model according to the questions will be asked to you. If you are willing to take a part in the interview, please give us your contact number or email address by emailing Abdussalam.M.Ali@student.uts.edu.au. We will ask you to fill in a Consent Form before we start the interview.

**Are there any risks/inconvenience?**

There are very few, if any, because the research has been carefully designed. However, it is possible that you might experience some discomfort for the first few minutes of your responses being audio recorded in the interview. However, you can always be assured that:

- Participants may be vulnerable if there are comments or when being asked about something related to the weakness in their professionalism or related to corrupted activities.
- The participation is voluntary and declining the invitation would not affect your academic results and career in any way.
- You can stop the interview and keep on when you're ready. The interview can always be rearranged another time at any place as you wish.
- You can choose to be interviewed through instant messaging or emails as you want.
- Your data interview will be transcribed and the data will be de-identified with a system of codes which is stored separately from the transcripts before analysis.
- Your real name will not be used or identified in any way in the research.
- The researcher won't take notes during the interview so that the conversation can take place as naturally as possible.
- The findings of this research are intended to be published in a journal article or presented at a conference, without identifying you, or your department/centre in any way.

**Why have I been asked?**

You are able to give me information and inputs I need to evaluate my model.

**Do I have to say yes?**

You don't have to say yes because your participation in this project is completely voluntary. You can withdraw at any time, for any reason, without prejudice.

**What will happen if I say no?**

Nothing. I will thank you for your time so far and won't contact you about this research again.

**If I say yes, can I change my mind later?**

You can change your mind and withdraw at any time without having to provide a reason. I will thank you for your time so far and won't contact you about this research again.

**What will be done with the results of the project?**

The results of this project will be used in the doctoral thesis of Abdussalam Ali, and may appear in other academic publications, e.g. a journal article, a report, a conference paper, or a similar future project. The results of the project will be available to you on request by email to Abdussalam.M.Ali@student.uts.edu.au.

**Will confidentiality of provided information be maintained?**

The information you provide in the interview will be kept confidential throughout the study as well as after the study has been completed. All hard-copy data (e.g. interview notes ...) will be stored in a safely locked drawer in the office of Abdussalam Ali, room 218, level 6, building 11, Faculty of Engineering and Information Technology, University of Technology, Sydney, Australia. The soft-copy data (e.g. audio files, interview transcripts, data entry ...) will be password protected and kept in the computer of Abdussalam Ali.

**What if I have concerns or a complaint?**

This project is subject to ethics approval from the University of Technology, Sydney, Australia. If you have any questions regarding this project, please do not hesitate to contact us, Prof. Igor Hawryszkiewicz, or Mr Abdussalam Ali (please see the contact details above). If you have any complaints or queries that we have not been able to answer to your satisfaction, you may contact the UTS Human Research Ethics Committee (HREC), University of Technology, Sydney, Australia, email: [Research.ethics@uts.edu.au](mailto:Research.ethics@uts.edu.au) and quote this number (UTS HREC REF NO. ETH16-0827).

We'd like to invite you to participate in this project.

Thank you very much for helping us with this project.

We look forward to getting your valuable input.

PhD candidate: Abdussalam Ali

Supervisor: Prof. Igor Hawryszkiewicz

### Appendix 3: Semi-Structured interview questions

Hi Mr./Mrs. \_\_\_\_\_ I would like to thank you for accepting my invitation to participate in our research evaluation process.

Mr./Mrs. \_\_\_\_\_ this interview will be recorded are you agree with that?

If you feel not comfortable about the interview then you can request to stop this interview any time and the recording as well.

Could you please introduce yourself?.

#### **Complexity and Self-Organisation**

Businesses operate in emergent environments. That means they should respond to environment emergences when required. The emergence can be, for example, a change in the market such as introducing a new product or service by a competitor. Also, it can be a potential idea that leads to an opportunity. Responding to such emergences needs businesses to be self-organised. Requirements of self-organisation include arrangements and knowledge needed to respond to emergence.

In our model there are two domains of self-organisation:

1. Business domain: in business domain self-organisation is viewed as the changes needed to support the business for responding to emergence. Example of that is modifying a business process or acquiring professionals to be involved or employed in the business.
2. Creativity environment domain: In this domain self-organisation is viewed as the modifications to be done to the creativity environment. That includes creating and modifying DAN-Spaces, creating and modifying collaborative spaces and managing DT activities.

Self-organisation in our model is enabled through the following **enablers**:

1. Bringing in a new knowledge.
2. Supporting team evolution.
3. Supporting team modification.

The model provides tools to be utilised by people in businesses to create and share knowledge in order to respond to an emergence. These tools allow business to:

4. Create new DAN-Spaces anytime.
5. Inviting people from other businesses to participate in DAN-Spaces.
6. Creating new CoDesign spaces in DAN-Spaces.
7. Creating CoDesign activities in CoDesign spaces(s).
8. Assigning DAN-Space participants to CoDesign spaces.

Businesses can modify their creativity environment of CoDesign if required. That includes:

1. Creating new DAN-Spaces
2. Creating new CoDesign spaces.
3. Creating new CoDesign activities in existing CoDesign-Space
4. Resigning CoDesign activities from existing CoDesign-Space
5. Inviting new people to participate in existing DAN-Spaces.
6. Resigning existing participants from DAN-Spaces.

**H1: The model enables businesses in DAN to self-organise in their environment.**

**Questions:**

Q1.1: The model enables businesses to create new DAN-Spaces, new CoDesign spaces, new DT activities and inviting people to participate in these spaces and activities. **Does that support team evolution when required?** (how/why/comments) (enabler: 1)

Q1.2: The model allows people to modify DAN-Spaces and CoDesign spaces when required.

**Does that support the business to be self-organised against emergence while it is utilising a current creativity environment?** (how/why/comments). (enabler: 2)

**Q1.3: Do creating new DAN-Spaces, creating new CoDesign spaces and inviting people to participate support businesses to reach new knowledge resources and create new knowledge to respond to emergence?** (why/how/comments) (enabler: 3)

**Q1.4: What is the future work needed to further enhancing self-organising feature?** (enablers: 1, 2, 3)

### Maintaining Privacy

CoDesign creativity environment is a collaborative environment. Different people from different businesses join the environment to create and share knowledge. In the case of business collaboration the concern is about accessing the knowledge by the competitors. People who own knowledge and spaces should have the ability to decide who accesses the knowledge created by them in CoDesign environments.

In our model we enable privacy maintaining through the following **enablers**:

1. Knowledge ownership: the knowledge is owned and controlled by the person who creates it and/or owns it.
2. Components privacy: DAN-Spaces, CoDesign spaces, and CoDesign activities are considered as the containers of the knowledge. People who create these components have the authority to control them.
3. Access Control: nobody can access knowledge or any other components he does not own unless authorised.

Our model supports two types of DAN-Spaces:

1. Governed DAN-Space: in this type of DAN-Space the person who creates the DAN-Space has the full control on it. Only the DAN-Space-Coordinator invites



people, creates CoDesign spaces and creates CoDesign activities in these spaces.

2. Not-Governed DAN-Space: in this type anyone who participates to the DAN-Space can invite other people. Also, any DAN-Space-Contributor can be a CoDesign-Space-Owner by creating CoDesign spaces in DAN-Space.

**H2: The model maintains privacy in the creative CoDesign environment for collaboration between businesses in DAN.**

**Questions:**

Q2.1: In the Governed DAN-Space, only the DAN-Space-Coordinator, can invite people from businesses in DAN to participate in the DAN-Space. Also, only the DAN-Space-Coordinator can create CoDesign-Spaces, and create CoDesign activities in these CoDesign-Spaces. The CoDesign-Space-Owner, the DAN-Space-Coordinator in this case, is the only one who can assign people from DAN-Space to CoDesign-Spaces.

**Does that enable what is called components privacy in the model?**  
(why/how/comments) (Enabler: 4,5,6).

Q2.3: In the Not-Governed DAN-Space anyone who participates in the DAN-Space from businesses in DAN can invite other people to participate. However, CoDesign-Space-Owner still has the same authorities on the owned CoDesign-Space here.

**Does that reduce or affect the privacy in any way?**

Q2.4: **Overall, does the privacy modeling in our model provide access control for the collaborative environment?** (enabler: 4,5,6,7)

Q2.5: **What is the future work to develop enhancing the privacy in the model?**  
(enabler: 4,5,6,7)

**Developing domain knowledge to enhance expertise**

Expertise is referred to any knowledge and skills that a person has and can apply to address a problem and solve it. Expertise can be enhanced by exploring the space of domain

knowledge in context. Domain knowledge is developed by collaboration between people in teams and groups and learning each from other. The wider the space, more domain knowledge can be captured and created.

To increase the space where businesses can reach more knowledge in the domain **the model supports the following enablers:**

1. Supporting multidisciplinary where different participants of different skills and knowledge can be invited.
2. Supporting Networking
3. Facilitating collaborative activities.

By creating CoDesign activities and CoDesign-Spaces in the DAN-Space and assigning participants to the CoDesign-Spaces allow people in DANs to learn from each other to enhance knowledge domain and expertise.

**H3: The model facilitates participants to learn from each other to enhance expertise.**

**Questions:**

Q3.1: The model allows people in businesses to create and customise different CoDesign activities. These activities are created in CoDesign-Spaces where people can be assigned to. Participants have different skills and experience. That includes professionals, consumers and users.

**Does that develop the domain knowledge where expertise can be enhanced for creativity?** (enablers: 12,13,14) (how/why/comments)

**Q3.2: What is the future work to be done in order to facilitate businesses to develop the expertise?**

**Creative thinking skills development**

Creative thinking skills include the ability to address and solve the problem. Such ability can be achieved and supported by looking for new knowledge resources and using ways

such as brainstorming that lead to ideas for addressing the problem.

Our model provides the following **enablers** to enhance creative thinking skills for better creativity:

1. Implementing Design Thinking tools.
2. Supporting brainstorming.

**H4: The model implements creativity tools where creative thinking skills can be developed.**

**Questions:**

**Q4.1: Do creativity tools (Design Thinking tools in prototype) in the model facilitate ideas brainstorming and sharing for creativity in CoDesign? (enabler: 10,11)**

**Q4.2: Can creativity tools (Design Thinking tools in prototype) in the model be utilised by different users of different skills to create knowledge? (enabler: 12)**

**Q4.3: What is the future work needed to develop creativity tools such as in Design Thinking for supporting knowledge creation and sharing in our model? (enabler: 10,11,12)**

**Collaboration**

Work group is where people work in groups and teams. There is quite a lot of evidence that working in groups and teams provides better creativity outcomes than working as individuals. Our model provides other dimensions to teams and groups workplace to collaborate. These teams and groups can work together regardless of their geographic distances, anywhere anytime.

**Enablers:**

1. Supporting networking.
2. Facilitating collaborative activities.

3. Supporting stakeholders participation.

**H5: The model enables groups and teams in DAN to collaborate.**

**Questions:**

**Q5.1: By facilitating DAN-Spaces and CoDesign-Spaces, does that support building teams and groups to collaborate for creativity? (enabler: 13,14,15)**

**Q5.2: By utilising DAN-Spaces and CoDesign-Spaces and joining people anywhere anytime how does that enhance collaboration outcomes?**

**Q5.3: What is the future work to enhance supporting work-group feature?**

**Knowledge management processes**

CoDesign involves knowledge management processes. That means knowledge management processes are involved when performing CoDesign and utilising creativity tools. These processes include knowledge creating, capturing, filtering and sharing. However, knowledge management by utilising tools such as Design Thinking tools is considered iterative comparing to KM processes in the traditional models of KM.

**H6: The model facilitates creativity by creating, filtering and sharing knowledge across CoDesign activities and spaces to develop knowledge domain and creative skills.**

**Questions:**

The model provides tools (Design Thinking tools in the prototype) to post knowledge and commenting on posts. **Does that support creating and sharing the knowledge between people in CoDesign-Spaces and DAN-Spaces?**

**Q6.1: The model provides tools to transfer a specific knowledge from one CoDesign activity to another and from one CoDesign-Space to another. Does that support the knowledge filtering process?(enabler: 8)**

**Q6.2: What is the future work required to develop knowledge management processes in our model?**

**Tacit and explicit knowledge capturing**

Knowledge is classified into two types, tacit and explicit. Tacit knowledge is referred to as the experience and skills which reside in the brains of people. Explicit knowledge is the knowledge presented in the various types of artefacts. Both of the two types of knowledge should be captured in CoDesign based on the context and domain. Tacit knowledge should be converted into explicit knowledge to be applied and shared.

Our model supports capturing both types of knowledge.

**H7: The model supports businesses in DAN to capture both tacit and explicit knowledge for domain knowledge development.**

**Questions:**

**Q7.1: Does the model facilitate businesses to create social environments to collaborate and share both types of knowledge?**

Q7.2: The model provides facilities such as posting knowledge, commenting on posts, attaching files of different formats and transferring knowledge between CoDesign activities. **Does that support social interaction to capture the various types of knowledge?**

Q7.3: The model provides the facility of creating different CoDesign activities based on the design requirements and the type of people who participate. **Does that facilitate utilising the different sources of knowledge types?**

## **Appendix 4: Prepared Scenario for Evaluators (Innovative Bags Design).**

Dear participant, this scenario is for demonstrating CoDAN functionality based on the semi-structured interview questions attached.

The scenario demonstrates the following functions:

1. Creating DAN-Spaces.
2. Inviting people to DAN-Space.
3. Creating CoDesign-Spaces.
4. Assigning different roles to people in DAN-Space and CoDesign-Space
5. Creating different CoDesign Activities
6. Utilising creativity tools to carry out CoDesign Activities
7. Transferring knowledge among activities and CoDesign-Spaces

### ***The Story:***

1. One of the duties of the business manager “George” in the Childrens’ Hospital is to look for business opportunities for the hospital.
2. One of these opportunities is to make innovative back bags for children to be used by school children.
3. The idea of the new bags came from the that fact where the traditional bags negatively affect the childrens’ backbones.
4. Auto-adjustable back bags were suggested by the hospital management to avoid or eliminate such a problem.
5. George, with the marketing team, has looked at many bags manufacturers to choose one for producing such a product.
6. The hospital has created its network, DAN, with bags suppliers to find the best way to manufacture the new bags.
7. The suppliers “All Bags Factory” and “Quality Bags” have been invited to contribute in the DAN.

8. George started to negotiate with the two bags factories to decide which one to choose for producing the bags. These factories are “All Bags Factory” and “Quality Bags” factory.
9. After negotiation with each of the two factories, the Childrens Hospital management has chosen the offer of “All Bags Factory”.
10. George, from the hospital, has utilised CoDAN for the two stages, negotiation and design.
11. George, as the person from the dominant and governing business, has created a Governed DAN-Space for the project.
12. In the negotiation stage he has created two CoDesign-Spaces for negotiation with each of the two business.
13. Creating the two CoDesign-Spaces is to keep the privacy of knowledge created by each business.
14. In the design stage, George has created three CoDesign-Spaces, CoDesign-Space 1 for CoDesign with All Bags Factory, CoDesign-Space 2 to empathise kids and parents and CoDesign-Space 3 to empathise the staff in the hospital.
15. Using CoDAN in the design stage has been illustrated in Figure A.1

### ***CoDesign-Spaces and CoDesign-Activities***

1. To start collaboration with businesses George has created a DAN-Space with a name “New-Bags”.
2. George has invited people from the three businesses to participate in the DAN-Space “New-Bags”.
3. For the design stage he has created three CoDesign-Spaces:
  - a. CoDesign-Space-1 “Bags-Design”: This CoDesign-Space is for designing the new innovative bags by collaboration with All Bags Factory. Examples of CoDesign Activities created in this CoDesign-Space are:
    1. Design-Ideas: a storyboarding activity to brainstorm for ideas about how to design the new bags.
    2. Development: a lotus blossom activity to develop the selected ideas of design.

- b. CoDesign-Space-2: Empathising-Staff. In this CoDesign-Space George creates Persona-map activities to empathise the staff in relation the new bags design.
  - c. CoDesign-Space-3: Empathising-Community. In this CoDesign-Space George creates Persona-map activities to empathise kids and parents for the new bags design.
4. The three CoDesign-Spaces have been created to isolate the different people who participate in CoDesign from each other for privacy.



**Roles in the New-Bags DAN-Space:**

<b>Person (User)</b>	<b>From</b>	<b>Role</b>	<b>In</b>	
George	Childrens Hospital	DAN-Space-Coordinator	New-Bags DAN-Space	
		CoDesign-Space-Owner	CoDesign-Spaces; Bags Design, Empathising-Staff and Empathising-Community	
Kate		DAN-Space-Contributor	New-Bags DAN-Space	
		CoDesign-Space-Participant	CoDesign-Spaces; Bags Design and Empathising-Staff	
John		DAN-Space-Contributor	New-Bags DAN-Space	
		CoDesign-Space-Participant	CoDesign-Spaces; Bags Design and Empathising-Staff	
Samantha		All Bags	DAN-Space-Contributor	New-Bags DAN-Space
			CoDesign-Space-Participant	CoDesign-Spaces; Bags Design
Larry	DAN-Space-Contributor		New-Bags DAN-Space	
	CoDesign-Space-Participant		CoDesign-Spaces; Bags Design and Empathising-Community	
Jack	Quality Bags		DAN-Space-Contributor	New-Bags DAN-Space
Alfred	Community		CoDesign-Space-Participant	CoDesign-Spaces Empathising-Community

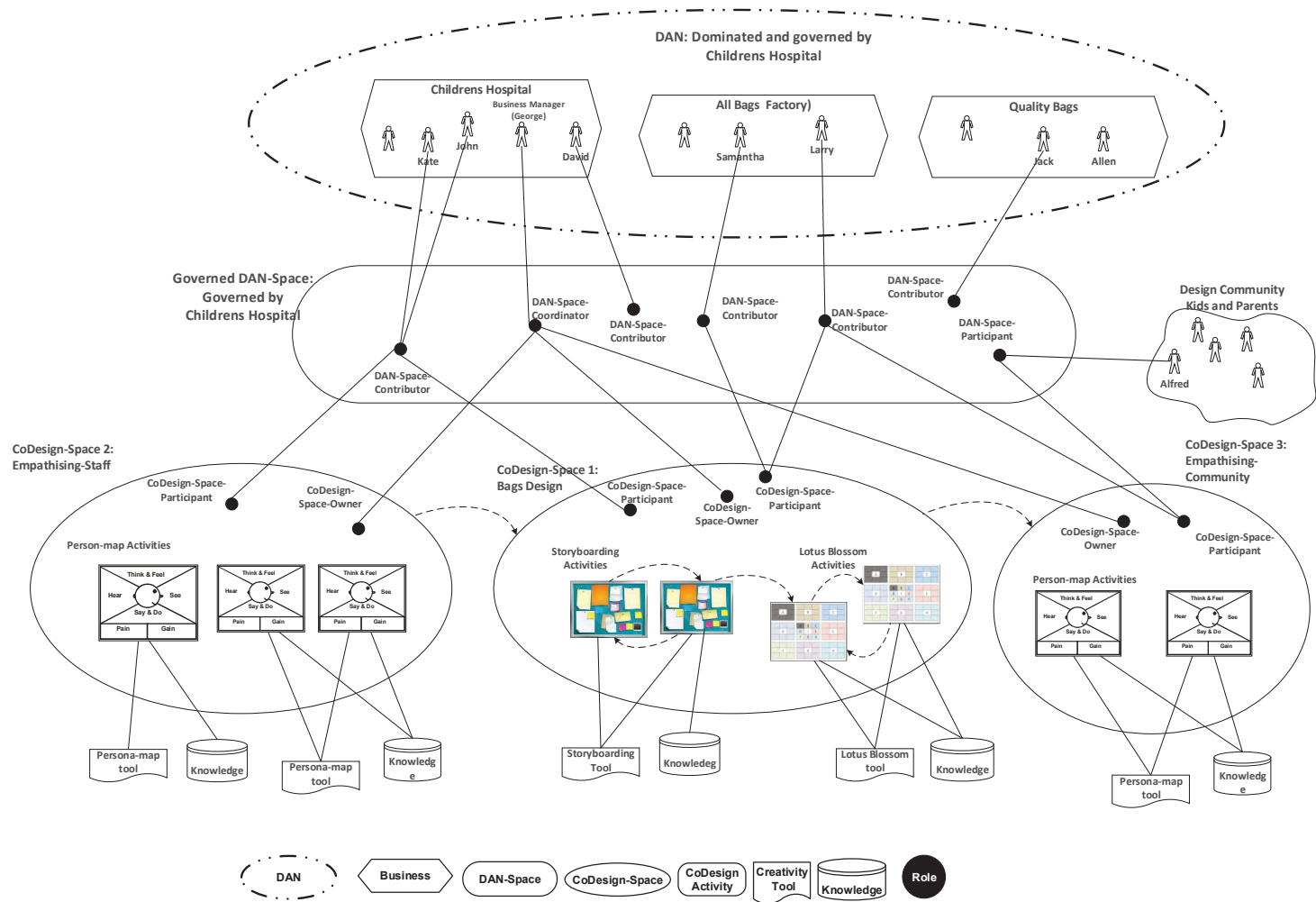


Figure A.1: Innovative Bags Scenario

## Appendix 5: Object Oriented Modeling Concepts

We refer to Alhir (2003) to define the concepts of UML and object-oriented modeling. According to Alhir (2003) UML is “a visual language for modeling and communicating about systems through the use of diagrams and supporting text”.

Figure A.2 shows an example of UML structure derived from Alhir (2003).

The figure describes the following in regard to project management:

1. Manager, defined by a name and contact information, manages a project that is defined by its name, start date and end date.
2. Manager also leads a team that is defined by description.
3. Team executes a project.

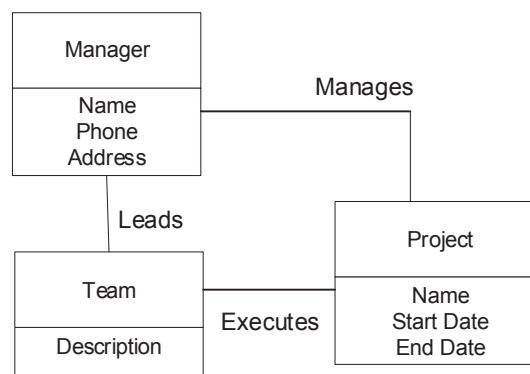


Figure A.2: Classes and UML example (Alhir, 2003)

The other concept to be defined here is the object oriented modeling. Elements of object-oriented modeling are defined as following according to Alhir (2003):

1. *Classes*: in the previous example, manager, team and project are words which refer to general concepts called classes. The Class refers to general concepts.
2. *Objects*: objects represent instances derived according to the general classes. Example of objects are shown in Figure A.3.

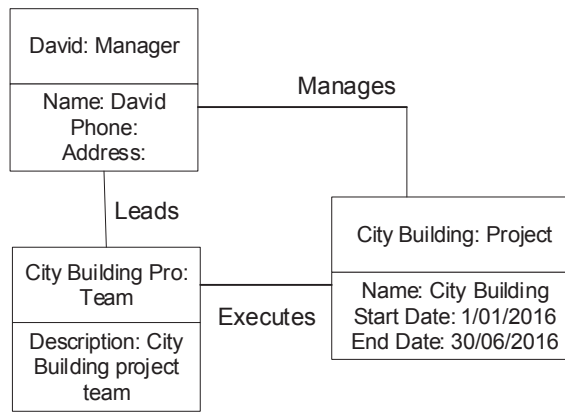


Figure A.3: Example of objects (Alhir, 2003)

Manager David manages the City Building project and leads the team of City Building Project.

3. *Associations*: associations represent the relationships between classes. These relationships are inherited by instances. In the example, associations are represented by the labels (Manage, Lead, Execute).
4. *Attributes*: attributes distinguish two or more objects of the same class from each other. For example, if there are two managers and each of them manages a project then managers are distinguished by their names and contacts. Also, the two projects are distinguished by names, start dates and end dates attributes.
5. *Operations and Methods*: operation or method refers to actions that an object can perform. Figure A.4 shows the previous example modified by adding methods performed by the manager.

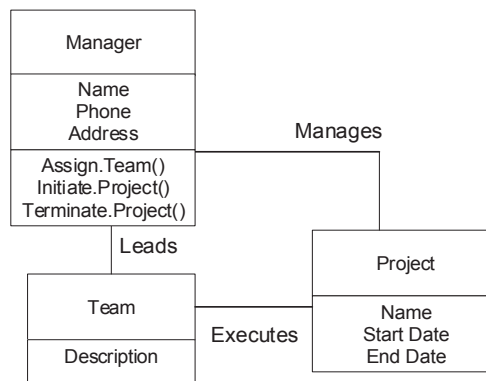


Figure A.4: Example of methods (Alhir, 2003)