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Critical success factors for linking digital technologies and circular supply chains

Ashish Dwivedi [1] | Anirban Ganguly [1] | Sanjoy Kumar Paul [2]

[1]Jindal Global Business School, O. P. Jindal Global University, Sonipat, Haryana, India

[2]UTS Business School, University of Technology Sydney, Sydney, Australia

Correspondence
Sanjoy Kumar Paul, UTS Business School, University of Technology Sydney, Sydney, Australia.
Email: sanjoy.paul@uts.edu.au

Abstract

Circular supply chains (CSCs) refer to the process of collecting used products from consumers and repurposing them through remanufacturing, recycling, renovation, and repair. Digital technologies have the potential to perform a crucial role in enhancing these processes and achieving sustainable development goals (SDGs). Therefore, exploring the factors that link digital technologies and CSCs is essential. This study identifies and analyzes the critical success factors (CSFs) associated with integrating digital technologies in CSCs. The study utilized a grey Decision-Making Trial and Evaluation Laboratory (DEMATEL) to identify and analyze CSFs. The initial set of CSFs was derived from existing literature and further refined based on expert opinions. The findings from the study reflect that the top five CSFs for linking digital technologies and CSCs were identified as the organizational commitment toward digitization, adoption of modern technologies, support from top administration toward digitization, adoption of contemporary business models, and data-driven modernization toward CSCs. The study also revealed that out of the 24 identified CSFs, 11 were associated with the "causal group" while the remaining 13 were associated with the "effect group." The integration of digital technologies in CSCs has been found to significantly enhance organizational effectiveness. However, there is a paucity of studies analyzing CSFs for linking digital technologies and CSCs. This study fills this research gap and contributes to the frame of knowledge in the domain of CSCs.

KEYWORDS
circular supply chains, critical success factors, digital technologies, digitalization, grey DEMATEL

1 | INTRODUCTION

Businesses face the challenge of dealing with significant growth in consumer waste, which has necessitated a redesign of production and distribution systems to incorporate sustainable practices and benefit society. One such practice involves the recovery of used products, with the aim of proper disposal or recycling (Dwivedi & Madaan, 2020). This process, known as product recovery, has become an essential operational and manufacturing strategy for many organizations. Therefore, supply chains that address the reverse flow of products and their

Abbreviations: AHP, analytic hierarchy process; AI, artificial intelligence; AIDC, automated identification and data capture; CE, circular economy; CFCS, Converting Fuzzy Data into Crisp Scores; CLSCs, closed loop supply chains; CSCs, circular supply chains; CSFs, critical success factors; DEMATEL, Decision Making Trial and Evaluation Laboratory; FCM, fuzzy cognitive maps; I4.0, Industry 4.0; ICTs, information and communication technologies; IoT, Internet of Things; ISM, interpretive structure model; MCDM, multicriteria decision making; PRS, product recovery system; PSS, product service systems; RSCs, reverse supply chains; SCOR, Supply Chain Operation Reference; SDGs, sustainable development goals; SEM, structure equation modelling.

forward flow have started holding a position of utmost importance. Known as circular supply chains (CSCs), it comprises a model where the products returned by customers undergo the necessary operations like repairing, recycling, and even remanufacturing, before being thrust back to the forward supply chain for reuse by the customers (Batista et al., 2018; Genovese et al., 2017). Therefore, CSCs can lead to zero waste, ensuring sustainable production and environmental sustainability (Amir et al., 2023; Dolatabad et al., 2022; Farooque et al., 2019). CSCs, therefore, are concerned with improving the supply chain's operational effectiveness by collaborating with each other, primarily through recovering the value from waste and end-of-life products (Farooque et al., 2022; Weetman, 2016).

CSCs consist of a combination of green, sustainable, reverse supply chains (RSCs) andclosed-loop supply chains (CLSCs) (Farooque et al., 2019), offering a comprehensive solution to achieve sustainability goals. CSCs are forward and RSCs that work collaboratively to create value from products and enhance an organization's triple bottom line sustainability (Farooque et al., 2019; Batista et al., 2018). Such supply chains comply with legal regulations and help organizations increase their revenue by recycling used products and/or parts (Dwivedi, Agrawal, et al., 2023). Therefore, CSCs are a critical aspect of sustainable development for organizations as they help maintain the maximum value incorporated into a product (Kazancoglu et al., 2022).

CSCs require significant effort in logistics and inventory management, quality control, and the design of customized recovery strategies (Zhang et al., 2021). In this context, adopting digitalization and innovative technologies can largely help track the movement of products and integrating information and digital technologies can lead to a digitalized CSC (Dwivedi & Paul, 2022). Bigliardi et al. (2022), in their study on supply chain digitalization, observed that digitalization can make an essential contribution to the successful implementation and operational effectiveness of CSC. Digitalization's advantages range from improving the availability and quality of information, effective inventory management, and optimizing logistics to improving supply chain resilience (Bigliardi et al., 2022). The gain in productivity and efficiency achieved through digitalization can further serve as an important component for the efficiency of CSC (Burmaoglu et al., 2023).

Employing digital competencies, such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT), can result in positive changes in an organization and its CSCs (Akter et al., 2022). Digitalization can also aid in managing and sharing information, enhancing communication and collaboration among the organization and its supply chain (Chen et al., 2022; Sarkis et al., 2020). Technology integration can largely facilitate CSCs by providing valuable information on the product's status during the return process (Abideen et al., 2021). The digitalization of CSCs adopting advanced technologies also improves their performance by streamlining information collection, integration, and sharing (Agrawal et al., 2021), facilitating sustainable production.

The effectiveness of digitalization on CSC is dependent on a plethora of important determinants. Known as critical success factors (CSFs), these can be stated as important elements towards the success of a process or technology (Gupta et al., 2018). Identifying and analyzing CSFs are crucial to understanding the significance of digitalization in CSCs and building resilience within the organization and its supply chain. Having a clear idea regarding CSFs can further aid policymakers and managers in making more informed decisions regarding operations and implementations of CSC, primarily through focusing on the critical CSFs. However, despite the vast literature available, CSFs for linking digital technologies and CSCs in manufacturing organizations are yet to be explored. Therefore, armed to fill the void in the extant literature, this study attempts to respond to the subsequent two concatenate research questions (RQs).

RQ1: What CSFs link digital technologies and CSCs in manufacturing organizations operating in a developing economy?

RQ2: What are the practical implications of cause-effect groups of CSFs to enhance supply chain sustainability?

This study intends to make three significant contributions to the literature on digitalization and CSCs. *Firstly*, the study proposes a set of CSFs that link digital technologies and CSCs in manufacturing organizations within the context of a developing economy, specifically India. *Secondly*, the study utilizes qualitative expert opinions and quantitative grey DEMATEL to analyze the identified CSFs empirically. *Finally*, based on the above two contributions, the study provides practical suggestions and recommendations for managers and practitioners to enhance the performance of their CSCs. While this research focuses on the manufacturing sector of a developing country, the authors believe that the identified CSFs can be applied to any manufacturing or service supply chain, including those in developed countries.

The remaining sections of the study are as follows. Section 2 reflects the literature related to the digitalization of supply chains and CSCs. The research methodology is provided in Section 3. Section 4 reflects the research analysis. Discussion and implications are provided in Section 5. Finally, the conclusion and limitations are provided in Section 6.

2 | LITERATURE REVIEW

In this study, the literature review is structured in two phases. In the first phase, studies related to the digitalization of supply chains are examined. In the second phase, studies focused specifically on the digitalizing CSCs are presented. Based on the analysis of the literature, research gaps are identified.

2.1 | Digitalization of supply chains

Digitalization has recently emerged as a crucial component of an organization's competitive strategy. It can be integrated throughout the product lifecycle, including the product recovery phase (Ilgin et al., 2015; Xin & Ojanen, 2017). Furthermore, digitalization can enable businesses to enhance the efficiency of their operations while ensuring quality and consistency (Parviainen et al., 2017). This is particularly

important in the context of product returns, where monitoring the process at each stage is essential for ensuring successful outcomes (Nakashima et al., 2002).

In recent years, organizations have come to recognize the pivotal role played by technology and digitalization in the product recovery process. This has led to the increasing use of digitalization and technologies such as the IoT, Blockchain, and big data analytics to better track products at various stages of their recovery journey. Organizations can significantly enhance the product recovery process by effectively integrating technology with decision-making, thereby playing a crucial role in improving their operational effectiveness (Madaan et al., 2012). The use of new technologies in the product recovery system (PRS) can enable the collection, sharing, and integration of information among the various partners in an organization's supply chain, leading to better decision-making (Dwivedi & Madaan, 2020).

One of the early studies on the role of digitalization on CLSC was conducted by Parlikad et al. (2009), who discussed the role of automated identification and data capture (AIDC) technologies in the success of product recovery. Ren et al. (2009) also emphasized the role of digitalization and the use of technologies like radio frequency identification and barcodes in the success of a PRS. Fang et al. (2016) and Haddud et al. (2017) determined that IoT can be a key facilitator of the PRS process. Digitalization and the importance of technologies in the success of PRS have also been studied by Dwivedi et al. (2020), who discussed the issues facing information-facilitated PRS for a circular economy (CE). Nandi et al. (2021) studied supply chains adopting blockchain and CE approaches. The results from the study provided insights and implications at multiple levels to various stakeholders and organizations. Dwivedi and Madaan (2020) modeled the KPIs of a digitalized and information-facilitated PRS.

Further work on the digitalization of PRS was also done by Dwivedi, Agrawal, et al. (2023); Dwivedi, Madaan, et al. (2023), who explored the contribution of digitalization and technologies in the efficiency and cost optimization of PRS. However, the adoption of digital technologies plays a pivotal role in optimizing CSCs by providing data-driven insights, improving transparency, and enabling efficient recovery processes.

2.2 | Studies on digitalizing CSCs

Digitization is considered an essential constituent in CSCs' development with the evolution of the Industry 4.0 (I4.0) paradigm. The increased acceptance of digital technologies has resulted in the efficient exercise of circular practices and responsible production and consumption. Khan et al. (2022) performed a study to analyze the impact of technological innovation on CE practices. The results from the study suggest that technological innovation is positively related to CE practices and advances in economic and environmental

TABLE 1 Recent studies related to digitalizing CSCs.

References	Scopes of the study	Methodology	Key findings
Khan et al. (2022)	They analyzed the impact of technological innovation on circular economy practices.	Structural equation modeling (SEM)	The results from the study suggest technological innovation is positively related to circular economy practices.
Romagnoli et al. (2023)	They examined how an organization can improve the performance of circular supply chains (CSCs) by employing sustainable practices and digital technologies.	Empirical analysis	The results from the study indicate green suppliers and ad hoc environmental regulations, along with the source of raw materials, can popularize CSCs.
Cherrafi et al. (2022)	They assessed the impact of COVID-19 on supply chains. The study further suggests strategies to cater to various impacts of the pandemic.	Case study	The findings from the study commit to evaluating the sustainability and resilience-specific challenges caused by the COVID-19 pandemic.
Chaouni Benabdellah et al. (2021)	They developed a circular digital supply chain operations reference (SCOR) model that illustrated the effect of digitalization on circular practices.	Design for X	The findings from the study provide managerial implications for practitioners and managers towards improving sustainability and resilience in supply chains.
Pagoropoulos et al. (2017)	They endeavored to recognize the contribution of digital transformation to CE.	Systematic literature review	The study reflects the contributions of digitization in the field of Product Service-Systems (PSS).
Awan et al. (2022)	They contributed to designing the value chain for a CE.	Literature review	The outcome of the study helps to understand the potential of value chains and emerging business models in the era of globalization.
Oyinlola et al. (2022)	They evaluated the plastic value chains and the importance of digital innovations contributing to the circular plastic economy.	Case study	The results from the study reflect the practices of various digital innovation entrepreneurs, including technology solutions.
Liu et al. (2022)	They recognized potential functions of digital technologies that are related to CE strategies.	Systematic literature review	The study provides a structured framework for managers to investigate the digital functions of their CE strategies.

Abbreviations: CE, circular economy; COVID-19, coronavirus disease 2019;

performance. Also, Romagnoli et al. (2023) suggested measures to enhance the performance of organizations by employing digitization and sustainable practices. The findings from the study reveal that green suppliers and ad hoc environmental regulations can contribute to promoting CSCs. A study to analyze the challenges to the supply chain in the wake of COVID-19 was presented by (Cherrafi et al., 2022). The findings from the study reflect sustainability and resilience-specific challenges to COVID-19. Further, Awan et al. (2022) analyzed reviews to highlight studies specific to I4.0 and CE based on a value chain scenario. A summary of recent literature specific to digital technologies and CSCs is represented in Table 1.

Previous studies broadly discussed the impact of digital technologies in CE, performance improvement through digitization, and challenges related to sustainability and resilience during the pandemic. To the best of the authors' knowledge, the success factors of the digitalization of CSCs in improving resilience have not been discussed, and this study tries to shed light on this issue.

3 | RESEARCH METHODOLOGY

The research methodology is segregated into three sub-sections. The first sub-section details the identified CSFs for linking digital technologies and CSCs. The second sub-section highlights a discussion on data collection and questionnaire development. The third sub-section presents the method to analyze cause-and-effect interactions among the identified CSFs.

3.1 | Identification of CSFs for linking digital technologies and CSCs

CSFs are a set of activities/operations that an organization needs to initiate to become successful and gain a competitive advantage (Freund, 1988). Thus, CSFs denote the operational areas that need special attention to guarantee a high organizational performance (Boynton & Zmud, 1984). The importance of CSFs in the success of an operational process has been highlighted in previous studies. While Giusti et al. (2019) discussed CSFs of synchromodal logistics, Khan et al. (2018) recognized and analyzed CSFs pertaining to traceability in supply chain management. Some other studies included investigating CSFs for improving supply chain quality (Chau et al., 2021), implementation of blockchain for CSC management (Huang et al., 2022), and CSFs towards supply chain sustainability (Kumar et al., 2021; Luthra et al., 2018; Yadav & Singh, 2020). However, to the best of the authors' knowledge, the extant literature still has a dearth of analyzing CSFs associated with digital technologies and CSCs.

As a part of the study, the authors decided to identify a set of CSFs to link digital technologies and CSCs. CSFs were identified through an in-depth review of the extant literature and discussions with experts in the field. This two-step methodology identified a final set of 24 CSFs associated with digital technologies and CSCs. Table 2 provides the identified CSFs.

3.2 | Data collection and questionnaire development

The data was collected from industry, education, and government personnel. A total of nine experts were selected. Among them, three experts belonged to academia, three were associated with the manufacturing industry, and three were Government personnel. All the identified experts had more than 9 years of experience and were from India. The details of the experts are provided in the Appendix section (Table A1). A questionnaire was designed to represent CSFs associated with the digitalization of CSCs, and the experts were required to comment on the relevance of each CSF. Further, the experts were requested to score CSFs adopting the linguistic scale highlighted in Table 3.

3.3 | Analyzing cause-and-effect interactions among the identified CSFs

The current study used grey DEMATEL to analyze cause-and-effect interactions among the identified CSFs. The grey DEMATEL approach established the causal interactions between the identified CSFs. In addition to determining the relative importance of the identified attributes, this approach also helps determine their cause-effect relationships and the most influential factors (Gupta & Barua, 2018). As grey DEMATEL traces its roots to the grey theory, it can cope with vague data and systems lacking the requisite information (Si et al., 2018). The foundation of this approach lies in the grey set theory (Deng, 1982), which has been observed to be an effective technique in dealing with uncertainties, incomplete information, and discrete data (Liu et al., 2011). While DEMATEL aids in developing and examining a structural model comprising of a causal interaction among a set of identified attributes, grey DEMATEL can generate results from a limited amount, often not concrete data (Bai & Sarkis, 2013). The authors chose grey DEMATEL because of its two-fold advantages over other commonly used techniques. Firstly, the two-way relationship depicted by DEMATEL puts it on a higher pedestal than other methods like ISM and FCM (Bai & Sarkis, 2013; de Campos et al., 2021). Secondly, unlike AHP, which exhibits a unidirectional relationship, DEMATEL provides a bi-directional relationship among the identified attributes, making it more robust (de Campos et al., 2021). Finally, as grey DEMATEL has been observed to be used in situations involving significant uncertainties about expert responses concerning relationships among the factors (de Campos et al., 2021), the authors decided to use grey DEMATEL as the preferred technique for analyzing the identified CSFs.

One of the early studies using the existing approach for CSFs was conducted by (Bai & Sarkis, 2013) to evaluate business process management (BPM). Other studies that have used grey DEMATEL to evaluate CSFs included the implementation of drones in the logistic sector (Raj & Sah, 2019), assessing the sustainability initiatives in supply chains (Luthra et al., 2018), and the development of medical devices (Kirkire & Rane, 2017). Recent studies using grey DEMATEL to

TABLE 2 CSFs for linking digital technologies and CSCs.

Code	CSFs	Brief explanation	References
CSF1	Adequate and effective exchange of information	Effective and efficient information/knowledge sharing across various components and networks is crucial for circular supply chains.	Wijewickrama et al. (2021); Khan et al. (2018)
CSF2	Dedicated IT infrastructure	A robust and dedicated IT infrastructure is the key to the success of digital technologies and digitalization. Less than efficient IT infrastructure can significantly impair the process of linking digital technologies and CSCs.	García-Sánchez et al. (2018); Beh et al. (2016)
CSF3	Employment of convenient technology for traceability	The technology that needs to be adopted should be convenient to use and traceable.	Hajipour et al. (2019); Kim and Woo (2016)
CSF4	Coordination and participation among the CSC partners	Effective coordination and participation among the various CSC partners would significantly aid in linking digital technologies to design and implement CSCs.	Heydari et al. (2017); Govindan and Popiuc (2014)
CSF5	Support from top administration toward digitization	Since the design and implementation of CSCs require significant financial and non-financial resources, support from top management is essential to its success.	Seepma et al. (2020); Giusti et al. (2019)
CSF6	Government support toward digitization	Support and incentives from the government and other legal and regulatory bodies toward digitalization for adopting and practicing CSC can be vital to its success.	Wehrle et al. (2022); Kumar et al. (2021); Ozkan-Ozen et al. (2020)
CSF7	Physical infrastructure toward technology adoption	The organization's robust and efficient physical infrastructure, which strives to adopt the digitization of CSCs, can be an essential factor.	Garrido-Hidalgo et al. (2019); Sundram et al. (2018)
CSF8	Legal and political framework	Adopting and implementing digitization towards CSCs is guided by a set of legal and regulatory principles the organization needs to address. Adhering to these legal and political frameworks helps in its success.	Giusti et al. (2019); Islam and Huda (2018)
CSF9	Effective data synthesis and synchronization	Since digitization involves analyzing and interpreting a large quantity of data, effective synthesis, and interpretation of the same can pave the way toward successfully digitalizing CSCs.	Plaza-Úbeda et al. (2020); Haddud et al. (2017)
CSF10	Trust development in supply chain members	Effection design and performance of CSCs involve a large number of actors and entities. Thus, trust among the various supply chain actors is essential to its success.	Mokhtar et al. (2019); Chen et al. (2011)
CSF11	Adoption of modern technologies	The latest state-of-the-art technologies are required to digitalize CSCs successfully. Thus, organizations need to adopt cutting-edge technologies to ensure the success of digitalizing CSCs.	Experts' suggestion
CSF12	Development of efficient recovery chain strategies	An effective strategy for recovering from supply chain disruption is essential to business operations. This is also true for CSCs, where developing efficient recovery strategies can aid in building the resiliency and robustness of the CSC.	Experts' suggestion
CSF13	Organizational commitment toward digitization	Commitment and support of the organizations and their policymakers toward digitization is vital to its success. A half-hazard approach can lead to a less-than-effective design of CSCs and improper use of digital technologies.	Kazancoglu et al. (2021); Sarkis et al. (2020); Srai and Lorentz (2019).
CSF14	Data-driven modernization toward CSCs	Data-driven digital supply chains can contribute to circular practices in the modern world.	Experts' suggestion
CSF15	Employee knowledge toward digitization practices	To ensure a smooth adoption and implementation of digitization, the employee must have the necessary knowledge regarding the process and its benefits.	Kazancoglu et al. (2021); Seyedghorban et al. (2020)
CSF16	Trust among members in recovery linkages	Mutual trust among the supply chain members is vital to its success. Thus, the members who work in harmony for successful recovery linkage need to bestow trust and confidence on each other.	Experts' suggestion
CSF17	Data security and privacy across recovery networks	Since supply chains often deal with sensitive consumer and organizational data, it is imperative to maintain data security and privacy across recovery networks.	Deepu and Ravi (2021); Cheung et al. (2021)

TABLE 2 (Continued)

Code	CSFs	Brief explanation	References
CSF18	Availability of funds and financial investment	Implementing digitization is vital to the success of CSC. However, digitization often involves complex and advanced technologies that require significant financial investment. Therefore, the availability of financial resources on the part of the organization is a vital ingredient towards successfully linking digital technologies and CSCs.	Experts' suggestion
CSF19	Waste reduction and enhanced cost-effectiveness	The reduction of waste, which leads to environmental benefits, is key to the success of CSCs. Thus, the digital technologies to enhance CSCs and recovery networks should be implemented in such a way that they lead to effective waste management and are cost-effective.	Luthra et al. (2020); Islam and Huda (2018)
CSF20	Adoption of contemporary business models	Organizations need to adopt contemporary business models as a part of their circular strategy.	Luthra et al. (2020); Mangla et al. (2018)
CSF21	Planning sustainable solutions for technology disruptions	Catering toward the factors of technology disruptions and planning sustainable solutions is important for overall sustainable development.	Gupta and Singh (2024); Hosseini-Motlagh et al. (2019)
CSF22	Employee willingness to implement technologies for CSCs	Implementing new technologies towards digitization requires additional (and specialized) training for the employees. Thus, willingness to adopt the new technologies and processes of the part of the employees will serve as a critical success factor.	Michaud and Llerena (2011); Moretto and Caniato (2021); Münch et al. (2022)
CSF23	Corporate social responsibility through digital technologies	In the contemporary world, attaining corporate social responsibility through digital innovation is essential.	Experts' suggestion
CSF24	Employing digital technologies for considerate dynamic consumer perception towards CSCs	Digital technologies can aid in improving consumer's perception of CSCs and their sustainable advantages.	Ivanov et al. (2019); Manavalan and Jayakrishna (2019).

Abbreviations: CSCs, circular supply chains; CSFs, critical success factors; IT, information technology.

TABLE 3 Linguistic scale considered for the analysis.

Linguistic terms	Grey numbers
No influence (No)	[0, 0]
Very low influence (VL)	[0, 25]
Low influence (L)	[0.25, 0.5]
High influence (H)	[0.5, 0.75]
Very high influence (VH)	[0.75, 1]

analyze CSFs include green strategic sourcing (Mubarik et al., 2021), sustainable manufacturer-supplier collaboration (Govindan et al., 2021), and factors affecting investment behavior (Ritika & Kishor, 2023). However, the existing approach has not been used to evaluate CSFs associated with linking digital technologies and CSCs. Hence, this study intends to shed light on this issue and, in the process, contribute to advancing the literature.

The rest of this section is devoted to the steps involved in the grey DEMATEL analysis in the context of the identified CSFs.

Step 1: Arrange a linguistic scale for examination.

The linguistic scale for the grey number (Cui et al., 2019) is reflected in Table 3.

Step 2: Develop the initial matrix.

In this step, each expert was requested to provide their scores for the relationship among CSFs, adopting a grey linguistic scale as reflected in Table A2 of the Appendix. Thus, if there are K experts, there will be K number of initial matrices. Further, the data gathered in the linguistic form is transformed into a grey number.

Let, $\otimes p_{ij}^{k}$ *is the* grey number, then it is defined as,

$$\otimes p_{ij}^{k} = \left(\underline{\otimes} p_{ij}^{k}, \overline{\otimes} p_{ij}^{k}\right) \tag{1}$$

where n is equal to the number of factors, K is equal to the number of experts, and $1 \leqslant k \leqslant K$, $\underline{\otimes} p_{ij}^{k}, \overline{\otimes} p_{ij}^{k}$ highlight lower and upper limits for the grey number, respectively, for Kth expert. The individual direct-influence grey matrix is highlighted in Table A3 of the Appendix.

$$\tilde{Z}_k = \left[\otimes p_{ij}^{k}\right]_{n \times n} \tag{2}$$

Step 3: Average direct relation matrix.

Further, the data received from the matrices were amalgamated using the aggregation method based on the grey system theory that adopted Equation (3).

$$\otimes\tilde{p}_{ij} = \left(\frac{\sum_k \underline{\otimes} p_{ij}^k}{K}, \frac{\sum_k \overline{\otimes} p_{ij}^k}{K}\right) \quad (3)$$

The group direct-influence grey matrix is presented in Table A4 of the Appendix.

$$\tilde{Z} = \left[\otimes\tilde{p}_{ij}\right]_{n\times n} \quad (4)$$

Step 4: Develop a normalized direct relation grey matrix.

The normalized direct-influence grey matrix X was obtained using Equation (12), and data are represented in Table A5 of the Appendix.

$$\tilde{X} = \frac{1}{r} * \tilde{Z} \quad (5)$$

where,

$$r = \max_{1\le i\le n}\left(\sum_{j=1}^{n} \otimes\tilde{p}_{ij}\right) \quad (6)$$

Step 5: Development of grey total relation matrix

$$\tilde{T} = \tilde{X}\left(I - \tilde{X}\right)^{-1}, \quad (7)$$

where I is the identity matrix and $\tilde{X}$ is the normalized direct-influence matrix. The grey total relation matrix $\tilde{T}$ is highlighted in Table A6 of the Appendix.

Step 6: Develop a crisp total relation matrix.

Further, crisp values were attained by employing the modified "Converting fuzzy data into Crisp Scores (CFCS)" approach suggested by Opricovic and Tzeng (2003) and enhanced by Dou and Sarkis (2013).

The stepwise process of the modified CFCS method for grey numbers is labeled as follows:

i. Converting into a crisp number

$$\underline{\otimes}\dot{p}_{ij} = \left(\underline{\otimes}\tilde{p}_{ij} - \min_j \underline{\otimes}\tilde{p}_{ij}\right) / \Delta_{min}^{max} \quad (8)$$

$$\overline{\otimes}\dot{p}_{ij} = \left(\overline{\otimes}\tilde{p}_{ij} - \min_j \overline{\otimes}\tilde{p}_{ij}\right) / \Delta_{min}^{max} \quad (9)$$

$$\text{where } \Delta_{min}^{max} = \max_j \overline{\otimes} p_{ij} - \min_j \overline{\otimes} p_{ij} \quad (10)$$

ii. Obtain the total normalized crisp values

$$p_{ij} = \left(\frac{\left(\underline{\otimes}\dot{p}_{ij}\left(1 - \underline{\otimes}\dot{p}_{ij}\right)\right) + \left(\overline{\otimes}\dot{p}_{ij} \times \overline{\otimes}\dot{p}_{ij}\right)}{\left(1 - \underline{\otimes}\dot{p}_{ij} + \overline{\otimes}\dot{p}_{ij}\right)}\right) \quad (11)$$

iii. Obtain the crisp values

$$p_{ij}^{*} = \left(\min_j \underline{\otimes}\tilde{p}_{ij} + \left(p_{ij} \times \Delta_{min}^{max}\right)\right) \quad (12)$$

The crisp total relation matrix was achieved as reflected in Equation (13) below.

$$\mathrm{T} = \left[\tilde{p}_{ij}^{*}\right] \quad (13)$$

Step 7: Computation of prominence and influence values.

In the crisp total relation matrix, the sum of rows (D) and columns (R) are obtained as follows:

$$T = \left[t_{ij}\right]_{n\times n}, i,j = 1,2,\ldots\ldots,\mathrm{n} \quad (14)$$

$$D = \left[\sum_{j=1}^{n} t_{ij}\right]_{n\times 1} = \left[t_i\right]_{\mathrm{n}\times 1} \quad (15)$$

$$R = \left[\sum_{i=1}^{n} t_{ij}\right]_{1\times \mathrm{n}} = \left[t_j\right]_{1\times n} \quad (16)$$

Later, D and R values were added and subtracted to obtain the values of prominence ($D + R$) and influence ($D - R$).

Step 8: Develop a cause-effect diagram.

In this step, the cause-and-effect figure for CSFs is developed and discussed.

4 | RESULT ANALYSIS

The study evaluates the interactions among various factors in a complicated environment, prioritizes them for effective decision-making, and highlights copes for improvement. The ($D + R$) scores of CSFs are employed to determine the relative orders of CSFs toward linking digital technologies and CSCs. The findings from the study highlight the ranked order of CSFs, as presented in Table 4, along with whether they were a part of the cause/effect category. The prioritized order of the identified CSFs is as follows: CSF13 > CSF11 > CSF5 > CSF20 > CSF14 > CSF4 > CSF12 > CSF2 > CSF1 > CSF9 > CSF18 > CSF3 > CSF7 > CSF21 > CSF15 > CSF17 > CSF24 > CSF6 > CSF23 > CSF19 > CSF22 > CSF10 > CSF8 > CSF16.

The causal category CSFs can impact other extant CSFs. The ranking of the causal category is specified based on the positive value of ($D - R$) scores. The findings of the cause category CSFs are presented as follows: CSF19 > CSF22 > CSF21 > CSF12 > CSF4 > CSF16 > CSF3 > CSF24 > CSF7 > CSF17 > CSF23. Other extant CSFs can impact the effect category CSFs. Effect category CSFs are ranked based on the negative value of ($D - R$) scores. The findings of

TABLE 4 Scores, ranking and interactions for CSFs.

Code	CSFs	D	R	D + R	D-R	Rank	Cause/Effect
CSF1	Adequate and effective exchange of information	4.4312	4.4484	8.8797	−0.0172	9	***Effect***
CSF2	Dedicated IT infrastructure	4.4460	4.4853	8.9314	−0.0393	8	***Effect***
CSF3	Employment of convenient technology for traceability	4.3605	4.2460	8.6065	0.1145	12	***Cause***
CSF4	Coordination and participation among the CSC partners	4.6299	4.4008	9.0307	0.2291	6	***Cause***
CSF5	Support from top administration toward digitization	4.3061	5.1957	9.5017	−0.8896	3	***Effect***
CSF6	Government support toward digitization	4.0256	4.3038	8.3293	−0.2782	18	***Effect***
CSF7	Physical infrastructure toward technology adoption	4.3463	4.2495	8.5958	0.0968	13	***Cause***
CSF8	Legal and political framework	3.6854	4.1257	7.8111	−0.4403	23	***Effect***
CSF9	Effective data synthesis and synchronization	4.2532	4.5947	8.8479	−0.3415	10	***Effect***
CSF10	Trust development in supply chain members	3.7608	4.0831	7.8439	−0.3223	22	***Effect***
CSF11	Adoption of modern technologies	4.6152	4.9122	9.5274	−0.2970	2	***Effect***
CSF12	Development of efficient recovery chain strategies	4.6702	4.2744	8.9446	0.3958	7	***Cause***
CSF13	Organizational commitment toward digitization	4.7694	4.9513	9.7207	−0.1818	1	***Effect***
CSF14	Data-driven modernization toward CSCs	4.5769	4.6052	9.1822	−0.0283	5	***Effect***
CSF15	Employee knowledge toward digitization practices	4.1783	4.3334	8.5117	−0.1552	15	***Effect***
CSF16	Trust among members in recovery linkages	3.9403	3.8257	7.7660	0.1146	24	***Cause***
CSF17	Data security and privacy across recovery networks	4.2835	4.1929	8.4764	0.0906	16	***Cause***
CSF18	Availability of funds and financial investment	4.1740	4.5590	8.7330	−0.3850	11	***Effect***
CSF19	Waste reduction and enhanced cost-effectiveness	4.4801	3.5153	7.9954	0.9648	20	***Cause***
CSF20	Adoption of contemporary business models	4.5013	4.6980	9.1993	−0.1967	4	***Effect***
CSF21	Planning sustainable solutions for technology disruptions	4.5610	4.0288	8.5897	0.5322	14	***Cause***
CSF22	Employee willingness to implement technologies for CSCs	4.3890	3.4955	7.8845	0.8935	21	***Cause***
CSF23	Corporate social responsibility through digital technologies	4.1021	4.0624	8.1645	0.0396	19	***Cause***
CSF24	Employing digital technologies for considerate dynamic consumer perception towards CSCs	4.2168	4.1160	8.3328	0.1008	17	***Cause***

Abbreviations: CSCs, circular supply chains; CSFs, critical success factors; IT, information technology.

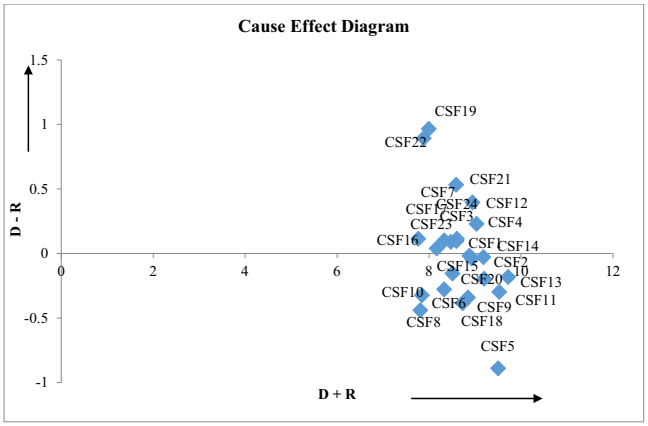


FIGURE 1 Cause-effect diagram for CSFs. CSFs, critical success factors.

the effect category CSFs are presented as follows: CSF1 > CSF14 > CSF2 > CSF15 > CSF13 > CSF20 > CSF6 > CSF11 > CSF10 > CSF9- > CSF18 > CSF8 > CSF5 (see Figure 1).

Further, sensitivity analysis is accomplished to investigate the robustness of the method. It also aids in analyzing the effect of adopting different discrepancies of expert groups. Sensitivity analysis is undertaken to analyze the consistency in the destined diverse weights to experts to evaluate uniformity in decision structure (Garg, 2021). It has been executed by autonomously giving significant weights for specialists 1–4, considering other weights constant. Primarily, an examination is conducted on the collected data from all the experts and is reflected in scenario 1. Next, calculations are performed for different groups of experts, namely, experts specific to Academia (Scenario 2), experts specific to Government (Scenario 3), and experts related to Industry (Scenario 4). The results obtained from sensitivity analysis based on the $D + R$ score are highlighted in Table 5.

The results obtained from sensitivity analysis based on rank are highlighted in Table 6.

Additionally, the ranking for different experts is presented in Figure 2. The CSF "Adoption of modern technologies (CSF11)" is ranked first for Scenarios 2 and 3, and "Adoption of contemporary business models (CSF20)" is ranked seventh for Scenario 2 and Scenario 3. The other CSFs indicate a modest change in their rankings

TABLE 5 Sensitivity analysis based on $D + R$ scores.

	D + R score			
Factors/scenario	Scenario 1 (aggregated)	Scenario 2 (academic expert)	Scenario 3 (government expert)	Scenario 4 (industry expert)
CSF1	8.8797	8.037936	6.842545	7.936247
CSF2	8.9314	7.514971	6.418091	9.148438
CSF3	8.6065	8.438374	7.063837	6.475418
CSF4	9.0307	8.132963	6.487294	8.682242
CSF5	9.5017	7.981132	7.180051	9.226156
CSF6	8.3293	6.999171	6.32122	8.241677
CSF7	8.5958	7.332181	6.426147	8.461271
CSF8	7.8111	7.142963	5.414381	7.773944
CSF9	8.8479	7.346429	6.841945	8.467329
CSF10	7.8439	5.673581	6.05432	8.719205
CSF11	9.5274	8.582072	7.60628	8.13011
CSF12	8.9446	8.044251	7.09666	7.711815
CSF13	9.7207	8.076187	7.516052	9.39297
CSF14	9.1822	7.20591	7.388407	9.012813
CSF15	8.5117	7.481817	5.884926	8.697105
CSF16	7.766	6.12646	5.454409	8.677178
CSF17	8.4764	7.331371	6.522192	8.048791
CSF18	8.733	7.380101	6.426224	8.805452
CSF19	7.9954	7.295349	6.177165	7.119841
CSF20	9.1993	8.029655	6.993949	8.678951
CSF21	8.5897	7.343275	6.388083	8.456029
CSF22	7.8845	6.89745	5.740719	7.826562
CSF23	8.1645	6.901688	5.811751	8.510341
CSF24	8.3328	7.601293	6.303744	7.679943

Abbreviation: CSF, critical success factor.

for different scenarios. This analysis highlights that the results attained for the study are robust and are not affected by a specific number of experts.

5 | DISCUSSIONS AND PRACTICAL IMPLICATIONS

The findings from the study reflect that "organizational commitment toward digitization (CSF13)" emerged as the most essential CSF towards attaining digitalization in CSCs. The theoretical knowledge of digital perception in organizations is in the inception stage. Organizations continuously revamp themselves through digital technological innovations like information and communication technologies (ICTs) (Bharadwaj et al., 2013). Therefore, this has become necessary to gain a competitive advantage (Grover et al., 2022; Kiron et al., 2016). "Adoption of modern technologies (CSF11)" emerged as the next essential CSF for attaining digitalization in CSCs. In developed economies, there are regulations, advanced infrastructure, and technical knowledge to implement digitalization infrastructure in organizations. However, emerging economies still struggle to recognize, examine, and adopt modern technologies to reduce carbon content and gain monetary benefits (Mangla et al., 2018). A smart infrastructure and modern technologies are required to strengthen various recovery practices in CSCs (Su et al., 2013).

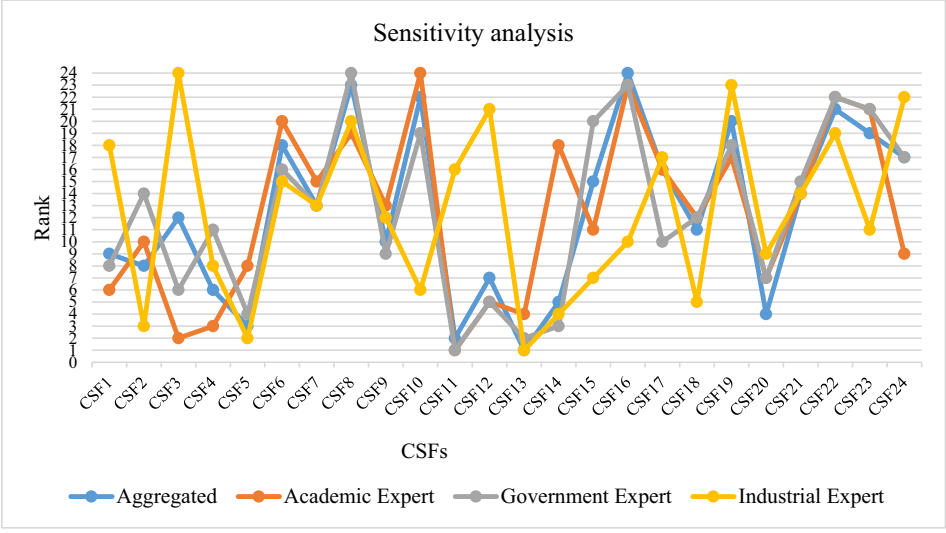
The third important CSF towards linking digital technologies and CSCs is "Support from top administration toward digitization (CSF5)." Digitalization is high on the agenda at the top administration level of various organizations (Bienhaus & Haddud, 2018). Thus, the top administration needs support to accommodate organizational modifications toward digitalization in CSC practices. "Adoption of contemporary business models (CSF20)" was ranked the fourth essential CSF toward digitalization in CSCs. Digitalization and contemporary business models are constructed with the power of the organization's advancement (Laamanen et al., 2018). With the advancements in digital technologies, organizations must develop and adopt various digital exercises in their business models (Tallman et al., 2018). Further, organizations can adopt digital technologies to enhance their processes within their recovery chains and implement them to develop contemporary business models (Bouncken et al., 2021).

TABLE 6 Sensitivity analysis based on ranks.

	Rank			
Factors/scenario	Scenario 1 (aggregated)	Scenario 2 (academic expert)	Scenario 3 (government expert)	Scenario 4 (industry expert)
CSF1	9	6	8	18
CSF2	8	10	14	3
CSF3	12	2	6	24
CSF4	6	3	11	8
CSF5	3	8	4	2
CSF6	18	20	16	15
CSF7	13	15	13	13
CSF8	23	19	24	20
CSF9	10	13	9	12
CSF10	22	24	19	6
CSF11	2	1	1	16
CSF12	7	5	5	21
CSF13	1	4	2	1
CSF14	5	18	3	4
CSF15	15	11	20	7
CSF16	24	23	23	10
CSF17	16	16	10	17
CSF18	11	12	12	5
CSF19	20	17	18	23
CSF20	4	7	7	9
CSF21	14	14	15	14
CSF22	21	22	22	19
CSF23	19	21	21	11
CSF24	17	9	17	22

Abbreviation: CSF, critical success factor.

FIGURE 2 Sensitivity analysis for ranking.



The next important CSF influencing digitalization in CSCs is "Data-driven modernization toward CSCs (CSF14)." Data-driven modernization can be an efficient facilitator toward the progress of circular practices. As digitalization involves adopting emergent information systems, there are concerns about whether digitalization can benefit the environment rather than strain it (Sarkis et al., 2020).

"Coordination and participation among the CSC partners (CSF4)" is examined as an imperative CSF towards linking digital technologies and CSCs. There is a requirement for efficient coordination and participation among recovery chain partners to facilitate digitalization in CSCs. To maintain perceptibility, digitization facilitates vertical integration from suppliers to customers and horizontal integration between other business partners along the recovery chain (Kayikci, 2018).

The next essential CSF towards attaining digitalization in CSCs is "Development of efficient recovery chain strategies (CSF12)" and "Dedicated IT infrastructure (CSF2)." Adopting ICTs into the recovery chain enhances process-oriented performance, decreases energy consumption, and provides a dedicated IT infrastructure for digitalization in CSCs (Garrido-Hidalgo et al., 2019). The next important CSF identified in the study is "Adequate and effective exchange of information (CSF1)." Information sharing is considered one of the essential components of supply chain integration and assists in enhancing the efficiency of supply chain practices (Nakandala et al., 2017). Adequate and effective exchange of information sharing among different stages of the recovery chain is essential to enhance the performance of CSCs (Olorunniwo & Li, 2010). Adopting digital technology can be seen as one of the solutions that can promote information sharing among different stages of the recovery chain. "Effective data synthesis and synchronization (CSF9)" is contemplated as another essential CSF for attaining digitalization in CSCs.

The next important CSF highlighted in the study is "Availability of funds and financial investment (CSF18)." Funds and investments are required to initiate digital practices in an organization. In emerging economies, organizations are reluctant to initiate digital practices as they are not confident with the results of adopting such practices. Therefore, organizations need to be aware of the advantages of digitalization in the long run, motivating them to make financial investments. The next important CSF for linking digital technology and CSCs is "Employment of convenient technology for traceability (CSF3)." Organizations must share detailed information to enhance the traceability of the reverse flow of products. Sharing information among the supply chain organizations results in a lack of trust (Behnke & Janssen, 2020), and blockchain can be a convenient technology to generate trust among organizations.

"Physical infrastructure toward technology adoption (CSF7)" is another essential CSF for attaining digitalization in CSCs. An information infrastructure based on ICTs is required to manage the RSC (Garrido-Hidalgo et al., 2019). Adding ICTs to the recovery chain can enhance the performance of the process and assist in minimizing energy consumption (Gubbi et al., 2013). In the present study, "Planning sustainable solutions for technology disruptions (CSF21)" occupies the fourteenth position. In CSCs, there are supply disruptions of used products and disruptions in demand for recycled products (Ali et al., 2018). To attain a digitalized CSC, sustainable solutions are required to cater to such disruptions related to the recovery chain.

"Employee knowledge toward digitization practices (CSF15)" is ranked as another essential CSF promoting digitalization in CSCs. In digitization, the main challenge is identifying the problem to be solved while adopting ICTs across different levels of organizations (Erol et al., 2016). The transition of organizations toward digitalization depends upon their effort to address investments in specific technologies and adoption attempts toward digitalization (Zangiacomi et al., 2020). This transition towards digitalization can be attained if employees have adequate knowledge of digitization practices. Thus, "Data security and privacy across recovery networks (CSF17)" is ranked sixteenth. As organizations depend on information, there is a requirement for special consideration of data security challenges from the recovery chain perspective (Ani et al., 2017). Integrating ICTs in CSCs improves data security across the recovery network. Therefore, it becomes imperative to construct a protected security architecture to prevent customer privacy violations and safeguard controlled access (Ogbuke et al., 2022).

The CSF "Employing digital technologies for considerate dynamic consumer perception towards CSCs (CSF24)" is ranked seventeenth. Digital technology can be seen as an efficient approach toward increasing productivity and sharing information among different stages of the recovery chain (Hrouga et al., 2022). Therefore, digitalization in CSCs is required to collect and treat hazardous waste efficiently. The CSF "Government support toward digitization (CSF6)" is ranked 18th that links digital technologies and CSCs. With the increase in the adoption of digital technology and information sharing in supply chains, there are possibilities of risks, such as data security and vulnerabilities (Aamer et al., 2023). This requires government support for digitization to cater to such difficulties.

CSFs such as "Corporate social responsibility through digital technologies (CSF23)," "Waste reduction and enhanced cost-effectiveness (CSF19)," "Employee willingness to implement technologies for CSCs (CSF22)," "Trust development in supply chain members (CSF10)," "Legal and political framework (CSF8)," and "Trust among members in recovery linkages (CSF16)" are ranked nineteenth, twentieth, twenty-first, twenty-second, twenty-third, and twenty-fourth, respectively. Industry managers and policymakers can find the results helpful in formulating a digitized CSC system.

6 | CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH DIRECTIONS

The primary objective of the current study is to recognize and evaluate a set of CSFs associated with linking digital technologies and CSCs. The study provided a comprehensive list of CSFs, which can be expected to serve as an important roadmap for academicians and practitioners in CSCs. Additionally, the study evaluated the interrelationship between the identified CSFs and determined cause-effect groups of CSFs. The relative criticality and relationships among the identified CSFs can significantly aid policymakers in constructing more informed decisions regarding resource allocation and risk minimization. This can translate to an improved operational process, subsequently gaining a competitive advantage in the market.

The study was conducted in the context of India, a developing economy. A growing consciousness has recently been associated with

product waste and environmental damage in developing countries. The review of extant literature indicated that although a plethora of studies were conducted on CSCs and CSFs, the current study attempts to combine these two concepts, especially in the context of a developing economy. This adds to the study's novelty, advancing the knowledge body in CSCs. Additionally, the exploratory study contributes to the literature using the MCDM technique of grey DEMATEL to arrive at potential research and practical implications.

The current study identified 24 potential CSFs associated with digitalization in CSCs by reviewing the literature and discussing them with experts. To perceive the significance and linkages of the obtained CSFs, an MCDM approach—the grey DEMATEL—is implemented. The basic advantage of DEMATEL lies in its ability to handle interdependencies within a set of criteria efficiently. The analysis revealed that organizational commitment towards digitization, adoption of modern technologies, support from top administration towards digitization, adoption of contemporary business models, and data-driven modernization towards product recovery formed the five most important CSFs towards linking digital technologies and CSCs. Further, the analysis shows that out of the 24 identified CSFs, 11 are associated with the cause group, and 13 CSFs are associated with the effect group.

The study's findings can also help decision-makers by providing a list of potential CSFs that will facilitate the digitalization of CSCs. Awareness regarding these CSFs, coupled with their relative criticality and interrelationship, can significantly aid decision-makers in designing appropriate strategies for operational effectiveness.

The current study has some limitations. The two important limitations of the current study were the number of experts surveyed and the geographical region. The data for this study is collected from nine experts associated with industry, academia, and government originating from an emerging economy, India. Expanding the study to other geographical locations worldwide can help establish generalizability and increase this study's external validity. Furthermore, increasing the number of experts can also help improve the external validity and reliability of the study. Another possible limitation of the study pertains to the use of grey-based scales, which, as suggested by Bai and Sarkis (2020), might provide more continuous results in outcomes, thereby making the ranges for normalized, average outcomes more arbitrary in nature. Thus, conforming to the results of the current study by using other quantitative techniques can also help attest to the study's validity.

Furthermore, future research can be directed toward the context of a developed country and with a more significant number of experts. Consistency in the results obtained would strengthen the generalizability of the current study, along with establishing its external validity and robustness. Additionally, a compare-contrast study of a similar nature can be conducted for developed vis-à-vis emerging economies to determine the difference in the relationship, if any, between CSFs in such economies.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ORCID

Ashish Dwivedi https://orcid.org/0000-0003-2943-0066
Anirban Ganguly https://orcid.org/0000-0002-9131-1060
Sanjoy Kumar Paul https://orcid.org/0000-0001-9523-179X

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APPENDIX A

TABLE A1 Experts' profile.

Expert number	Domain	Experience
Expert 1	Academia	More than 10 years
Expert 2	Academia	More than 15 years
Expert 3	Academia	More than 12 years
Expert 4	Manufacturing industry	More than 10 years
Expert 5	Manufacturing industry	More than 12 years
Expert 6	Manufacturing industry	More than 15 years
Expert 7	Government personnel	More than 14 years
Expert 8	Government personnel	More than 10 years
Expert 9	Government personnel	More than 12 years

TABLE A2 Individual direct-influence grey matrix.

Code	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12
CSF1		L	L	VH	H	H	L	L	H	VH	H	H
CSF2	L		H	H	L	L	H	L	VH	No	VH	H
CSF3	H	H		H	H	L	VH	L	VH	No	H	H
CSF4	VH	H	H		H	VL	L	L	H	VH	H	H
CSF5	VH	H	No	No		L	L	H	No	No	H	H
CSF6	H	No	No	No	H		H	VH	L	No	H	No
CSF7	No	H	H	H	VH	VL		No	L	No	H	L
CSF8	VL	No	No	L	H	H	L		L	No	L	L
CSF9	H	H	L	No	L	VL	H	No		H	H	L
CSF10	VH	No	No	H	L	L	No	L	H		No	H
CSF11	L	L	H	H	VH	H	H	L	H	L		H
CSF12	VH	H	H	H	H	L	L	L	H	H	H	
CSF13	H	H	L	H	VH	H	L	H	L	H	H	H
CSF14	H	H	H	H	H	L	VL	L	H	No	VH	No
CSF15	VH	No	No	L	L	L	No	No	L	L	H	H
CSF16	VH	No	No	H	L	VL	L	L	H	VH	No	L
CSF17	H	L	No	VH	H	H	L	H	VH	No	H	No
CSF18	No	No	H	No	VH	H	H	L	H	No	H	H
CSF19	No	L	No	H	H	VH	L	H	VH	No	H	H
CSF20	H	L	H	H	VH	L	L	VL	H	L	H	VH
CSF21	H	L	H	H	VH	L	H	L	H	No	H	H
CSF22	H	H	H	L	H	No	L	No	H	H	H	L
CSF23	No	No	No	No	H	VH	No	H	No	No	L	No
CSF24	L	L	H	H	H	L	L	H	VH	H	H	H

Abbreviation: CSF, critical success factor.

TABLE A2 (Continued)

Code	CSF13	CSF14	CSF15	CSF16	CSF17	CSF18	CSF19	CSF20	CSF21	CSF22	CSF23	CSF24
CSF1	H	L	VH	VH	H	No	No	H	L	No	L	L
CSF2	VH	H	L	L	VH	VH	No	H	No	H	L	L
CSF3	H	H	H	H	H	VH	VL	H	No	L	VL	H
CSF4	H	L	H	H	H	H	H	No	No	H	No	H
CSF5	VH	L	L	VL	H	VH	L	L	L	No	H	L
CSF6	H	No	No	No	VH	H	L	H	No	No	H	No
CSF7	H	L	No	No	H	H	L	H	L	VL	No	L
CSF8	H	No	No	No	H	H	L	L	H	No	L	No
CSF9	H	H	L	H	VH	H	L	H	No	No	L	L
CSF10	No	No	L	VH	L	No	No	L	H	L	No	H
CSF11	H	VH	H	No	H	H	H	VH	H	L	L	H
CSF12	H	H	H	No	VL	L	VH	H	H	H	No	L
CSF13		H	H	No	VH	VH	H	H	H	VL	H	L
CSF14	H		H	No	H	H	H	H	No	H	No	L
CSF15	No	L		No	L	No	L	H	H	H	No	L
CSF16	L	L	No		H	No	No	H	VL	H	No	L
CSF17	H	H	L	L		No	No	H	No	VL	No	H
CSF18	VH	H	No	No	L		VL	H	L	No	VH	H
CSF19	H	H	L	No	L	H		H	H	No	L	L
CSF20	H	H	H	L	L	H	L		H	H	H	L
CSF21	H	L	H	No	L	H	No	H		L	H	L
CSF22	H	VL	H	H	L	No	No	H	L		No	L
CSF23	VH	L	No	No	No	VH	VH	H	H	L		No
CSF24	H	VL	L	No	VL	No	L	H	L	H	No	

Abbreviation: CSF, critical success factor.

TABLE A3 Group direct-influence grey matrix.

Code	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12	CSF13
CSF1	(0, 0)	(0.456, 0.667)	(0.478, 0.722)	(0.578, 0.711)	(0.489, 0.7)	(0.267, 0.5)	(0.267, 0.489)	(0.578, 0.767)	(0.389, 0.589)	(0.467, 0.689)	(0.489, 0.7)	(0.389, 0.589)	(0.356, 0.589)
CSF2	(0.411, 0.578)	(0, 0)	(0.533, 0.8)	(0.367, 0.6)	(0.4, 0.667)	(0.378, 0.622)	(0.289, 0.5)	(0.122, 0.344)	(0.356, 0.567)	(0.456, 0.622)	(0.378, 0.556)	(0.422, 0.656)	(0.556, 0.767)
CSF3	(0.344, 0.544)	(0.3, 0.511)	(0, 0)	(0.422, 0.611)	(0.567, 0.811)	(0.289, 0.478)	(0.456, 0.667)	(0.211, 0.433)	(0.511, 0.678)	(0.189, 0.333)	(0.456, 0.678)	(0.322, 0.556)	(0.333, 0.533)
CSF4	(0.589, 0.733)	(0.4, 0.678)	(0.556, 0.778)	(0, 0)	(0.567, 0.811)	(0.2, 0.411)	(0.2, 0.456)	(0.3, 0.567)	(0.344, 0.6)	(0.589, 0.8)	(0.322, 0.556)	(0.344, 0.556)	(0.489, 0.689)
CSF5	(0.444, 0.644)	(0.444, 0.656)	(0.356, 0.589)	(0.133, 0.322)	(0, 0)	(0.378, 0.622)	(0.422, 0.656)	(0.467, 0.7)	(0.356, 0.511)	(0.322, 0.5)	(0.533, 0.678)	(0.456, 0.689)	(0.422, 0.656)
CSF6	(0.289, 0.489)	(0.378, 0.567)	(0.356, 0.578)	(0.222, 0.4)	(0.378, 0.633)	(0, 0)	(0.489, 0.767)	(0.4, 0.556)	(0.344, 0.6)	(0.278, 0.467)	(0.611, 0.844)	(0.311, 0.478)	(0.289, 0.489)
CSF7	(0.189, 0.378)	(0.378, 0.678)	(0.422, 0.667)	(0.422, 0.611)	(0.578, 0.767)	(0.367, 0.533)	(0, 0)	(0.178, 0.367)	(0.322, 0.5)	(0.411, 0.578)	(0.589, 0.8)	(0.278, 0.511)	(0.567, 0.811)
CSF8	(0.078, 0.256)	(0.544, 0.689)	(0.167, 0.389)	(0.356, 0.578)	(0.367, 0.611)	(0.367, 0.6)	(0.278, 0.511)	(0, 0)	(0.478, 0.722)	(0.344, 0.556)	(0.267, 0.489)	(0.367, 0.589)	(0.533, 0.744)
CSF9	(0.5, 0.722)	(0.6, 0.822)	(0.389, 0.644)	(0.267, 0.433)	(0.444, 0.644)	(0.267, 0.5)	(0.478, 0.678)	(0.144, 0.289)	(0, 0)	(0.356, 0.578)	(0.556, 0.778)	(0.278, 0.511)	(0.511, 0.756)
CSF10	(0.456, 0.611)	(0.333, 0.533)	(0.311, 0.478)	(0.578, 0.833)	(0.478, 0.667)	(0.222, 0.456)	(0.544, 0.7)	(0.222, 0.456)	(0.422, 0.667)	(0, 0)	(0.211, 0.433)	(0.411, 0.633)	(0.289, 0.433)
CSF11	(0.333, 0.578)	(0.389, 0.589)	(0.411, 0.633)	(0.389, 0.656)	(0.556, 0.778)	(0.578, 0.844)	(0.489, 0.756)	(0.344, 0.544)	(0.378, 0.633)	(0.356, 0.622)	(0, 0)	(0.367, 0.6)	(0.344, 0.556)
CSF12	(0.389, 0.578)	(0.567, 0.744)	(0.411, 0.633)	(0.356, 0.578)	(0.3, 0.567)	(0.344, 0.6)	(0.256, 0.467)	(0.311, 0.533)	(0.556, 0.789)	(0.433, 0.689)	(0.444, 0.656)	(0, 0)	(0.644, 0.856)
CSF13	(0.533, 0.733)	(0.467, 0.7)	(0.289, 0.478)	(0.578, 0.833)	(0.667, 0.844)	(0.567, 0.756)	(0.289, 0.478)	(0.411, 0.644)	(0.267, 0.489)	(0.422, 0.678)	(0.378, 0.622)	(0.5, 0.711)	(0, 0)
CSF14	(0.678, 0.878)	(0.478, 0.733)	(0.367, 0.6)	(0.433, 0.689)	(0.4, 0.678)	(0.2, 0.456)	(0.444, 0.644)	(0.267, 0.489)	(0.378, 0.578)	(0.311, 0.478)	(0.6, 0.756)	(0.4, 0.611)	(0.389, 0.656)
CSF15	(0.422, 0.6)	(0.378, 0.567)	(0.4, 0.556)	(0.278, 0.511)	(0.289, 0.533)	(0.422, 0.656)	(0.289, 0.489)	(0.422, 0.611)	(0.256, 0.522)	(0.311, 0.522)	(0.467, 0.711)	(0.356, 0.578)	(0.444, 0.6)

TABLE A3 (Continued)

Code	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12	CSF13
CSF16	(0.489, 0.689)	(0.167, 0.344)	(0.356, 0.578)	(0.356, 0.578)	(0.333, 0.578)	(0.256, 0.467)	(0.378, 0.622)	(0.411, 0.689)	(0.3, 0.522)	(0.544, 0.689)	(0.244, 0.456)	(0.167, 0.433)	(0.556, 0.778)
CSF17	(0.489, 0.689)	(0.233, 0.467)	(0.367, 0.544)	(0.7, 0.856)	(0.456, 0.689)	(0.467, 0.7)	(0.244, 0.5)	(0.344, 0.556)	(0.567, 0.744)	(0.222, 0.4)	(0.289, 0.544)	(0.256, 0.478)	(0.422, 0.611)
CSF18	(0.322, 0.444)	(0.311, 0.533)	(0.344, 0.6)	(0.4, 0.556)	(0.589, 0.733)	(0.222, 0.456)	(0.4, 0.667)	(0.333, 0.578)	(0.244, 0.5)	(0.367, 0.544)	(0.5, 0.778)	(0.4, 0.678)	(0.667, 0.833)
CSF19	(0.344, 0.556)	(0.3, 0.5)	(0.156, 0.311)	(0.556, 0.789)	(0.333, 0.533)	(0.633, 0.833)	(0.278, 0.567)	(0.5, 0.722)	(0.489, 0.678)	(0.4, 0.556)	(0.4, 0.622)	(0.489, 0.7)	(0.311, 0.544)
CSF20	(0.578, 0.778)	(0.422, 0.667)	(0.278, 0.522)	(0.267, 0.5)	(0.622, 0.8)	(0.311, 0.522)	(0.256, 0.467)	(0.444, 0.656)	(0.6, 0.833)	(0.256, 0.411)	(0.4, 0.622)	(0.356, 0.567)	(0.389, 0.6)
CSF21	(0.433, 0.644)	(0.278, 0.511)	(0.211, 0.433)	(0.444, 0.711)	(0.456, 0.622)	(0.467, 0.7)	(0.667, 0.922)	(0.411, 0.644)	(0.356, 0.589)	(0.4, 0.556)	(0.278, 0.522)	(0.522, 0.767)	(0.511, 0.744)
CSF22	(0.311, 0.533)	(0.4, 0.622)	(0.378, 0.567)	(0.356, 0.567)	(0.289, 0.544)	(0.367, 0.544)	(0.367, 0.533)	(0.6, 0.767)	(0.544, 0.767)	(0.344, 0.556)	(0.411, 0.644)	(0.178, 0.411)	(0.5, 0.722)
CSF23	(0.278, 0.467)	(0.267, 0.489)	(0.367, 0.544)	(0.167, 0.389)	(0.367, 0.6)	(0.578, 0.767)	(0.3, 0.5)	(0.456, 0.689)	(0.367, 0.544)	(0.356, 0.511)	(0.367, 0.589)	(0.333, 0.522)	(0.289, 0.433)
CSF24	(0.367, 0.589)	(0.389, 0.644)	(0.522, 0.778)	(0.289, 0.489)	(0.322, 0.567)	(0.411, 0.578)	(0.233, 0.478)	(0.433, 0.633)	(0.4, 0.611)	(0.422, 0.667)	(0.556, 0.789)	(0.444, 0.711)	(0.256, 0.478)

Abbreviation: CSF, critical success factor.

TABLE A3 (Continued)

Code	CSF14	CSF15	CSF16	CSF17	CSF18	CSF19	CSF20	CSF21	CSF22	CSF23	CSF24
CSF1	(0.278, 0.511)	(0.522, 0.711)	(0.389, 0.589)	(0.367, 0.6)	(0.267, 0.444)	(0.244, 0.456)	(0.322, 0.567)	(0.344, 0.6)	(0.289, 0.489)	(0.433, 0.678)	(0, 0)
CSF2	(0.378, 0.622)	(0.344, 0.544)	(0.322, 0.611)	(0.378, 0.611)	(0.567, 0.744)	(0.144, 0.344)	(0.556, 0.778)	(0.467, 0.633)	(0.344, 0.556)	(0.256, 0.522)	(0.411, 0.578)
CSF3	(0.478, 0.733)	(0.456, 0.689)	(0.378, 0.578)	(0.356, 0.578)	(0.589, 0.789)	(0.222, 0.456)	(0.433, 0.633)	(0.344, 0.544)	(0.333, 0.578)	(0.433, 0.633)	(0.344, 0.544)
CSF4	(0.467, 0.7)	(0.578, 0.778)	(0.289, 0.5)	(0.522, 0.767)	(0.489, 0.7)	(0.422, 0.656)	(0.156, 0.367)	(0.278, 0.522)	(0.4, 0.611)	(0.267, 0.489)	(0.589, 0.733)
CSF5	(0.511, 0.733)	(0.311, 0.522)	(0.311, 0.544)	(0.444, 0.656)	(0.433, 0.633)	(0.133, 0.367)	(0.344, 0.6)	(0.344, 0.589)	(0.244, 0.389)	(0.422, 0.667)	(0.444, 0.644)
CSF6	(0.4, 0.556)	(0.256, 0.411)	(0.178, 0.367)	(0.511, 0.678)	(0.344, 0.611)	(0.289, 0.533)	(0.522, 0.767)	(0.244, 0.389)	(0.267, 0.433)	(0.633, 0.833)	(0.289, 0.489)
CSF7	(0.422, 0.6)	(0.289, 0.489)	(0.356, 0.578)	(0.333, 0.589)	(0.478, 0.733)	(0.433, 0.678)	(0.256, 0.478)	(0.378, 0.611)	(0.144, 0.344)	(0.389, 0.589)	(0.189, 0.378)

TABLE A3 (Continued)

Code	CSF14	CSF15	CSF16	CSF17	CSF18	CSF19	CSF20	CSF21	CSF22	CSF23	CSF24
CSF8	(0.333, 0.533)	(0.333, 0.522)	(0.344, 0.5)	(0.278, 0.522)	(0.433, 0.644)	(0.111, 0.322)	(0.378, 0.622)	(0.356, 0.578)	(0.189, 0.333)	(0.3, 0.567)	(0.078, 0.256)
CSF9	(0.3, 0.511)	(0.444, 0.7)	(0.422, 0.667)	(0.467, 0.633)	(0.389, 0.6)	(0.233, 0.422)	(0.411, 0.644)	(0.222, 0.4)	(0.156, 0.322)	(0.244, 0.5)	(0.5, 0.722)
CSF10	(0.178, 0.367)	(0.222, 0.456)	(0.344, 0.544)	(0.4, 0.611)	(0.3, 0.456)	(0.233, 0.422)	(0.322, 0.556)	(0.422, 0.667)	(0.111, 0.322)	(0.311, 0.544)	(0.456, 0.611)
CSF11	(0.467, 0.644)	(0.289, 0.489)	(0.456, 0.622)	(0.322, 0.567)	(0.467, 0.656)	(0.478, 0.733)	(0.567, 0.8)	(0.411, 0.644)	(0.1, 0.3)	(0.278, 0.511)	(0.333, 0.578)
CSF12	(0.667, 0.856)	(0.444, 0.711)	(0.289, 0.489)	(0.411, 0.633)	(0.411, 0.633)	(0.433, 0.622)	(0.344, 0.567)	(0.278, 0.511)	(0.456, 0.678)	(0.222, 0.456)	(0.389, 0.578)
CSF13	(0.378, 0.633)	(0.511, 0.756)	(0.244, 0.444)	(0.456, 0.667)	(0.5, 0.656)	(0.267, 0.5)	(0.411, 0.589)	(0.389, 0.656)	(0.333, 0.522)	(0.322, 0.567)	(0.533, 0.733)
CSF14	(0, 0)	(0.456, 0.678)	(0.256, 0.422)	(0.422, 0.667)	(0.322, 0.567)	(0.489, 0.756)	(0.333, 0.533)	(0.1, 0.3)	(0.467, 0.711)	(0.322, 0.5)	(0.678, 0.878)
CSF15	(0.456, 0.744)	(0, 0)	(0.467, 0.644)	(0.222, 0.444)	(0.344, 0.556)	(0.267, 0.489)	(0.533, 0.789)	(0.467, 0.7)	(0.478, 0.678)	(0.144, 0.344)	(0.422, 0.6)
CSF16	(0.389, 0.589)	(0.289, 0.489)	(0, 0)	(0.344, 0.6)	(0.189, 0.389)	(0.3, 0.456)	(0.5, 0.733)	(0.367, 0.6)	(0.356, 0.578)	(0.333, 0.533)	(0.489, 0.689)
CSF17	(0.4, 0.611)	(0.4, 0.6)	(0.433, 0.689)	(0, 0)	(0.378, 0.567)	(0.178, 0.367)	(0.433, 0.689)	(0.2, 0.411)	(0.389, 0.589)	(0.311, 0.478)	(0.489, 0.689)
CSF18	(0.411, 0.589)	(0.189, 0.333)	(0.367, 0.544)	(0.289, 0.544)	(0, 0)	(0.311, 0.533)	(0.333, 0.533)	(0.322, 0.556)	(0.267, 0.433)	(0.433, 0.633)	(0.322, 0.444)
CSF19	(0.544, 0.767)	(0.444, 0.656)	(0.5, 0.667)	(0.489, 0.678)	(0.5, 0.722)	(0, 0)	(0.367, 0.611)	(0.356, 0.578)	(0.067, 0.233)	(0.244, 0.444)	(0.344, 0.556)
CSF20	(0.433, 0.633)	(0.411, 0.644)	(0.344, 0.544)	(0.222, 0.456)	(0.567, 0.822)	(0.289, 0.533)	(0, 0)	(0.456, 0.622)	(0.411, 0.589)	(0.544, 0.7)	(0.578, 0.778)
CSF21	(0.322, 0.567)	(0.433, 0.578)	(0.244, 0.389)	(0.278, 0.522)	(0.322, 0.511)	(0.467, 0.644)	(0.344, 0.556)	(0, 0)	(0.378, 0.622)	(0.511, 0.756)	(0.433, 0.644)
CSF22	(0.456, 0.667)	(0.533, 0.733)	(0.3, 0.511)	(0.189, 0.433)	(0.244, 0.444)	(0.311, 0.489)	(0.489, 0.7)	(0.411, 0.633)	(0, 0)	(0.378, 0.567)	(0.311, 0.533)
CSF23	(0.311, 0.533)	(0.367, 0.533)	(0.433, 0.622)	(0.356, 0.511)	(0.556, 0.722)	(0.344, 0.544)	(0.367, 0.6)	(0.467, 0.7)	(0.589, 0.789)	(0, 0)	(0.278, 0.467)
CSF24	(0.289, 0.489)	(0.356, 0.567)	(0.233, 0.422)	(0.167, 0.389)	(0.267, 0.389)	(0.356, 0.567)	(0.511, 0.756)	(0.367, 0.589)	(0.422, 0.678)	(0.389, 0.533)	(0.367, 0.589)

Abbreviation: CSF, critical success factor.

TABLE A4 Normalized direct-influence grey matrix.

Code	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12	CSF13
CSF1	(0, 0)	(0.03, 0.043)	(0.031, 0.047)	(0.038, 0.046)	(0.032, 0.046)	(0.017, 0.033)	(0.017, 0.032)	(0.038, 0.05)	(0.025, 0.038)	(0.03, 0.045)	(0.032, 0.046)	(0.025, 0.038)	(0.023, 0.038)
CSF2	(0.027, 0.038)	(0, 0)	(0.035, 0.052)	(0.024, 0.039)	(0.026, 0.043)	(0.025, 0.04)	(0.019, 0.033)	(0.008, 0.022)	(0.023, 0.037)	(0.03, 0.04)	(0.025, 0.036)	(0.027, 0.043)	(0.036, 0.05)
CSF3	(0.022, 0.035)	(0.02, 0.033)	(0, 0)	(0.027, 0.04)	(0.037, 0.053)	(0.019, 0.031)	(0.03, 0.043)	(0.014, 0.028)	(0.033, 0.044)	(0.012, 0.022)	(0.03, 0.044)	(0.021, 0.036)	(0.022, 0.035)
CSF4	(0.038, 0.048)	(0.026, 0.044)	(0.036, 0.051)	(0, 0)	(0.037, 0.053)	(0.013, 0.027)	(0.013, 0.03)	(0.02, 0.037)	(0.022, 0.039)	(0.038, 0.052)	(0.021, 0.036)	(0.022, 0.036)	(0.032, 0.045)
CSF5	(0.029, 0.042)	(0.029, 0.043)	(0.023, 0.038)	(0.009, 0.021)	(0, 0)	(0.025, 0.04)	(0.027, 0.043)	(0.03, 0.046)	(0.023, 0.033)	(0.021, 0.033)	(0.035, 0.044)	(0.03, 0.045)	(0.027, 0.043)
CSF6	(0.019, 0.032)	(0.025, 0.037)	(0.023, 0.038)	(0.014, 0.026)	(0.025, 0.041)	(0, 0)	(0.032, 0.05)	(0.026, 0.036)	(0.022, 0.039)	(0.018, 0.03)	(0.04, 0.055)	(0.02, 0.031)	(0.019, 0.032)
CSF7	(0.012, 0.025)	(0.025, 0.044)	(0.027, 0.043)	(0.027, 0.04)	(0.038, 0.05)	(0.024, 0.035)	(0, 0)	(0.012, 0.024)	(0.021, 0.033)	(0.027, 0.038)	(0.038, 0.052)	(0.018, 0.033)	(0.037, 0.053)
CSF8	(0.005, 0.017)	(0.035, 0.045)	(0.011, 0.025)	(0.023, 0.038)	(0.024, 0.04)	(0.024, 0.039)	(0.018, 0.033)	(0, 0)	(0.031, 0.047)	(0.022, 0.036)	(0.017, 0.032)	(0.024, 0.038)	(0.035, 0.048)
CSF9	(0.033, 0.047)	(0.039, 0.053)	(0.025, 0.042)	(0.017, 0.028)	(0.029, 0.042)	(0.017, 0.033)	(0.031, 0.044)	(0.009, 0.019)	(0, 0)	(0.023, 0.038)	(0.036, 0.051)	(0.018, 0.033)	(0.033, 0.049)
CSF10	(0.03, 0.04)	(0.022, 0.035)	(0.02, 0.031)	(0.038, 0.054)	(0.031, 0.043)	(0.014, 0.03)	(0.035, 0.046)	(0.014, 0.03)	(0.027, 0.043)	(0, 0)	(0.014, 0.028)	(0.027, 0.041)	(0.019, 0.028)
CSF11	(0.022, 0.038)	(0.025, 0.038)	(0.027, 0.041)	(0.025, 0.043)	(0.036, 0.051)	(0.038, 0.055)	(0.032, 0.049)	(0.022, 0.035)	(0.025, 0.041)	(0.023, 0.04)	(0, 0)	(0.024, 0.039)	(0.022, 0.036)
CSF12	(0.025, 0.038)	(0.037, 0.048)	(0.027, 0.041)	(0.023, 0.038)	(0.02, 0.037)	(0.022, 0.039)	(0.017, 0.03)	(0.02, 0.035)	(0.036, 0.051)	(0.028, 0.045)	(0.029, 0.043)	(0, 0)	(0.042, 0.056)
CSF13	(0.035, 0.048)	(0.03, 0.046)	(0.019, 0.031)	(0.038, 0.054)	(0.043, 0.055)	(0.037, 0.049)	(0.019, 0.031)	(0.027, 0.042)	(0.017, 0.032)	(0.027, 0.044)	(0.025, 0.04)	(0.033, 0.046)	(0, 0)
CSF14	(0.044, 0.057)	(0.031, 0.048)	(0.024, 0.039)	(0.028, 0.045)	(0.026, 0.044)	(0.013, 0.03)	(0.029, 0.042)	(0.017, 0.032)	(0.025, 0.038)	(0.02, 0.031)	(0.039, 0.049)	(0.026, 0.04)	(0.025, 0.043)
CSF15	(0.027, 0.039)	(0.025, 0.037)	(0.026, 0.036)	(0.018, 0.033)	(0.019, 0.035)	(0.027, 0.043)	(0.019, 0.032)	(0.027, 0.04)	(0.017, 0.034)	(0.02, 0.034)	(0.03, 0.046)	(0.023, 0.038)	(0.029, 0.039)
CSF16	(0.032, 0.045)	(0.011, 0.022)	(0.023, 0.038)	(0.023, 0.038)	(0.022, 0.038)	(0.017, 0.03)	(0.025, 0.04)	(0.027, 0.045)	(0.02, 0.034)	(0.035, 0.045)	(0.016, 0.03)	(0.011, 0.028)	(0.036, 0.051)

TABLE A4 (Continued)

Code	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12	CSF13
CSF17	(0.032, 0.045)	(0.015, 0.03)	(0.024, 0.035)	(0.046, 0.056)	(0.03, 0.045)	(0.03, 0.046)	(0.016, 0.033)	(0.022, 0.036)	(0.037, 0.048)	(0.014, 0.026)	(0.019, 0.035)	(0.017, 0.031)	(0.027, 0.04)
CSF18	(0.021, 0.029)	(0.02, 0.035)	(0.022, 0.039)	(0.026, 0.036)	(0.038, 0.048)	(0.014, 0.03)	(0.026, 0.043)	(0.022, 0.038)	(0.016, 0.033)	(0.024, 0.035)	(0.033, 0.051)	(0.026, 0.044)	(0.043, 0.054)
CSF19	(0.022, 0.036)	(0.02, 0.033)	(0.01, 0.02)	(0.036, 0.051)	(0.022, 0.035)	(0.041, 0.054)	(0.018, 0.037)	(0.033, 0.047)	(0.032, 0.044)	(0.026, 0.036)	(0.026, 0.04)	(0.032, 0.046)	(0.02, 0.035)
CSF20	(0.038, 0.051)	(0.027, 0.043)	(0.018, 0.034)	(0.017, 0.033)	(0.04, 0.052)	(0.02, 0.034)	(0.017, 0.03)	(0.029, 0.043)	(0.039, 0.054)	(0.017, 0.027)	(0.026, 0.04)	(0.023, 0.037)	(0.025, 0.039)
CSF21	(0.028, 0.042)	(0.018, 0.033)	(0.014, 0.028)	(0.029, 0.046)	(0.03, 0.04)	(0.03, 0.046)	(0.043, 0.06)	(0.027, 0.042)	(0.023, 0.038)	(0.026, 0.036)	(0.018, 0.034)	(0.034, 0.05)	(0.033, 0.048)
CSF22	(0.02, 0.035)	(0.026, 0.04)	(0.025, 0.037)	(0.023, 0.037)	(0.019, 0.035)	(0.024, 0.035)	(0.024, 0.035)	(0.039, 0.05)	(0.035, 0.05)	(0.022, 0.036)	(0.027, 0.042)	(0.012, 0.027)	(0.033, 0.047)
CSF23	(0.018, 0.03)	(0.017, 0.032)	(0.024, 0.035)	(0.011, 0.025)	(0.024, 0.039)	(0.038, 0.05)	(0.02, 0.033)	(0.03, 0.045)	(0.024, 0.035)	(0.023, 0.033)	(0.024, 0.038)	(0.022, 0.034)	(0.019, 0.028)
CSF24	(0.024, 0.038)	(0.025, 0.042)	(0.034, 0.051)	(0.019, 0.032)	(0.021, 0.037)	(0.027, 0.038)	(0.015, 0.031)	(0.028, 0.041)	(0.026, 0.04)	(0.027, 0.043)	(0.036, 0.051)	(0.029, 0.046)	(0.017, 0.031)

Abbreviation: CSF, critical success factor.

TABLE A4 (Continued)

Code	CSF14	CSF15	CSF16	CSF17	CSF18	CSF19	CSF20	CSF21	CSF22	CSF23	CSF24
CSF1	(0.018, 0.033)	(0.034, 0.046)	(0.025, 0.038)	(0.024, 0.039)	(0.017, 0.029)	(0.016, 0.03)	(0.021, 0.037)	(0.022, 0.039)	(0.019, 0.032)	(0.028, 0.044)	(0.016, 0.033)
CSF2	(0.025, 0.04)	(0.022, 0.035)	(0.021, 0.04)	(0.025, 0.04)	(0.037, 0.048)	(0.009, 0.022)	(0.036, 0.051)	(0.03, 0.041)	(0.022, 0.036)	(0.017, 0.034)	(0.026, 0.04)
CSF3	(0.031, 0.048)	(0.03, 0.045)	(0.025, 0.038)	(0.023, 0.038)	(0.038, 0.051)	(0.014, 0.03)	(0.028, 0.041)	(0.022, 0.035)	(0.022, 0.038)	(0.028, 0.041)	(0.025, 0.038)
CSF4	(0.03, 0.046)	(0.038, 0.051)	(0.019, 0.033)	(0.034, 0.05)	(0.032, 0.046)	(0.027, 0.043)	(0.01, 0.024)	(0.018, 0.034)	(0.026, 0.04)	(0.017, 0.032)	(0.023, 0.038)
CSF5	(0.033, 0.048)	(0.02, 0.034)	(0.02, 0.035)	(0.029, 0.043)	(0.028, 0.041)	(0.009, 0.024)	(0.022, 0.039)	(0.022, 0.038)	(0.016, 0.025)	(0.027, 0.043)	(0.029, 0.042)
CSF6	(0.026, 0.036)	(0.017, 0.027)	(0.012, 0.024)	(0.033, 0.044)	(0.022, 0.04)	(0.019, 0.035)	(0.034, 0.05)	(0.016, 0.025)	(0.017, 0.028)	(0.041, 0.054)	(0.018, 0.03)
CSF7	(0.027, 0.039)	(0.019, 0.032)	(0.023, 0.038)	(0.022, 0.038)	(0.031, 0.048)	(0.028, 0.044)	(0.017, 0.031)	(0.025, 0.04)	(0.009, 0.022)	(0.025, 0.038)	(0.033, 0.048)
CSF8	(0.022, 0.035)	(0.022, 0.034)	(0.022, 0.033)	(0.018, 0.034)	(0.028, 0.042)	(0.007, 0.021)	(0.025, 0.04)	(0.023, 0.038)	(0.012, 0.022)	(0.02, 0.037)	(0.012, 0.023)
CSF9	(0.02, 0.033)	(0.029, 0.046)	(0.027, 0.043)	(0.03, 0.041)	(0.025, 0.039)	(0.015, 0.027)	(0.027, 0.042)	(0.014, 0.026)	(0.01, 0.021)	(0.016, 0.033)	(0.028, 0.044)

TABLE A4 (Continued)

Code	CSF14	CSF15	CSF16	CSF17	CSF18	CSF19	CSF20	CSF21	CSF22	CSF23	CSF24
CSF10	(0.012, 0.024)	(0.014, 0.03)	(0.022, 0.035)	(0.026, 0.04)	(0.02, 0.03)	(0.015, 0.027)	(0.021, 0.036)	(0.027, 0.043)	(0.007, 0.021)	(0.02, 0.035)	(0.018, 0.034)
CSF11	(0.03, 0.042)	(0.019, 0.032)	(0.03, 0.04)	(0.021, 0.037)	(0.03, 0.043)	(0.031, 0.048)	(0.037, 0.052)	(0.027, 0.042)	(0.007, 0.02)	(0.018, 0.033)	(0.018, 0.034)
CSF12	(0.043, 0.056)	(0.029, 0.046)	(0.019, 0.032)	(0.027, 0.041)	(0.027, 0.041)	(0.028, 0.04)	(0.022, 0.037)	(0.018, 0.033)	(0.03, 0.044)	(0.014, 0.03)	(0.017, 0.032)
CSF13	(0.025, 0.041)	(0.033, 0.049)	(0.016, 0.029)	(0.03, 0.043)	(0.033, 0.043)	(0.017, 0.033)	(0.027, 0.038)	(0.025, 0.043)	(0.022, 0.034)	(0.021, 0.037)	(0.025, 0.038)
CSF14	(0, 0)	(0.03, 0.044)	(0.017, 0.027)	(0.027, 0.043)	(0.021, 0.037)	(0.032, 0.049)	(0.022, 0.035)	(0.007, 0.02)	(0.03, 0.046)	(0.021, 0.033)	(0.035, 0.048)
CSF15	(0.03, 0.048)	(0, 0)	(0.03, 0.042)	(0.014, 0.029)	(0.022, 0.036)	(0.017, 0.032)	(0.035, 0.051)	(0.03, 0.046)	(0.031, 0.044)	(0.009, 0.022)	(0.014, 0.029)
CSF16	(0.025, 0.038)	(0.019, 0.032)	(0, 0)	(0.022, 0.039)	(0.012, 0.025)	(0.02, 0.03)	(0.033, 0.048)	(0.024, 0.039)	(0.023, 0.038)	(0.022, 0.035)	(0.012, 0.028)
CSF17	(0.026, 0.04)	(0.026, 0.039)	(0.028, 0.045)	(0, 0)	(0.025, 0.037)	(0.012, 0.024)	(0.028, 0.045)	(0.013, 0.027)	(0.025, 0.038)	(0.02, 0.031)	(0.031, 0.047)
CSF18	(0.027, 0.038)	(0.012, 0.022)	(0.024, 0.035)	(0.019, 0.035)	(0, 0)	(0.02, 0.035)	(0.022, 0.035)	(0.021, 0.036)	(0.017, 0.028)	(0.028, 0.041)	(0.027, 0.041)
CSF19	(0.035, 0.05)	(0.029, 0.043)	(0.033, 0.043)	(0.032, 0.044)	(0.033, 0.047)	(0, 0)	(0.024, 0.04)	(0.023, 0.038)	(0.004, 0.015)	(0.016, 0.029)	(0.026, 0.043)
CSF20	(0.028, 0.041)	(0.027, 0.042)	(0.022, 0.035)	(0.014, 0.03)	(0.037, 0.053)	(0.019, 0.035)	(0, 0)	(0.03, 0.04)	(0.027, 0.038)	(0.035, 0.046)	(0.017, 0.03)
CSF21	(0.021, 0.037)	(0.028, 0.038)	(0.016, 0.025)	(0.018, 0.034)	(0.021, 0.033)	(0.03, 0.042)	(0.022, 0.036)	(0, 0)	(0.025, 0.04)	(0.033, 0.049)	(0.024, 0.038)
CSF22	(0.03, 0.043)	(0.035, 0.048)	(0.02, 0.033)	(0.012, 0.028)	(0.016, 0.029)	(0.02, 0.032)	(0.032, 0.046)	(0.027, 0.041)	(0, 0)	(0.025, 0.037)	(0.036, 0.05)
CSF23	(0.02, 0.035)	(0.024, 0.035)	(0.028, 0.04)	(0.023, 0.033)	(0.036, 0.047)	(0.022, 0.035)	(0.024, 0.039)	(0.03, 0.046)	(0.038, 0.051)	(0, 0)	(0.02, 0.031)
CSF24	(0.019, 0.032)	(0.023, 0.037)	(0.015, 0.027)	(0.011, 0.025)	(0.017, 0.025)	(0.023, 0.037)	(0.033, 0.049)	(0.024, 0.038)	(0.027, 0.044)	(0.025, 0.035)	(0, 0)

Abbreviation: CSF, critical success factor.

TABLE A5 Grey total relation matrix.

Code	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12	CSF13
CSF1	(0.034, 0.291)	(0.062, 0.337)	(0.061, 0.33)	(0.069, 0.335)	(0.068, 0.369)	(0.048, 0.319)	(0.047, 0.317)	(0.066, 0.327)	(0.058, 0.337)	(0.061, 0.318)	(0.066, 0.356)	(0.055, 0.324)	(0.059, 0.35)
CSF2	(0.061, 0.329)	(0.033, 0.296)	(0.065, 0.336)	(0.056, 0.329)	(0.063, 0.368)	(0.055, 0.327)	(0.049, 0.318)	(0.038, 0.302)	(0.056, 0.336)	(0.06, 0.315)	(0.06, 0.349)	(0.057, 0.329)	(0.072, 0.362)
CSF3	(0.056, 0.322)	(0.052, 0.324)	(0.031, 0.282)	(0.058, 0.325)	(0.073, 0.371)	(0.049, 0.314)	(0.059, 0.324)	(0.044, 0.303)	(0.065, 0.338)	(0.043, 0.293)	(0.065, 0.352)	(0.051, 0.318)	(0.058, 0.344)
CSF4	(0.072, 0.346)	(0.059, 0.347)	(0.067, 0.342)	(0.034, 0.301)	(0.074, 0.386)	(0.045, 0.323)	(0.044, 0.324)	(0.05, 0.324)	(0.056, 0.347)	(0.069, 0.333)	(0.057, 0.358)	(0.054, 0.331)	(0.068, 0.366)
CSF5	(0.061, 0.325)	(0.06, 0.33)	(0.053, 0.316)	(0.041, 0.306)	(0.037, 0.319)	(0.055, 0.321)	(0.057, 0.321)	(0.059, 0.317)	(0.055, 0.326)	(0.051, 0.301)	(0.069, 0.35)	(0.059, 0.324)	(0.063, 0.349)
CSF6	(0.05, 0.303)	(0.054, 0.312)	(0.051, 0.303)	(0.044, 0.297)	(0.059, 0.344)	(0.03, 0.269)	(0.059, 0.315)	(0.053, 0.296)	(0.053, 0.318)	(0.046, 0.286)	(0.072, 0.345)	(0.048, 0.298)	(0.052, 0.324)
CSF7	(0.046, 0.312)	(0.056, 0.333)	(0.057, 0.323)	(0.059, 0.326)	(0.074, 0.369)	(0.054, 0.318)	(0.03, 0.283)	(0.041, 0.299)	(0.053, 0.327)	(0.057, 0.308)	(0.072, 0.359)	(0.048, 0.316)	(0.071, 0.36)
CSF8	(0.034, 0.275)	(0.062, 0.305)	(0.037, 0.278)	(0.049, 0.294)	(0.055, 0.327)	(0.049, 0.293)	(0.043, 0.286)	(0.025, 0.247)	(0.058, 0.311)	(0.048, 0.279)	(0.047, 0.309)	(0.049, 0.292)	(0.065, 0.325)
CSF9	(0.065, 0.328)	(0.069, 0.338)	(0.055, 0.318)	(0.049, 0.311)	(0.065, 0.357)	(0.047, 0.312)	(0.059, 0.32)	(0.038, 0.29)	(0.032, 0.291)	(0.053, 0.304)	(0.069, 0.353)	(0.047, 0.312)	(0.067, 0.352)
CSF10	(0.058, 0.3)	(0.049, 0.299)	(0.047, 0.286)	(0.064, 0.313)	(0.063, 0.334)	(0.041, 0.287)	(0.06, 0.3)	(0.04, 0.279)	(0.055, 0.311)	(0.027, 0.248)	(0.044, 0.309)	(0.052, 0.297)	(0.05, 0.309)
CSF11	(0.056, 0.336)	(0.058, 0.341)	(0.057, 0.333)	(0.058, 0.34)	(0.074, 0.384)	(0.068, 0.349)	(0.062, 0.342)	(0.052, 0.322)	(0.058, 0.348)	(0.054, 0.322)	(0.037, 0.323)	(0.055, 0.333)	(0.059, 0.358)
CSF12	(0.061, 0.338)	(0.07, 0.353)	(0.058, 0.335)	(0.057, 0.338)	(0.059, 0.373)	(0.054, 0.336)	(0.048, 0.326)	(0.051, 0.322)	(0.07, 0.359)	(0.06, 0.328)	(0.065, 0.366)	(0.032, 0.297)	(0.079, 0.378)
CSF13	(0.07, 0.351)	(0.065, 0.353)	(0.052, 0.329)	(0.071, 0.356)	(0.082, 0.393)	(0.069, 0.348)	(0.051, 0.33)	(0.059, 0.333)	(0.053, 0.345)	(0.06, 0.331)	(0.063, 0.367)	(0.065, 0.345)	(0.04, 0.329)
CSF14	(0.077, 0.352)	(0.064, 0.348)	(0.056, 0.33)	(0.061, 0.341)	(0.064, 0.375)	(0.045, 0.323)	(0.059, 0.332)	(0.048, 0.317)	(0.058, 0.343)	(0.052, 0.312)	(0.075, 0.368)	(0.057, 0.332)	(0.062, 0.362)
CSF15	(0.059, 0.318)	(0.055, 0.32)	(0.054, 0.309)	(0.048, 0.312)	(0.054, 0.347)	(0.056, 0.318)	(0.047, 0.306)	(0.055, 0.307)	(0.048, 0.322)	(0.049, 0.298)	(0.063, 0.346)	(0.051, 0.313)	(0.063, 0.34)

TABLE A5 (Continued)

Code	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12	CSF13
CSF16	(0.061, 0.313)	(0.04, 0.296)	(0.05, 0.3)	(0.052, 0.307)	(0.055, 0.338)	(0.044, 0.296)	(0.051, 0.304)	(0.053, 0.302)	(0.049, 0.311)	(0.062, 0.298)	(0.047, 0.319)	(0.038, 0.294)	(0.067, 0.339)
CSF17	(0.065, 0.327)	(0.047, 0.318)	(0.054, 0.313)	(0.075, 0.336)	(0.066, 0.361)	(0.059, 0.324)	(0.045, 0.31)	(0.052, 0.308)	(0.068, 0.339)	(0.045, 0.294)	(0.054, 0.34)	(0.046, 0.31)	(0.062, 0.345)
CSF18	(0.053, 0.307)	(0.051, 0.317)	(0.051, 0.311)	(0.056, 0.314)	(0.073, 0.358)	(0.044, 0.305)	(0.054, 0.316)	(0.05, 0.304)	(0.047, 0.319)	(0.053, 0.299)	(0.066, 0.349)	(0.055, 0.318)	(0.077, 0.353)
CSF19	(0.057, 0.327)	(0.053, 0.328)	(0.042, 0.306)	(0.068, 0.341)	(0.059, 0.36)	(0.071, 0.34)	(0.049, 0.323)	(0.062, 0.325)	(0.065, 0.343)	(0.057, 0.312)	(0.062, 0.354)	(0.062, 0.332)	(0.057, 0.35)
CSF20	(0.071, 0.341)	(0.061, 0.339)	(0.049, 0.32)	(0.05, 0.324)	(0.078, 0.377)	(0.052, 0.323)	(0.048, 0.318)	(0.059, 0.323)	(0.072, 0.353)	(0.048, 0.304)	(0.062, 0.355)	(0.054, 0.325)	(0.063, 0.354)
CSF21	(0.062, 0.336)	(0.052, 0.334)	(0.045, 0.318)	(0.061, 0.341)	(0.067, 0.37)	(0.062, 0.337)	(0.073, 0.348)	(0.057, 0.325)	(0.057, 0.342)	(0.058, 0.316)	(0.055, 0.352)	(0.065, 0.34)	(0.07, 0.366)
CSF22	(0.054, 0.322)	(0.058, 0.332)	(0.055, 0.318)	(0.055, 0.324)	(0.056, 0.356)	(0.055, 0.319)	(0.054, 0.317)	(0.068, 0.324)	(0.068, 0.345)	(0.053, 0.308)	(0.062, 0.351)	(0.042, 0.311)	(0.068, 0.356)
CSF23	(0.05, 0.304)	(0.048, 0.309)	(0.053, 0.303)	(0.042, 0.299)	(0.059, 0.344)	(0.067, 0.319)	(0.049, 0.302)	(0.058, 0.307)	(0.056, 0.317)	(0.052, 0.292)	(0.058, 0.333)	(0.051, 0.304)	(0.054, 0.324)
CSF24	(0.055, 0.319)	(0.056, 0.327)	(0.062, 0.324)	(0.049, 0.313)	(0.056, 0.351)	(0.056, 0.315)	(0.044, 0.307)	(0.056, 0.31)	(0.057, 0.329)	(0.056, 0.308)	(0.069, 0.352)	(0.057, 0.322)	(0.051, 0.334)

Abbreviation: CSF, critical success factor.

TABLE A5 (Continued)

Code	CSF14	CSF15	CSF16	CSF17	CSF18	CSF19	CSF20	CSF21	CSF22	CSF23	CSF24
CSF1	(0.052, 0.332)	(0.065, 0.331)	(0.054, 0.302)	(0.054, 0.321)	(0.052, 0.325)	(0.041, 0.281)	(0.054, 0.34)	(0.051, 0.313)	(0.045, 0.281)	(0.057, 0.319)	(0.045, 0.31)
CSF2	(0.058, 0.34)	(0.054, 0.322)	(0.049, 0.304)	(0.054, 0.322)	(0.07, 0.344)	(0.035, 0.276)	(0.069, 0.354)	(0.059, 0.316)	(0.049, 0.286)	(0.047, 0.311)	(0.055, 0.318)
CSF3	(0.064, 0.342)	(0.061, 0.326)	(0.053, 0.298)	(0.053, 0.316)	(0.071, 0.342)	(0.04, 0.279)	(0.061, 0.341)	(0.051, 0.306)	(0.048, 0.283)	(0.057, 0.313)	(0.055, 0.313)
CSF4	(0.064, 0.353)	(0.07, 0.345)	(0.048, 0.305)	(0.064, 0.34)	(0.066, 0.349)	(0.052, 0.301)	(0.045, 0.338)	(0.048, 0.317)	(0.052, 0.296)	(0.047, 0.316)	(0.054, 0.325)
CSF5	(0.065, 0.339)	(0.051, 0.314)	(0.048, 0.294)	(0.057, 0.318)	(0.061, 0.33)	(0.034, 0.271)	(0.055, 0.337)	(0.05, 0.307)	(0.042, 0.27)	(0.056, 0.313)	(0.057, 0.314)
CSF6	(0.057, 0.315)	(0.046, 0.294)	(0.039, 0.271)	(0.06, 0.307)	(0.055, 0.316)	(0.042, 0.27)	(0.064, 0.333)	(0.043, 0.283)	(0.042, 0.261)	(0.068, 0.311)	(0.046, 0.291)
CSF7	(0.06, 0.334)	(0.05, 0.314)	(0.051, 0.298)	(0.051, 0.317)	(0.064, 0.339)	(0.053, 0.292)	(0.049, 0.331)	(0.053, 0.31)	(0.035, 0.269)	(0.054, 0.31)	(0.062, 0.322)

TABLE A5 (Continued)

Code	CSF14	CSF15	CSF16	CSF17	CSF18	CSF19	CSF20	CSF21	CSF22	CSF23	CSF24
CSF8	(0.049, 0.3)	(0.048, 0.288)	(0.046, 0.266)	(0.043, 0.285)	(0.056, 0.304)	(0.028, 0.245)	(0.052, 0.31)	(0.047, 0.281)	(0.034, 0.243)	(0.044, 0.281)	(0.037, 0.271)
CSF9	(0.052, 0.324)	(0.059, 0.323)	(0.055, 0.3)	(0.058, 0.315)	(0.058, 0.326)	(0.039, 0.273)	(0.059, 0.338)	(0.043, 0.294)	(0.035, 0.264)	(0.044, 0.301)	(0.056, 0.314)
CSF10	(0.041, 0.293)	(0.042, 0.287)	(0.047, 0.272)	(0.052, 0.293)	(0.049, 0.295)	(0.037, 0.254)	(0.049, 0.308)	(0.052, 0.289)	(0.03, 0.245)	(0.045, 0.283)	(0.044, 0.284)
CSF11	(0.064, 0.349)	(0.051, 0.326)	(0.058, 0.312)	(0.052, 0.328)	(0.065, 0.347)	(0.056, 0.306)	(0.07, 0.364)	(0.056, 0.324)	(0.033, 0.277)	(0.049, 0.318)	(0.048, 0.321)
CSF12	(0.077, 0.364)	(0.062, 0.342)	(0.049, 0.305)	(0.058, 0.333)	(0.062, 0.347)	(0.054, 0.301)	(0.057, 0.352)	(0.048, 0.318)	(0.056, 0.301)	(0.045, 0.315)	(0.049, 0.321)
CSF13	(0.061, 0.354)	(0.067, 0.348)	(0.047, 0.306)	(0.061, 0.339)	(0.068, 0.352)	(0.044, 0.296)	(0.062, 0.357)	(0.056, 0.33)	(0.05, 0.295)	(0.053, 0.326)	(0.057, 0.329)
CSF14	(0.035, 0.307)	(0.062, 0.336)	(0.046, 0.298)	(0.058, 0.331)	(0.056, 0.339)	(0.057, 0.305)	(0.056, 0.346)	(0.037, 0.302)	(0.056, 0.3)	(0.05, 0.314)	(0.065, 0.332)
CSF15	(0.061, 0.335)	(0.031, 0.277)	(0.056, 0.295)	(0.043, 0.301)	(0.054, 0.32)	(0.041, 0.275)	(0.066, 0.343)	(0.057, 0.309)	(0.055, 0.283)	(0.038, 0.289)	(0.042, 0.297)
CSF16	(0.054, 0.315)	(0.047, 0.298)	(0.025, 0.246)	(0.049, 0.301)	(0.042, 0.3)	(0.041, 0.263)	(0.061, 0.328)	(0.049, 0.294)	(0.046, 0.268)	(0.048, 0.291)	(0.039, 0.287)
CSF17	(0.058, 0.331)	(0.057, 0.318)	(0.055, 0.301)	(0.03, 0.277)	(0.057, 0.325)	(0.036, 0.27)	(0.06, 0.341)	(0.041, 0.295)	(0.051, 0.281)	(0.049, 0.3)	(0.059, 0.318)
CSF18	(0.058, 0.325)	(0.043, 0.297)	(0.051, 0.288)	(0.047, 0.306)	(0.033, 0.285)	(0.044, 0.276)	(0.053, 0.326)	(0.048, 0.3)	(0.042, 0.267)	(0.056, 0.305)	(0.055, 0.308)
CSF19	(0.069, 0.349)	(0.061, 0.329)	(0.061, 0.307)	(0.062, 0.327)	(0.066, 0.343)	(0.026, 0.254)	(0.058, 0.344)	(0.052, 0.313)	(0.032, 0.267)	(0.046, 0.306)	(0.055, 0.321)
CSF20	(0.062, 0.342)	(0.059, 0.33)	(0.052, 0.301)	(0.045, 0.314)	(0.071, 0.35)	(0.044, 0.288)	(0.035, 0.307)	(0.059, 0.317)	(0.053, 0.289)	(0.065, 0.323)	(0.047, 0.311)
CSF21	(0.055, 0.341)	(0.061, 0.329)	(0.045, 0.294)	(0.049, 0.322)	(0.056, 0.335)	(0.056, 0.298)	(0.056, 0.345)	(0.03, 0.281)	(0.051, 0.294)	(0.063, 0.329)	(0.054, 0.322)
CSF22	(0.062, 0.338)	(0.066, 0.331)	(0.048, 0.294)	(0.042, 0.308)	(0.05, 0.322)	(0.045, 0.281)	(0.065, 0.346)	(0.056, 0.313)	(0.026, 0.248)	(0.054, 0.31)	(0.065, 0.324)
CSF23	(0.052, 0.317)	(0.054, 0.304)	(0.055, 0.289)	(0.051, 0.299)	(0.068, 0.325)	(0.046, 0.273)	(0.056, 0.326)	(0.058, 0.304)	(0.062, 0.285)	(0.029, 0.262)	(0.049, 0.294)
CSF24	(0.051, 0.322)	(0.053, 0.314)	(0.042, 0.283)	(0.039, 0.299)	(0.05, 0.313)	(0.047, 0.281)	(0.064, 0.343)	(0.051, 0.304)	(0.052, 0.284)	(0.053, 0.302)	(0.028, 0.27)

Abbreviation: CSF, critical success factor.

TABLE A6 Crisp total relation matrix.

Code	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12	CSF13
CSF1	0.1466	0.1983	0.1932	0.2022	0.2263	0.1763	0.1741	0.1948	0.1957	0.1848	0.2154	0.1847	0.2064
CSF2	0.1919	0.1490	0.1998	0.1889	0.2223	0.1865	0.1765	0.1574	0.1938	0.1818	0.2058	0.1898	0.2238
CSF3	0.1839	0.1821	0.1385	0.1877	0.2317	0.1736	0.1876	0.1622	0.2017	0.1551	0.2116	0.1777	0.2006
CSF4	0.2126	0.2035	0.2061	0.1532	0.2429	0.1763	0.1765	0.1810	0.2014	0.2014	0.2102	0.1887	0.2245
CSF5	0.1900	0.1930	0.1779	0.1617	0.1678	0.1823	0.1840	0.1827	0.1862	0.1661	0.2126	0.1877	0.2075
CSF6	0.1663	0.1758	0.1675	0.1586	0.2019	0.1295	0.1816	0.1643	0.1793	0.1530	0.2120	0.1624	0.1828
CSF7	0.1695	0.1918	0.1855	0.1883	0.2301	0.1799	0.1384	0.1573	0.1851	0.1750	0.2218	0.1743	0.2218
CSF8	0.1367	0.1769	0.1401	0.1603	0.1868	0.1593	0.1506	0.1119	0.1776	0.1496	0.1683	0.1585	0.1926
CSF9	0.1948	0.2047	0.1806	0.1708	0.2152	0.1703	0.1853	0.1494	0.1453	0.1695	0.2159	0.1705	0.2135
CSF10	0.1705	0.1633	0.1533	0.1837	0.1972	0.1491	0.1724	0.1436	0.1757	0.1140	0.1662	0.1646	0.1713
CSF11	0.1939	0.1987	0.1927	0.1980	0.2409	0.2113	0.2024	0.1812	0.2039	0.1830	0.1705	0.1910	0.2120
CSF12	0.1989	0.2157	0.1946	0.1960	0.2220	0.1922	0.1809	0.1807	0.2205	0.1911	0.2219	0.1496	0.2405
CSF13	0.2146	0.2125	0.1861	0.2192	0.2542	0.2120	0.1859	0.1939	0.1980	0.1935	0.2210	0.2068	0.1767
CSF14	0.2204	0.2078	0.1889	0.2006	0.2274	0.1768	0.1928	0.1746	0.2002	0.1742	0.2298	0.1913	0.2164
CSF15	0.1834	0.1818	0.1739	0.1719	0.2000	0.1810	0.1671	0.1735	0.1779	0.1626	0.2058	0.1742	0.2015
CSF16	0.1818	0.1546	0.1645	0.1705	0.1947	0.1576	0.1682	0.1685	0.1714	0.1723	0.1754	0.1516	0.2041
CSF17	0.1941	0.1749	0.1764	0.2078	0.2183	0.1877	0.1680	0.1710	0.2045	0.1573	0.1952	0.1685	0.2045
CSF18	0.1720	0.1770	0.1731	0.1789	0.2220	0.1641	0.1787	0.1676	0.1757	0.1661	0.2098	0.1805	0.2206
CSF19	0.1885	0.1860	0.1630	0.2062	0.2136	0.2079	0.1794	0.1907	0.2053	0.1780	0.2107	0.1954	0.2045
CSF20	0.2086	0.1996	0.1779	0.1810	0.2391	0.1815	0.1752	0.1869	0.2176	0.1660	0.2118	0.1848	0.2115
CSF21	0.1983	0.1888	0.1733	0.2008	0.2266	0.1986	0.2145	0.1869	0.1987	0.1809	0.2045	0.2028	0.2253
CSF22	0.1825	0.1927	0.1804	0.1842	0.2085	0.1812	0.1789	0.1943	0.2084	0.1722	0.2086	0.1663	0.2165
CSF23	0.1672	0.1698	0.1685	0.1580	0.2020	0.1897	0.1653	0.1754	0.1806	0.1609	0.1927	0.1675	0.1839
CSF24	0.1812	0.1871	0.1901	0.1722	0.2043	0.1790	0.1653	0.1759	0.1901	0.1746	0.2147	0.1851	0.1886

Abbreviation: CSF, critical success factor.

TABLE A6 (Continued)

Code	CSF14	CSF15	CSF16	CSF17	CSF18	CSF19	CSF20	CSF21	CSF22	CSF23	CSF24
CSF1	0.1877	0.1974	0.1686	0.1814	0.1828	0.1455	0.1956	0.1747	0.1483	0.1823	0.1681
CSF2	0.1975	0.1830	0.1663	0.1827	0.2093	0.1375	0.2157	0.1818	0.1545	0.1693	0.1811
CSF3	0.2037	0.1907	0.1652	0.1772	0.2089	0.1432	0.2006	0.1695	0.1520	0.1784	0.1770
CSF4	0.2117	0.2100	0.1668	0.2024	0.2103	0.1673	0.1870	0.1747	0.1639	0.1733	0.1841
CSF5	0.2027	0.1751	0.1590	0.1826	0.1935	0.1338	0.1937	0.1697	0.1391	0.1778	0.1795
CSF6	0.1800	0.1582	0.1377	0.1769	0.1791	0.1395	0.1977	0.1481	0.1333	0.1847	0.1555
CSF7	0.1950	0.1741	0.1637	0.1768	0.2015	0.1614	0.1857	0.1736	0.1333	0.1742	0.1880
CSF8	0.1639	0.1550	0.1397	0.1494	0.1719	0.1134	0.1727	0.1498	0.1170	0.1478	0.1355
CSF9	0.1821	0.1869	0.1678	0.1811	0.1883	0.1389	0.1969	0.1553	0.1305	0.1608	0.1787
CSF10	0.1528	0.1503	0.1440	0.1611	0.1606	0.1252	0.1693	0.1587	0.1148	0.1499	0.1491
CSF11	0.2090	0.1835	0.1785	0.1849	0.2079	0.1735	0.2235	0.1851	0.1368	0.1756	0.1774
CSF12	0.2288	0.2027	0.1672	0.1932	0.2057	0.1681	0.2058	0.1751	0.1701	0.1712	0.1778
CSF13	0.2099	0.2103	0.1659	0.1997	0.2140	0.1581	0.2129	0.1895	0.1614	0.1842	0.1893
CSF14	0.1580	0.1987	0.1606	0.1915	0.1955	0.1735	0.2004	0.1559	0.1692	0.1745	0.1978
CSF15	0.1965	0.1349	0.1660	0.1597	0.1814	0.1415	0.2055	0.1759	0.1572	0.1482	0.1570
CSF16	0.1777	0.1613	0.1115	0.1640	0.1592	0.1345	0.1920	0.1598	0.1409	0.1567	0.1474
CSF17	0.1918	0.1825	0.1695	0.1341	0.1869	0.1350	0.2001	0.1548	0.1529	0.1642	0.1834
CSF18	0.1876	0.1577	0.1573	0.1670	0.1420	0.1450	0.1847	0.1633	0.1376	0.1724	0.1733
CSF19	0.2120	0.1925	0.1776	0.1921	0.2059	0.1174	0.2009	0.1745	0.1291	0.1658	0.1831
CSF20	0.2022	0.1918	0.1667	0.1709	0.2144	0.1526	0.1582	0.1825	0.1596	0.1909	0.1700
CSF21	0.1969	0.1924	0.1575	0.1786	0.1927	0.1678	0.2003	0.1373	0.1612	0.1937	0.1823
CSF22	0.2000	0.1973	0.1595	0.1642	0.1798	0.1489	0.2074	0.1775	0.1137	0.1739	0.1920
CSF23	0.1776	0.1706	0.1610	0.1652	0.1944	0.1442	0.1867	0.1729	0.1638	0.1243	0.1596
CSF24	0.1797	0.1766	0.1481	0.1561	0.1730	0.1495	0.2047	0.1685	0.1555	0.1680	0.1289

Abbreviation: CSF, critical success factor.