BMIJ
ISSN: 2148-2586

bmij (2024) 12 (4):693-712
doi: https://doi.org/10.15295/bmij.v12i4.2413
Research Article

The relationship between dynamic capabilities and sustainable innovation performance in supply chains and antecedents of the dynamic capabilities

Tedarik zincirlerinde dinamik yetenekler ile sürdürülebilir inovasyon performansı arasındaki ilişki ve dinamik yeteneklerin öncülleri

Hülya Uzun[1]

Ali Çağrı Buran[2]

[1] Assist. Prof. Dr, Kütahya Dumlupinar University, Kütahya, Türkiye, hulya.cinar@dpu.edu.tr

ORCID: 0000-0003-4122-5014

[2] Assist. Prof. Dr, Kütahya Dumlupinar University, Kütahya, Türkiye, acagri.buran@dpu.edu.tr

ORCID: 0000-0002-8676-4831

Corresponding Author:

Hulya Uzun,

Kütahya Dumlupinar University, Kütahya, Türkiye, hulya.cinar@dpu.edu.tr

Submitted: 31/07/2024

Revised: 08/09/2024

Accepted: 17/11/2024

Online Published: 25/12/2024

Citation: Uzun, H. & Buran, A.C. The relationship between dynamic capabilities and sustainable innovation performance in supply chains and antecedents of the dynamic capabilities, bmij (2024) 12 (4): 693-712, doi: https://doi.org/10.15295/bmij.v12i4.2413

Abstract

The main objective of this study is to examine the relationship between dynamic capabilities and sustainable innovation performance in supply chains. Moreover, it aims to examine the internal and external factors influencing dynamic capabilities within the framework of this research. The relationship between dynamic capabilities and sustainable, innovative performance in supply chains was investigated in this context, considering sustainability's environmental, social, and economic dimensions. The effect of organisational structure and environmental dynamism as internal and external factors on supply chain dynamic capabilities was examined. For this purpose, 233 enterprises that are the leading manufacturers in the supply chains among the five hundred largest industrial enterprises determined by the Istanbul Chamber of Industry (ISO) for 2022 were selected as a sample area. An online survey questionnaire was distributed to the selected businesses, and 151 completed survey forms were collected. The Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to evaluate the proposed theoretical framework. The SmartPLS 4 software package analysed the data.

Keywords: Dynamic Capabilities, Sustainable Innovation Performance, Supply Chain

Jel Codes: L200, L250, M11, D85

Öz

Bu araştırmanın temel amacı Türkiye'deki sanayi işletmelerinin tedarik zincirlerinde dinamik yetenekler ile sürdürülebilir inovasyon performansı arasındaki ilişkiyi ortaya koymaktır. Ayrıca çalışma kapsamında dinamik yetenekleri etkileyen iç ve dış unsurların belirlenmesi amaçlanmıştır. Bu doğrultuda bu çalışma kapsamında tedarik zinciri dinamik yetenekleri ile tedarik zinciri sürdürülebilir yenilikçi performansı arasındaki ilişki, sürdürülebilirliğin çevresel, sosyal ve ekonomik boyutları dikkate alınarak incelenmiştir. Öte yandan çalışma kapsamında iç ve dış faktörler olarak organizasyon yapısı ve çevresel dinamizmin tedarik zinciri dinamik yetenekleri üzerindeki etkisinin belirlenmesi amaçlanmıştır. Bu amaçla İstanbul Sanayi Odası'nın (İSO) 2022 yılı için belirlediği beş yüz büyük sanayi kuruluşu arasında, tedarik zincirlerinde ana üretici konumunda olan hem ciro hem de ihracat açısından Türkiye'deki üretim işletmelerini temsil edebilecek nitelikte olan 233 işletme, uygulama alanı olarak seçilmiştir. Çevrimiçi anket formu 233 işletmeye gönderilmiş ve 151 kullanılabilir anket formu elde edilmiştir. Teorik modeli test etmek için En Küçük Kareler Yapısal Eşitlik Analizi (PLS-SEM) kullanılmış ve veriler SmartPLS 4 paket programı kullanılarak analiz edilmiştir.

Anahtar Kelimeler: Dinamik Yetenekler, Sürdürülebilir İnnovasyon Performansı, Tedarik Zinciri

JEL Kodları: L200, L250, M11, D85

Introduction

Innovation is key for a business to compete in the market consistently. It can be expressed as discovering, developing and applying novel ideas, products and services, processes, or technologies. Innovation is a potential indicator of creativity that contributes to corporate development and is expressed as the key to market success via increased competitiveness and overall profitability (Fartash et al., 2018, p. 1500). However, sustainability has emerged as an important driver for innovation (Gupta, Kusi-Sarpong and Rezaei, 2020, p. 2; Klewitz and Hansen, 2014, p. 58; Kusi-Sarpong, Gupta and Sarkis, 2019, p. 1990). The concept of sustainability has lately been central to companies' value-creation strategies. Businesses and scholars should closely examine how sustainability and economic success coexist. Organisations, therefore, focus not only on fulfilling their environmental and social obligations but also try to find new solutions to incorporate these sustainable practices into their business models. Sustainable innovation can be addressed as one of these solutions.

Sustainable innovation is "*new or modified processes, techniques, practices, systems and products to reduce social and environmental harm*" (Kusi-Sarpong et al., 2019, p. 1992). According to Rauter, Globocnik and Baumgartner (2023, p. 1), sustainable innovation includes innovation in products, services, and processes, as well as innovations in business models that are desired to result in sustainable innovation performance, which refers to environmental and social aspects. Sustainable innovation means implementing innovative processes by considering economic, social, and environmental dimensions, enabling companies to achieve their economic goals and fulfil their social and environmental responsibilities. In this context, the relationship between sustainability and innovation is a key factor for the sustainability of competitive advantage. Today, businesses are driven to develop sustainable innovations by consumers' awareness of sustainability and their preferences for socially and environmentally friendly products (Bocken, Short, Rana and Evans, 2014, p. 42). Reducing costs and increasing resource efficiency may also encourage businesses to develop sustainable innovations that optimise material, energy, and other resources (Adams, Jeanrenaud, Bessant, Denyer and Overy, 2016, p. 194). Thus, sustainable innovation could leverage businesses to gain a competitive advantage and efficiently operate (Klewitz and Hansen, 2014, p. 71). From the supply chain perspective, sustainable innovation in supply chains can be referred to as integrating innovative practices and Technologies within supply chain management to enhance sustainability, encompassing environmental, social and economic dimensions. This concept is driven by the need to address growing environmental concerns and the demand for sustainable development, which has led to adopting practices such as sustainable sourcing, innovations in logistics, and the integration of modern technologies (Chen, 2024, p. 28). The dynamic capabilities of market sensing and innovation play a crucial role in driving sustainable innovation practices within supply chains, positively impacting market performance and fostering competitive advantages (Barreto, Freitas and de Paula, 2024, p. 1).

The relationship between innovation methodologies and inventive concepts underscores the importance of dynamic capabilities. The capacity to develop novel products and/or venture into new markets relies on an organisation's harmonisation of strategic, innovative direction with innovative actions and procedures. This connection is critical because dynamic capabilities act as a key strategic driver in improving organisational performance, promoting innovation, and enhancing competitiveness. Following the dynamic capabilities approach, it is suggested that businesses adjust their foundational capabilities, identify changes in market needs, promote and assimilate innovative technologies, extract insights from market events, and take advantage of emerging opportunities within the market (Felin and Powell, 2016, p. 80).

Organisations must transform these resources into dynamic capabilities responding to rapidly changing customer needs (Gupta and Gupta, 2019, p. 325). Supply chains operate in a highly competitive and rapidly changing environment that can be affected by several factors, including political and economic developments, technological developments, pandemics, climate change, etc. In environments with high levels of dynamism, companies need to innovate and adapt to changes to survive against risks and uncertainties (Kyrdoda, Balzano and Marzi, 2023, p. 3), and senior managers need to come up with creative and innovative strategies to create rapid response ability (Jiao, Alon and Cui, 2011, p. 135). In this sense, supply chains need to develop their dynamic capabilities. Developing dynamic capabilities is also important for long-term sustainable productivity (Hong, Zhang and Ding, 2018, p. 3509).

The formation of dynamic capabilities in businesses depends on various internal and external factors, also called antecedents of dynamic capabilities. Organisational structure, behaviour of organisational members, managerial processes, etc., are referred to as internal factors (Wilden, Gudergan, Nielsen and Lings, 2013, p. 75; Liao, Kickul and Ma, 2009, p. 269), while organisational environment, competitive intensity, technology, and the rate of change of competition (Wilden et al., 2013, p. 73; Liao et al., 2009, p. 271; Singh, Charan and Chattopadhyay, 2019, p. 307) are referred to as external factors.

Despite the significance of the subject matter, an abundance of research is present in the literature regarding sustainable supply chain performance; nonetheless, the amount of research on sustainable, innovative performance within supply chains is notably restricted. To our knowledge, empirical investigations on supply chain innovative performance are lacking. Despite the research on the relationship between innovative performance, dynamic capabilities, environmental dynamism and organisational structure, there remains a gap in the literature regarding thoroughly examining these factors in the context of sustainable, innovative performance within supply chains. Hence, we argue that the importance of this study lies in its potential to address the scarcity of empirical evidence-based research on this topic within the current literature. Therefore, this research will seek answers to the following two questions:

1. What is the relationship between sustainable, innovative performance in supply chains and supply chain dynamic capabilities?

2. What internal and external factors influence supply chain dynamic capabilities?

Drawing on these claims, the primary aim of this research is to investigate the relationship between dynamic capabilities and sustainable innovation performance in the supply chains of industrial companies in Turkey. Additionally, a central focus of this study is to uncover the internal and external factors that shape dynamic capabilities. In addition, the study seeks to establish the relationship between organisational structure and environmental dynamism, considering them as internal and external factors alongside supply chain dynamic capabilities.

To achieve these objectives, an initial step involved conducting a thorough review of existing literature, establishing a theoretical framework, formulating hypotheses, and developing a theoretical model. Subsequently, the theoretical model underwent validation by applying Partial Least Squares Structural Equation Modeling (PLS-SEM). The process started with thoroughly clarifying the conceptual framework and hypotheses, which were elaborated on in subsequent parts of the study. The following section of the document explicates the methodologies utilised and delineates the results acquired from the study. The paper's final portion is allocated to presenting conclusions drawn from the findings and their evaluation.

Theoretical background and hypothesis

Supply chain sustainable innovation (SCSI)

Innovation is important due to the variability and intense competitive environment supply chains operate in. Innovation can be expressed as the discovery, development and application of novel ideas, products and services, processes, or technologies. Innovation is a potential indicator of creativity that contributes to corporate development and is expressed as the key to market success via increased competitiveness and overall profitability (Fartash et al., 2018, p. 1500). However, sustainability has emerged as an important driver for innovation (Gupta et al., 2020, p. 2; Klewitz and Hansen, 2018, p. 58; Kusi-Sarpong et al., 2019, p. 1990).

Sustainable innovation is "*new or modified processes, techniques, practices, systems and products to reduce social and environmental harm*" (Kusi-Sarpong et al., 2019, p. 1992). These innovations, which are implied to yield better outcomes, are (i) new sustainable product design, (ii) increased process efficiency, (iii) reduction of environmental pollution and (iv) social responsibility as sustainable output dimensions of the innovation portfolio (Rauter et al., 2023).

Sustainable innovation involves making conscious changes not only in products, practices, or processes but also in the philosophy and values of the organisation to achieve sustainable goals besides economic returns (Adams et al., 2016, p. 4). Sustainable innovation has three dimensions: economic, social, and environmental (Ahmadi, Pamucar, Pourhejazy, Kaya and Liou, 2023, p. 39677). Although these three dimensions are mentioned, the environmental dimension is more emphasised in the literature (Adams et al., 2016, p. 4; Ahmadi et al., 2023, p. 39675).

The primary means supply chains can progress and accomplish the sustainability objective is by implementing sustainable innovation practices. (Gupta et al., 2020, p. 1). The driving forces behind sustainable innovation encompass robust business networks aimed at fostering competitive advantage, support from research and development organisations, opportunities for cost reduction, financial incentives such as subsidies and tax benefits, adherence to regulatory requirements, and responsiveness to customer needs (Vasilenko and Arbačiauskas, 2012, p. 64; Kusi-Sarpong et al., 2019, p. 1992).

One of the key barriers to the development and realisation of sustainable innovation is the financial impediments caused by a shortage of time and skilled personnel (Vasilenko and Arbačiauskas, 2012, p. 64). Sustainable innovation may face obstacles due to various factors. These factors encompass the absence of suitable policy frameworks that can offer companies structured guidance during their innovative endeavours, the uncertainty surrounding innovation processes, and uncertainties in the market's reception of sustainable innovation (Gupta et al., 2020, p. 3). Moreover, challenges such as insufficient internal financing, which diminishes the likelihood of innovation introduction, and financial limitations that hinder access to public funding or incentives further impede sustainable innovation efforts (Cecere, Corrocher and Mancusi, 2016, p. 1). Additionally, the lack of awareness and comprehension among companies regarding this matter, coupled with the necessity for skilled professionals to strategise and execute innovation, also pose significant barriers (De Jesus Pacheco, ten Caten, Jung, Navas and Cruz-Machado, 2018, p. 13).

De Jesus and Mendonça (2018) defined obstacles to sustainable innovation in two categories: hard drivers, which consist of obstacles arising from technological and economic factors, and soft drivers, which consist of institutional/regulatory factors and social/cultural factors. Rauter et al. (2023, p. 2) also stated that the underlying reasons why companies fail to act towards sustainable innovation are due to their more complex structure compared to traditional innovation activities, underlining the importance of the development of novel skill sets and necessary knowledge to follow sustainability-oriented innovations, advanced or modified technologies, adaptation of management approaches, changes in the supply chain. They also underscored the importance of changes in the attitudes and values held by organisational members.

Supply chain dynamic capabilities (SCDC)

The term capabilities is defined as "*the key role of strategic management in appropriately adapting, integrating and restructuring internal and external organisational skills, resources and functional competencies to suit the needs of a changing environment*" (Teece, Pisano and Shuen, 1997, p. 515). Capability refers to the potential of a business to achieve specific goals (Mikalef, Boura, Lekakos and Krogstie, 2019, p. 275), the ability to use resources to achieve the goal (Wang and Ahmed, 2007, p. 36), the business processes required to structure assets in advantageous ways (O'Connor, 2008, p. 316), and a desired result by the business. In other words, it can be expressed as the capacity to use resources for the expected result (Capron and Mitchell, 2009, p. 295). There are various classifications in different studies in the literature. Wang and Ahmed (2007, p. 36) divided abilities into three degrees: skills are the first degree, basic skills are the second degree, and dynamic skills, which constitute one of the research subjects of the current study, are the third degree.

The core principles of the dynamic capability approach are deeply rooted in the resource-based perspective, according to Gupta and Gupta (2019, p. 325) and O'Connor (2008, p. 316). Dynamic capabilities highlight a firm's continuous endeavour to refresh, reorganise, and reconstruct resources, capabilities, and core competencies in response to changes in the external environment, as noted by Wang and Ahmed (2007, p. 35). Teece et al. (1997, p. 516) defined dynamic capabilities as "*the ability of the business to integrate, build and reconfigure internal and external competencies to address rapidly changing environments*." Eisenhardt and Martin (2000, p. 1107) defined dynamic capabilities as "*the driving forces behind the creation, development and transformation of resources into new sources of competitive advantage*." Cavusgil, Seggie and Talay (2007, p. 161) defined dynamic capabilities as "*organisational and strategic routines (also called processes), through which new resource configurations are created in response to market change*s." Based on these definitions, supply chain dynamic capabilities can be referred to as the ability of supply chains to adapt and respond to changes. The significance of these capabilities is crucial for enhancing the functionality of Inter-Organisational Systems (Chang, 2011, p. 10) and can potentially cultivate a sustainable competitive advantage (Defee and Fugate, 2010, p. 188). The importance of dynamic capabilities has become more relevant due to longer and more complex supply chains and heightened competition (Masteika and Čepinskis, 2015, p. 832).

It is possible to examine the factors affecting the formation and development of dynamic capabilities in two groups: internal and external factors. Internal factors can be considered as organisational structure (Wilden et al., 2013, p. 6; Andrews, 2010, p. 6; Singh et al., 2019, p. 301), technological, financial, structural assets and reputation (Ambrosini and Bowman, 2009, p. 43), organisational members' behaviours (Andrews, 2010, p. 6), intra-organizational practices such as procedures, designs and incentives, managerial processes, information, and management systems (Liao et al., 2009, p. 268), and training (Capron and Mitchell, 2009, p. 296).

External factors affecting the formation of dynamic capabilities in organisations are the organisational environment (Ambrosini and Bowman, 2009, p. 43; Singh et al., 2019, p. 301), market (Ambrosini and

Bowman, 2009, p. 43), competitive intensity (Wilden et al., 2013, p. 6), external partners (Mikalef et al., 2019, p. 282), and the speed of changes in technology and competition (Liao et al., 2009, p. 268).

Hypothesis development

This section further explains the relationships between the variables that the current study addresses, as well as the hypotheses of the study.

Relationship between SCDC and environmental dynamism

The dynamic environmental structure presents novel opportunities for organisations and elevates the risks and uncertainties arising from external environmental factors, such as market potential and technology. Environmental dynamism, being associated with change and unpredictability, denotes the pace of environmental change, the extent of environmental instability within which the organisation functions (Dess and Beard, 1984, p. 56; Chan, Yee, Dai and Lim, 2016, p. 386), and the frequency as well as the magnitude of changes (Verma, Kumar, Daim and Sharma, 2023, p. 3).

Multiple academic studies have been conducted concerning the concept of environmental dynamism. Upon examination of these previous research studies in conjunction with the current scholarly investigation, specific discoveries have shed light on the relationship between environmental dynamism and dynamic capabilities (Wilhelm, Schlömer and Maurer, 2015, p. 327). The research performed by Wang and Ahmed (2007, p. 35), which constitutes one of the inquiries into the connection between environmental dynamism and dynamic capabilities, characterises dynamic capabilities as the inclination to enhance and reorganise fundamental capabilities in reaction to the evolving surroundings, highlighting environmental dynamism as a crucial determinant influencing the enhancement of dynamic capabilities. Wilhelm et al. (2015, p. 327) contend that dynamic capabilities exhibit unique performance results in settings with high dynamism compared to those with low dynamism, indicating that dynamic capabilities are effective exclusively in environments defined by heightened environmental dynamism. Singh et al. (2019, p. 301) conducted a study that suggests that dynamic capabilities positively influence a company's responsiveness, especially in circumstances of heightened environmental dynamism and a strong perceptual capacity.

Considering these studies, the following hypothesis has been put forward within the scope of this study:

***H_1:** Supply Chain Dynamic Capabilities are positively related to the Dynamic Environment*

Relationship between SCDC and organisational structure

The organisational structure can be considered as the anatomy of the organisation (Dalton, Todor, Spendolini, Fielding and Porter, 1980, p. 49) and defined as the arrangement of work (Kovaçi, Tahiri, Bushi and Zhubi, 2021, p. 4) and the sum of the ways of dividing the work into different tasks and then ensuring coordination between them (Mintzberg, 1979, p. 81). Without organisational structures, the organisation may not function well and achieve its goals (Armstrong and Rasheed, 2013, p. 1). For this reason, mechanical and organic organisational structures are also of great importance in addition to the necessity of the organisation's structure.

The attributes of a mechanical organisational framework encompass centralised decision-making, conformity to formal regulations and protocols, rigorous management of information dissemination, and comprehensive reporting (Wilden et al., 2013, p. 7). This structure involves the development of significant hierarchical control and the rearrangement of all job roles based on power and authority (Martínez-León and Martínez-García, 2011, p. 544). Conversely, organic structures are characterised by their ability to adapt to changing conditions that continuously present new problems and unpredictable action requirements (Burns and Stalker, 2016, p. 121). They are typically linked to decentralised decision-making, open communication, organisational adaptability, and a reduced emphasis on formal rules and procedures (Wilden et al., 2013, p. 7).

The notable aspect of organic and decentralised structures is the perception of organisations as complex social entities where individual and social forces compete and interact (Martínez-León and Martínez-García, 2011, p. 544). The distinction between mechanical and organic structures becomes evident when analysing the dimensions impacting the organisational structure. Centralisation, formalisation, authority control, specialisation, standardisation, communication, and information placement within the organisation (Wilkesmann and Wilkesmann, 2018, p. 241; Nahm, Vonderembse and Koufteros, 2003, p. 283) are key dimensions influencing organisational structure. Among these dimensions, Andrews (2010, p. 11) contends that levels of centralisation, formalisation, and specialisation are fundamental structuring dimensions that can influence organisational decisions and outcomes. This study considers the levels of centralisation, formalisation, and specialisation as fundamental dimensions for assessing the connection between variable organisational structure and dynamic capabilities.

The level of centralisation pertains to the extent to which decisions are rendered by top executives (Armstrong and Rasheed, 2013, p. 2), distancing itself from the correlation between learning and action, as well as the capacity to promptly adjust to a dynamic, uncertain environment (Martínez-León and Martínez-García, 2011, p. 548). When the level of centralisation, predominantly high within firms, diminishes, the organisational framework transitions from a mechanistic arrangement to an organic configuration. A decentralised configuration, synonymous with power distribution, denotes the extent to which decision-making authority is distributed (Martínez-León and Martínez-García, 2011, p. 548). Teece (2007, p. 1339) asserts that decentralised setups facilitate the process of restructuring, a pivotal aspect of dynamic capabilities. Conversely, Andrews (2010, p. 7) emphasises that in a decentralised structure, senior executives trust the capacity of mid-level managers to make critical decisions, thus amplifying the favourable impacts of trust-centred interactions on corporate performance. The research carried out by Rindova and Kotha (2001, p. 1277), one of the pioneering studies directly investigating the nexus between how a decentralised organisational framework bolsters flexibility and dynamic capabilities, affirms that the advancement and utilisation of dynamic capabilities hinge on decentralised setups. In the face of escalating dynamism and competitive constraints, a decentralised configuration is especially recommended since it brings top management into closer proximity to novel technologies, clientele, and the market (Teece, 2007, p. 1335) and affords knowledge workers with extensive skills, expertise, and job responsibilities the opportunity for heightened autonomy and self-governance (Martínez-León and Martínez-García, 2011, p. 548).

Formalisation encompasses documented protocols, regulations, job specifications, and rules (Armstrong and Rasheed, 2013, p. 2). Organisations characterised by high levels of formalisation rely extensively on written procedures and precise regulations (Martínez-León and Martínez-García, 2011, p. 547). Mechanical organisational structures are commonly found in organisations with heightened formalisation. Such structures emphasise the implementation of rules and procedures that limit the autonomy and creativity of employees, thus hindering their capacity for independent work and learning (Nahm et al., 2003, p. 285). Conversely, less formalised operational processes tend to promote social engagement among members of the organisation, fostering creativity and enriching the learning experience (Martínez-León and Martínez-García, 2011, p. 547). In environments characterised by dynamism, where collaboration and interpersonal relationships hold significance, reducing regulations and procedures can contribute to cultivating a culture prioritising open communication and collaboration (Singh et al., 2019, p. 305). Consequently, Damanpour (1991, p. 558) asserts that a high level of formalisation exhibits an adverse association with innovation; however, introducing flexible working regulations can catalyse innovation.

Specialisation relates to how organisational tasks are divided into smaller tasks (Armstrong and Rasheed, 2013, p. 2). Specialisation can be horizontal and vertical. The low vertical specialisation contains employers taking part in control and design of their work as well as performing tasks, whilst low horizontal specialisation has a positive impact on individuals and their learning capacity (Martínez-León and Martínez-García, 2011, p. 547). Since the development of an organic organisational structure prevents employees from staying fixed when assigned to a department (Fettig, Gačić, Köskal, Kühn and Stuber, 2018, p. 2), the degree of specialisation is low in such structures.

Martínez-León and Martínez-García (2011, p. 544) argue that the mechanical structure is suitable for organisations displaying reactive tendencies and a reluctance to take risks. It is determined that organisations aspiring to thrive in the competitive landscape by adapting to evolving circumstances must embrace dynamism, with centralisation, formalisation, and specialisation kept to a minimum within an organic framework. Wilden et al. (2013, p. 9) believe an exceedingly organic structure is optimal for enhancing organisational performance through dynamic capabilities, while Singh et al. (2019, p. 305) argue that the fundamental aspects of dynamic capabilities rely heavily on organisational structures. Teece (2000, p. 41-42) underscores the significance of flexible, non-bureaucratic, decentralised, and less hierarchical organisational frameworks, fostering innovative and entrepreneurial cultures that nurture knowledge and confer competitive advantages. Wilden et al. (2013) further suggest that the impacts of organisational structure should be examined in conjunction with organisational processes concerning the identification and exploitation of opportunities, as well as restructuring to realign the organisation externally, emphasising the need for internal alignment with the organisational structure to enable dynamic capabilities to function effectively.

In line with these explanations, he following hypotheses have been put forward within the scope of this study;

H*$_2$*: Supply Chain Dynamic Capabilities are positively related to the Decentralised Organisational Structure

H*$_3$*: Supply Chain Dynamic Capabilities are positively related to Formal Organizational Structure

H*$_4$*: Supply Chain Dynamic Capabilities are positively related to Specialized Organizational Structure

Relationship between supply chain sustainable innovation performance and SCDC

The fact that innovation practices stem from original creative concepts again highlights the significance of dynamic capabilities. The creation of novel products and/or markets through the amalgamation of an organisation's strategic, innovative orientation with innovative behaviours and processes (Wang and Ahmed, 2004, p. 31) is contingent upon dynamic capabilities. This is attributed to dynamic capabilities being perceived as a pivotal strategic element that enhances organisational performance, innovation, and competitiveness (Singh and Rao, 2016, p. 113).

Existing scholarly literature has established a positive relationship between dynamic capabilities and innovation performance. Grünbaum and Stenger (2013, p. 70) and Wendra, Sule, Joeliaty and Azis (2019, p. 131) have emphasised the significance of dynamic capabilities in stimulating innovation performance, further reinforcing this association. The latter suggests that dynamic capabilities are precursors to intellectual capital, impacting innovation performance. Conversely, existing research on the relationship between supply chain dynamic capabilities and innovation performance underscores the necessity of transitioning from static to dynamic capabilities (Defee and Fugate, 2010, p. 187). Supply chain dynamic capabilities have a favourable impact on technology innovation and operational performance, with technology innovation acting as a mediator in this relationship (Ju, Park and Kim, 2016, p. 6). Additionally, SCDCs are instrumental in mediating the connection between sustainable supply chain management practices and organisational performance (Hong et al., 2018, p. 3516). Cultivating organisational and supply chain dynamic capabilities is essential for enhancing market performance and sustainability (Alzate, Manotas, Boada and Burbano, 2022, p. 335). Harun, Hogset and Mwesiumo (2023, p. 2636) affirm that firms with dynamic capabilities are more inclined to enhance their economic, social, and environmental sustainability performance.

However, additional investigation is required regarding the relationship between the dynamic capabilities of firms and the capacity for innovation within supply chains (Storer and Hyland, 2009, p. 921). Thus, based on the studies presented above and from a sustainability perspective, the following hypothesis has been suggested:

H*$_5$*: Supply Chain Sustainable Innovation Performance is positively related to Supply Chain Dynamic Capabilities

Methodology

Sample data and collection

The primary purpose of this research is to reveal the relationship between dynamic capabilities and sustainable innovation performance in the supply chains of industrial enterprises in Türkiye. In addition, the study aims to determine the internal and external elements that affect dynamic capabilities. The study focuses on the enterprises that are the leading manufacturers in the supply chains among the five hundred largest industrial enterprises determined by the Istanbul Chamber of Industry (ISO) every year, as they could represent the manufacturers in Türkiye in terms of both turnover and export. For this purpose, the list for 2022 was used, and the necessary information about the 233 identified enterprises was obtained from the ISO website. This study mainly explores the relationship between dynamic capabilities and sustainable innovation performance in supply chains, where the existing knowledge is limited and could be seen as a new variable. For this reason, a cross-sectional survey was designed to obtain better insights into these situations (Spector, 2019).

A self-administered online survey form was used for data collection. Since the original items scales are in English, to localise items reverse translation method is used to asses the accuracy of translated survey items. Then, a pilot test was conducted by obtaining data from 30 companies and interviewing experts to pinpoint potential inadequacies in the survey items. The final iteration of the survey was designed through interviews with three academics and four target business managers and analysing data from the pilot test. The research was conducted for the companies' Supply Chain, Logistics, Production Planning and Purchasing managers and employees from September 2023 to January 2024. The online survey form was initially sent to 233 businesses, and 111 usable responses were collected in the first round. Subsequently, the survey was resent to non-responding firms, resulting in approximately 130 responses, which eventually increased to 151 (%64).

The utilisation of the partial least squares structural equation modelling (PLS-SEM) approach in data analysis is justified by various considerations. PLS-SEM represents a robust and sophisticated methodology appropriate for forecasting within complex multi-equation econometric frameworks (Wong, 2019, p. 19).

PLS-SEM is particularly useful for research projects with limited participants, as it can handle small sample sizes effectively (Hair, Sarstedt, Hopkins and Kuppelwieser, 2014, p. 109). Moreover, PLS-SEM focuses on estimating complex interrelationships and making predictions in success factor studies and unlike covariance-based SEM, it does not make distributional assumptions about the data (Wong, 2019, p. 17; Hair et al., 2014, p. 116). PLS-SEM can conduct sophisticated modelling methodologies such as mediation analysis and categorical moderation, thereby establishing itself as a robust tool for academic researchers and professionals. Additionally, PLS-SEM is continuously evolving and being debated by the research community, leading to a better understanding of its capabilities and limitations. Overall, PLS-SEM provides researchers with a flexible and powerful structural modelling and analysis method. On the other hand, determining the appropriate sample size for Partial Least Squares Structural Equation Modeling (PLS-SEM) is crucial for ensuring the validity and reliability of the results. Various methods and considerations are employed to determine the sample size in PLS-SEM studies. A widely used sample size estimation method in PLS-SEM is the "10-time rule Hair, Ringle and Sarstedt (2011, p. 144), which suggests that "the minimum sample size should be 10 times the maximum number of inner or outer model paths directed at a construct in the model". Based on this rule, the minimum sample size in this study should be 40 (4*10). Krejcie and Morgan (1970) proposed a table for determining sample size by considering the population. According to this table, based on the population of this study (233), the required sample size is calculated as 136. Power analysis is another widely used method for determining the sample size (Chuan and Penyelidikan, 2006, p. 80). G*Power is a tool used for power analysis, which is crucial in determining the sample size needed for statistical tests by considering statistical parameters such as effect size, desired power, and estimated variance. This study included four predictive variables demonstrating a moderate effect size measured at 0.15 and a significance level set at 5%. Using these parameters as a point of reference, the researchers established that a sample size of 129 samples was required to reach statistical significance, with a power of 0.95 regarded as adequately sufficient. Accordingly, the 151 (%64). surveys collected within the scope of this study can be considered statistically sufficient.

The SmartPLS 4.1.0.0 package program was employed to analyse the answers given by the participants to the questions and statements in the measurement tool (survey) formed according to the purpose, scope and method of the research.

Measurements and research model

The measurement tool (survey) used in the research consists of four parts, and a 7-point Likert scale was used (1. Strongly Disagree, 2. Partially Disagree, 3. Disagree, 4. Neutral, 5. Partially Agree, 6. Agree, 7. Strongly Agree). Figure 1 illustrates the research model and scales created within the framework of the theoretical infrastructure explained above and other studies in the literature as follows:

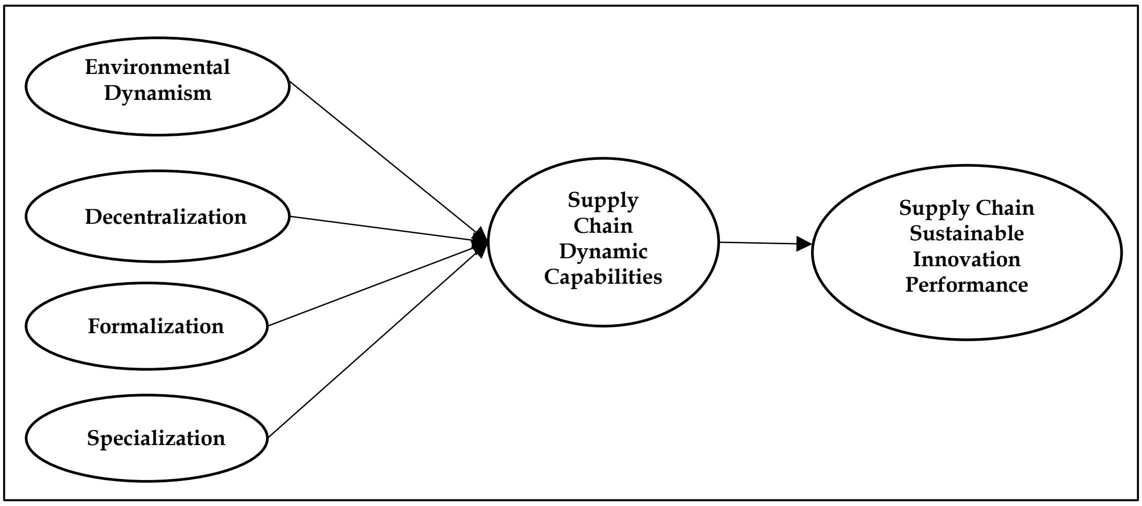

Figure 1: Research Model

Source: Authors

Environmental Dynamism (ED) has been discussed regarding uncertainty and market competition, and the questions suggested by (Gupta and Gupta, 2019, p. 333) consisting of 5 items were used; the relationship between environmental dynamism and supply chain dynamic capabilities was investigated.

Organisational structures have been discussed in three dimensions: decentralisation (DC), formalisation (FRM), and specialisation (SPC). Their relationship with supply chain dynamic capabilities was investigated. For this purpose, the scales created by (Daugherty, Chen and Ferrin, 2011, p. 37) were used. There are a total of 9 statements: 3 statements of decentralisation, three statements of formalism, and three statements of specialisation.

Supply Chain Dynamic Capabilities (SCDC) are considered the capabilities of the leading business and supply chain partners to receive, integrate and reconstruct information from internal and external sources of the supply chain. Its direct impact on the supply chain sustainable innovation performance has been investigated, and the scale consisting of 9 questions was adapted from the scale developed by Yang, Li and Qiao (2023, p. 24).

Supply Chain Sustainable Innovation Performance (SCSIP*)* has been discussed within the framework of the economic, environmental and social dimensions of sustainability, and the scale items developed for manufacturers by Calik and Bardudeen (2016, p. 453) were adapted to this study.

Common method bias

A full collinearity test can assess common method bias in partial least squares structural equation modelling (PLS-SEM). This approach involves identifying common method bias based on variance inflation factors (VIF) generated through the test. The full collinearity test has successfully detected common method bias even in models that pass standard validity and reliability assessments (Kock, 2015, p. 7). According to this method, when the VIF of each latent factor has a value less than 3.3, no CMB issue is detected. As shown in Table 1 in this study, there is no CMB issue because all VIF values of latent variables are less than 3.3.

Table 1: Colinearity Statistics (VIF)

	DC	ED	FRM	SCD	SSIP
DC				1.281	
ED				1.324	
FRM				1.051	
SCD					1.000
SSIP					

Source: Authors

Measurement assessment, reliability and validity

Before examining the research model, the constructs' validity and reliability were assessed in the study. The validity and reliability assessment encompassed internal consistency, convergent, and discriminant validity. The researchers analysed Cronbach's Alpha and composite reliability (CR=Composite Reliability) coefficients to evaluate internal consistency reliability. Convergent validity was determined by assessing the Average Variance Extracted (AVE) values, which indicate the variance explained by factor loadings. It is expected that factor loadings will be equal to or greater than 0.70, with both Cronbach's Alpha and composite reliability coefficients also needing to meet or exceed the threshold of 0.70. The average variance explained value is also expected to be 0.50 or higher (Hair, Risher, Sarstedt and Ringle, 2019, p. 8-9; Hair et al., 2014, p. 111).

According to Hair et al. (2019, p. 7), factor loadings should be equal to or greater than 0.70 (≥ 0.70). The researchers emphasised the significance of excluding statements with factor loadings below 0.40 from the measurement model, suggesting that items with factor loads ranging from 0.40 to 0.70 should be omitted if their AVE or CR values fall below the specified threshold. In the first analysis, the factor load of the 2nd question of the Specialisation variable was found to be 0.391 (0.391 ≤ 0.70). Therefore, this question was removed from the model, and the analysis was performed again. In the second analysis, although the factor loadings of the first and third items of Specialization (SPC1: 0.856, SPC3:0.850) were above the 0.70, CR values (CR: 0.641) and Cronbach's Alpha (0.621) of the Specialisation variable remained below the threshold values. Internal consistency reliability could not be achieved. Therefore, the Specialisation variable was removed from the model and tested again.

Table 2 shows the results of the final measurement model. The Cronbach's Alpha coefficients of the constructs ranged from 0.789 to 0.925, while the CR coefficients ranged from 0.873 to 0.943. These results indicate that internal consistency reliability has been established.

The factor loadings of the structures fell within the range of 0.716 to 0.897, while the AVE values ranged from 0.579 to 0.737. Therefore, it is reasonable to propose that convergent validity has been established.

Table 2: Measurement Model Results

Variable	Item	Means	Standard Deviations	Factor Loadings	Cronbach's Alpha	C.R.	AVE
Environmental Dynamism	ED1	5.267	1.403	0.722	0.818	0.873	0.579
	ED2	5.173	1.312	0.820			
	ED3	5.307	1.152	0.752			
	ED4	5.600	1.106	0.759			
	ED5	5.653	1.235	0.747			
Decentralisation	DC1	5.180	1.236	0.817	0.789	0.876	0.703
	DC2	4.973	1.181	0.887			
	DC3	5.093	1.227	0.810			
Formalisation	FRM1	5.447	1.144	0.831	0.826	0.894	0.737
	FRM2	4.827	1.516	0.847			
	FRM3	4.947	1.609	0.897			
Supply Chain Dynamic Capabilities	SCD1	5.260	1.189	0.716	0.932	0.943	0.648
	SCD2	5.133	1.286	0.824			
	SCD3	5.247	1.277	0.813			
	SCD4	5.280	1.328	0.810			
	SCD5	5.367	1.274	0.823			
	SCD6	5.493	1.239	0.810			
	SCD7	5.267	1.301	0.839			
	SCD8	5.353	1.204	0.822			
	SCD9	5.393	1.256	0.782			
Supply Chain Sustainable Innovation Performance	SSIP1	5.427	1.205	0.780	0.925	0.937	0.596
	SSIP2	5.233	1.211	0.799			
	SSIP3	5.293	1.238	0.806			
	SSIP4	5.320	1.242	0.759			
	SSIP5	5.447	1.201	0.799			
	SSIP6	5.553	1.121	0.759			
	SSIP7	5.327	1.340	0.734			
	SSIP8	5.420	1.363	0.759			
	SSIP9	5.407	1.247	0.769			
	SSIP10	5.493	1.157	0.756			

Source: Authors

Discriminant validity has been ascertained through the utilisation of cross-loadings by the guideline established by Fornell and Larcker (1981, p. 44) and the HTMT criterion put forth by Henseler, Ringle and Sarstedt (2015, p. 121). The cross-loadings have been detailed in Table 3, while the outcomes of the discriminant validity assessment are presented in Table 4, and the HTMT coefficients are displayed in Table 5.

Having checked the cross-loading table in Table 3, the researchers found no overlapping items between the statements measuring the research variables.

Table 3: Cross Loadings

	Environmental Dynamism	Decentralisation	Formalisation	Supply Chain Dynamic Capabilities	Supply Chain Sustainable Innovation Performance
ED1	**0.722**	0.308	0.220	0.346	0.299
ED2	**0.820**	0.368	0.140	0.457	0.370
ED3	**0.752**	0.303	0.073	0.345	0.289
ED4	**0.759**	0.323	0.193	0.392	0.361
ED5	**0.747**	0.448	0.198	0.471	0.404
DC1	0.374	**0.817**	0.143	0.350	0.319
DC2	0.397	**0.887**	0.126	0.437	0.397
DC3	0.408	**0.810**	0.037	0.354	0.335
FRM1	0.068	0.237	**0.831**	0.221	0.280
FRM2	0.060	0.071	**0.847**	0.125	0.150
FRM3	0.171	0.204	**0.897**	0.220	0.247
SCD1	0.498	0.445	0.100	**0.714**	0.482
SCD2	0.429	0.493	0.272	**0.823**	0.562
SCD3	0.334	0.497	0.214	**0.814**	0.576
SCD4	0.282	0.417	0.100	**0.811**	0.514
SCD5	0.381	0.449	0.119	**0.823**	0.528
SCD6	0.430	0.367	0.152	**0.810**	0.517
SCD7	0.325	0.396	0.247	**0.839**	0.543
SCD8	0.303	0.398	0.276	**0.823**	0.573
SCD9	0.318	0.410	0.180	**0.783**	0.549
SSIP1	0.450	0.412	0.285	0.554	**0.780**
SSIP2	0.276	0.287	0.199	0.451	**0.756**
SSIP3	0.377	0.423	0.324	0.574	**0.799**
SSIP4	0.351	0.436	0.283	0.606	**0.806**
SSIP5	0.320	0.344	0.232	0.491	**0.760**
SSIP6	0.323	0.325	0.220	0.533	**0.799**
SSIP7	0.290	0.352	0.164	0.509	**0.759**
SSIP8	0.312	0.309	0.027	0.476	**0.734**
SSIP9	0.256	0.336	0.174	0.476	**0.759**
SSIP10	0.255	0.283	0.188	0.468	**0.769**

Source: Authors

It can be suggested that discriminant validity was achieved according to cross-loadings, the Fornell-Larcker criterion, and the HTMT criterion. Based on the criterion Fornell and Larcker (1981, p. 44), the square root of the average variance explained (AVE) values related to the studied structures must surpass the correlation coefficients among those structures within the research investigation. The values in parentheses in the table (Table 4) are the square root values of AVE, while the other coefficients are the correlation values between the variables. Upon further examination of the data presented in the table, it becomes evident that the square root of the Average Variance Extracted (AVE) for each structural element surpasses the correlation coefficients observed with other structural elements.

According to the criterion suggested by Henseler et al. (2015, p. 125), HTMT (Heterotrait-Monotrait Ratio) expresses the ratio of the average correlations between indicators of different variables (heterotrait) to the geometric average of the correlations between indicators of the same variable (monotrait). According to the researchers, the HTMT value is theoretically supposed to be below 0.90 for concepts close to each other, whereas concepts far from one another should have a value below 0.85. As can be seen in Table 5, the HTMT coefficients are below the threshold value.

Table 4: Discriminant Validity Results (Fornell and Larcker Criterion)

	Environmental Dynamism	Decentralisation	Formalisation	Supply Chain Dynamic Capabilities	Supply Chain Sustainable Innovation Performance
Environmental Dynamism	**(0.761)**				
Decentralisation	0.468	**(0.839)**			
Formalisation	0.218	0.123	**(0.859)**		
Supply Chain Dynamic Capabilities	0.537	0.457	0.232	**(0.805)**	
Supply Chain Sustainable Innovation Performance	0.459	0.420	0.277	0.670	**(0.772)**

Source: Authors

Table 5: Discriminant Validity Results (HTMT Criterion)

	Environmental Dynamism	Decentralisation	Formalisation	Supply Chain Dynamic Capabilities	Supply Chain Sustainable Innovation Performance
Environmental Dynamism					
Decentralisation	0.574				
Formalisation	0.244	0.164			
Supply Chain Dynamic Capabilities	0.603	0.527	0.247		
Supply Chain Sustainable Innovation Performance	0.515	0.484	0.296	0.716	

Source: Authors

Empirical analysis and results

Middle and senior managers from 151 manufacturers participated in the survey. Descriptive information about the participants is shown in Table 6.

Table 6: Descriptive Information

Features		Frequency	Ratio (%)
Gender	Male	92	61
	Woman	59	39
		151	**100**
Operating Period of the Business	1-5 Years	18	12
	6-10 Years	33	22
	11-15 Years	41	27
	16 years and above	59	39
		151	**100**
Capital Structure of the Business	Local	93	61.5
	Foreign	16	10.5
	Foreign Partnership	42	28
		151	**100**

Source: Authors

The structural equation model developed to investigate the hypotheses posited in the study is visually depicted in Figure 2.

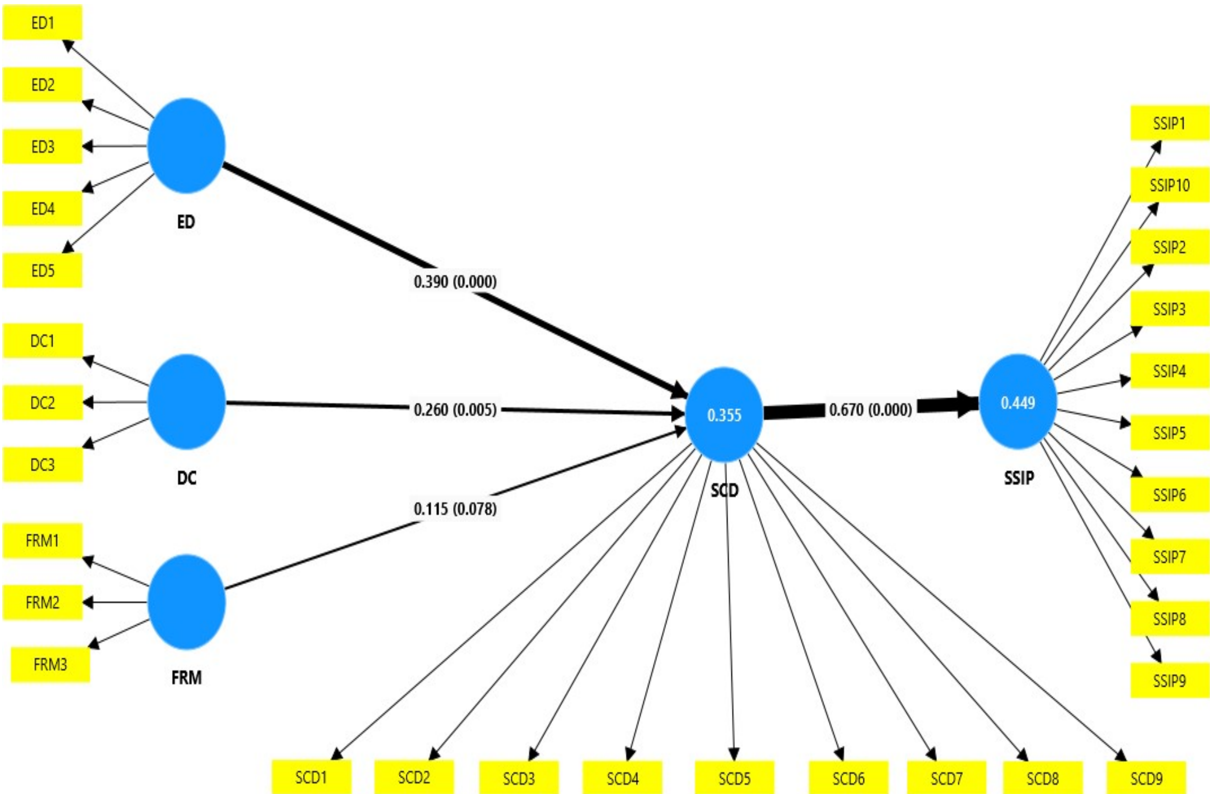

Figure 2: Structural Equation Model

Source: Authors

Table 7: Research Model Coefficients

Variables		VIF	R2	f^2	Q2
Environmental Dynamism	**Supply Chain Dynamic Capabilities**	1.324	0.355	**0.178**	0.332
Decentralisation		1.281		0.082	
Formalisation		1.051		0.019	
Supply Chain Dynamic Capabilities	**Supply Chain Sustainable Innovation Performance**	1.000	0.449	**0.815**	0.288

Source: Authors

Table 8: Direct Effect Coefficients

Variables		Standardised β	Standard deviation	t value	p
Environmental Dynamism	**Supply Chain Dynamic Capabilities**	0.390	0.094	4.162	0.000
Decentralisation		0.260	0.093	2.809	0.005
Formalisation		0.115	0.065	1.763	0.078
Supply Chain Dynamic Capabilities	**Supply Chain Sustainable Innovation Performance**	0.670	0.064	10.538	0.000

Source: Authors

Partial least squares structural equation modelling (PLS-SEM) was employed to examine the theoretical framework. The data underwent analysis utilising the statistical software SmartPLS 4.1.0.0. Within the context of the theoretical framework, the PLS algorithm was employed to compute linearity, path coefficients, R2, and effect size (f2'), followed by the implementation of PLSpredict analysis to ascertain the predictive capability (Q2). The evaluation of the statistical significance of PLS path coefficients entailed the derivation of t values via bootstrapping, with 5000 subsamples randomly selected from the dataset (Yıldız, 2021).

Regarding the research results, VIF, R2, f2 and Q2 values are presented in Table 7. Results for direct effects are given in Table 8. Examining the variance inflation factor (VIF) values linked to the variables established no linearity among the variables. Such determination was reached by observing that the values were lower than the specified threshold value of 5, as indicated by Hair, Hult, Ringle and Sarstedt (2022, p. 93).

Upon analysing the R^2 values derived from the model, it was established that it explained 35% of the variance in the supply chain dynamic capabilities variable and 45% in the supply chain sustainable innovation performance variable.

Cohen (1988, p. 22) pointed out that the effect size coefficient (f2) is classified as low when it attains 0.02 or above, moderate at 0.15 or above, and high at 0.35 or above. Sarstedt, Ringle and Hair (2017, p. 21) underlined that instances where the coefficient is below 0.02 exclude discussing an effect. After examining the effect size coefficients (f^2), the researchers determined that decentralisation and formalisation have a low effect size on the supply chain dynamic capabilities variable, while environmental dynamism has a medium effect size; it was also observed that supply chain dynamic capabilities have a high effect size on the supply chain sustainable innovation performance variable.

The observation that the predictive power coefficients (Q2) derived for endogenous factors exhibit values above zero indicates the presence of predictive capability in the research framework (Hair et al., 2022, p. 93). Given that the Q2 results detailed in Table 8 surpass zero, one can infer that the research framework possesses predictive power concerning supply chain dynamic capabilities and sustainable innovation performance.

Having analysed the effects in Table 8, the variables decentralisation (β=0.260; $p<0.01$) and environmental dynamism (β=0.39; $p<0.01$) have been found to have positive effects on the supply chain dynamic capabilities variable. However, the effect of the formalisation variable on the supply chain dynamic capabilities variable was found to be statistically insignificant. In addition, it has been determined that the supply chain dynamic capabilities variable positively affects the supply chain sustainable innovation performance variable. In the light of these results, hypotheses 1, 2 and 5 of the current study were supported, while hypothesis 3 was not supported.

Conclusion and evaluation

Supply chains are making great efforts to adjust to current conditions and prepare for future applications in a highly competitive and rapidly changing environment. Particularly today, sustainability has emerged as one of the most crucial points of reference for supply chain operations due to the negativities experienced, such as the deterioration of ecological balance, destruction of the environment, and life-threatening elements. Thus, sustainability's environmental, social, and economic aspects in innovation efforts have become crucial since they are among the most crucial components of supply chains in adding value and giving businesses a competitive edge. In this respect, the other elements of sustainability—the social and economic dimensions—were considered while examining the link between supply chain dynamic capacities and sustainable innovation performance within the parameters of this study. On the other hand, the current study also aimed to determine the effect of organisational structure and environmental dynamism as internal and external factors on supply chain dynamic capabilities.

In order to test the research model and hypotheses put forward for this study, 233 manufacturers out of Turkey's top 500 largest production enterprises listed by the Istanbul Chamber of Industry (ISO) in 2022, which produce final consumer products, were determined as the sample area. Detailed analysis of the collected data has revealed that environmental dynamism directly impacts the supply chain's dynamic capabilities. However, while the formal organisational structure was found to directly affect supply chain dynamic capabilities, decentralised and specialisation-based organisational structures did not affect supply chain dynamic capabilities. On the other hand, it has been revealed that supply chain dynamic capabilities directly impact supply chain sustainable innovation performance.

These results suggest that environmental variability has a high effect; in other words, a dynamic environment has a direct impact on improving the dynamic capabilities of supply chains. In this regard, it is a result that supports the studies revealing the relationship between environmental dynamism and dynamic capabilities (Wang and Ahmed, 2007, p. 34; Wilhelm et al., 2015, p. 341; Singh et al., 2019, p. 315); moreover, it has been observed that the relationship in question is in the same direction from the perspective of supply chains.

Organisational structure, one of the internal factors affecting the formation of dynamic capabilities in businesses, has been discussed in three dimensions within the scope of this study: centralisation, specialisation, and formality. The bulk of research underlines decentralised organisational structures, where decision-making power is shared and, therefore, the degree of centralisation is low, are more organic structures, which positively affects dynamic capabilities (Martínez-León and Martínez-García, 2011, p. 548; Teece, 2007, p. 1339; Rindova and Kotha, 2001, p. 1277). According to this research, a positive relationship has been found between a decentralised organisational structure and supply chain dynamic capabilities. As it has been stated in the literature, organisational structures with low formality are more organic and have a positive impact on dynamic capabilities (Teece, 2000, p. 41-42; Wilden et al., 2013, p. 9; Rindova and Kotha, 2001, p. 1277), the current study has revealed a positive relationship between decentralisation and dynamic capabilities which is consistent with the literature.

Another research finding is the positive relationship between supply chain dynamic capabilities and supply chain sustainable innovation. One of the most important elements in the development of innovation capability in businesses is the dynamic capabilities of businesses. As stated before, businesses' ability to combine their strategies with innovative behaviours and processes to develop new products and/or markets (Wang and Ahmed, 2004, p.31) depends on dynamic capabilities. Previous studies in the literature have found that innovation performance is significantly affected by dynamic capabilities (Wang and Ahmed, 2007, p. 35), which are expressed as the businesses' continuous renewal, restructuring and re-creation of resources, talents and core competencies to address environmental change (Wu, Chen and Jiao, 2016, p. 2685; Grünbaum and Stenger, 2013, p. 70; Wendra et al., 2019, p. 71; Ansari, Barati and Sharabiani, 2016, p. 47; Ali, Hussin, Haddad, Alkhodary and Marei, 2021, p. 26; Ellonen, Wikström and Jantunen, 2009, p. 759; Giniuniene and Jurksiene, 2015, p. 989). From the perspective of sustainability, however, various studies have addressed the relationship between dynamic capabilities and green innovation performance, revealing that dynamic capabilities have an impact on green innovation performance (Huang and Li, 2017, p. 317; Dangelico, Pujari and Pontrandolfo, 2017, p. 501; Albort-Morant, Leal-Millán and Cepeda-Carrión, 2016, p. 4916). However, these studies focused specifically on the environmental dimension of sustainability. Therefore, according to this research, supply chain dynamic capabilities have positively affected sustainable, innovative performance. In other words, the better supply chains can structure their resources to adapt to changing conditions, the more they can innovate sustainably. Today, given that supply chain strategies, policies and practices rely heavily on sustainability, and innovation is considered to give businesses a cutting edge, this result is remarkable for businesses and supply chains.

Due to time and cost constraints, this research was primarily limited to industrial enterprises in Turkey that are included in ISO 500 and produce final consumer goods. Of the roughly 230 firms on this list, 151 (64%) could be reached. Therefore, further studies are recommended to evaluate the results using a larger sample size and a wider range of industries. On the other hand, in this study, supply chain dynamic capabilities were examined by considering a single scale variable. Future studies can separately analyse the specific aspects of dynamic capabilities, such as learning, restructuring, and selecting opportunities in the market, and investigate whether these capabilities stand out individually in certain situations. The current study also addressed organisational structures as internal factors affecting dynamic capabilities; it had been observed that organisational structures with low formality positively affect dynamic capabilities. It would, therefore, be helpful to investigate this relationship with different samples (country, sector, etc.) in future studies.

Peer-review:

Externally peer-reviewed

Conflict of interests:

The authors have no conflict of interest to declare.

Grant Support:

The authors declared that this study has received no financial support.

Ethics Committee Approval:

Ethics committee approval was received for this study from Kütahya Dumlupinar University, Social and Human Sciences Scientific Research and Publication Ethics Committee on 22/06/2023 and 2023/06 document number.

Author Contributions:

Idea/Concept/Design: **H.U., A.Ç.B.** Data Collection and/or Processing: **H.U., A.Ç.B.** Analysis and/or Interpretation: **H.U., A.Ç.B.** Literature Review: **H.U., A.Ç.B.** Writing the Article: **H.U., A.Ç.B.** Critical Review: **H.U., A.Ç.B.** Approval: **H.U., A.Ç.B.**

References

Adams, R., Jeanrenaud, S., Bessant, J., Denyer, D., and Overy, P. (2016). Sustainability-oriented innovation: A systematic review. *International Journal of Management Reviews*, *18*(2), 180-205. doi:10.1111/ijmr.12068

Ahmadi, H.B., Pamucar, D., Pourhejazy, P., Kaya, S.K., and Liou, J.J. (2023). An integrated approach for assessing suppliers considering economic sustainability innovation. *IEEE Access 11*, 39675-39694. doi:10.1109/access.2023.3268438

Albort-Morant, G., Leal-Millán, A., and Cepeda-Carrión, G. (2016). The antecedents of green innovation performance: A model of learning and capabilities. *Journal of Business Research*, *69*(11), 4912-4917. doi: 10.1016/j.jbusres.2016.04.052

Ali, M.A., Hussin, N., Haddad, H., Alkhodary, D., and Marei, A. (2021). Dynamic capabilities and their impact on intellectual capital and innovation performance. *Sustainability*, *13*(18), 10028. doi: 10.3390/su131810028

Alzate, I., Manotas, E., Boada, A., and Burbano, C. (2022). Meta-analysis of organisational and supply chain dynamic capabilities: A theoretical-conceptual relationship. *Problems and Perspectives in Management*, *20*(3), 335-349. doi:10.21511/ppm.20(3).2022.27

Ambrosini, V., and Bowman, C. (2009). What are dynamic capabilities and are they a useful construct in strategic management?. *International Journal of Management Reviews*, *11*(1), 29-49. doi:10.1111/j.1468-2370.2008.00251.x

Andrews, R. (2010). Organisational social capital, structure and performance. *Human Relations*, *63*(5), 1-26. doi:10.1177/0018726709342931

Ansari, R., Barati, A., and Sharabiani, A.A.A. (2016).The role of dynamic capability in intellectual capital and innovative performance. *International Journal of Innovation and Learning*, *20*(1), 47-67. doi:10.1504/IJIL.2016.076671

Armstrong, O.E., and Rasheed, A. (2013). Structural dimensions and functions of structure influencing agribusiness enterprises: Mechanistic vs organic systems approach. *IOSR Journal of Business and Management*, *6*(6), 1-63.

Barreto, L. S., Freitas, V. and de Paula, V.A.F. (2024). Sustainable supply chain innovation and market performance: The role of sensing and innovation capabilities. Cleaner and Responsible Consumption. doi:10.1016/j.clrc.2024.100199

Bocken, N.M.P., Short, S.W., Rana, P., and Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, *65*, 42–56. doi:10.1016/j.jclepro.2013.11.039

Burns, T., and Stalker, G.M. (2016). *The management of innovation*, Oxford University Press. New York.

Calik, E., and Bardudeen, F. (2016). A measurement scale to evaluate sustainable innovation performance in manufacturing organisations. *Procedia Cirp*, *40*, 449-454. doi:10.1016/j.procir.2016.01.091

Capron, L., and Mitchell, W. (2009). Selection capability: How capability gaps and internal social frictions affect internal and external strategic renewal. *Organization Science*, *20*(2), 294-312. doi:10.1287/orsc.1070.0328

Cavusgil, E., Seggie, S.H., and Talay, M.B. (2007). Dynamic capabilities view: Foundations and research agenda. *Journal of Marketing Theory and Practice*, *15*(2), 159-166. doi: 10.2753/mtp1069-6679150205

Cecere, G., Corrocher, N., and Mancusi, M.L. (2016). Financial constraints and public funding of eco-innovation: Empirical evidence from European SMEs. *Small Business Economics*, *54*, 285-302.

Chan, H.K., Yee, R.W., Dai, J., and Lim, M.K. (2016). The moderating effect of environmental dynamism on green product innovation and performance. *International Journal of Production Economics,* 181, 384-391. doi:10.1016/j.ijpe.2015.12.006.

Chang, H.L. (2011). Developing supply chain dynamic capability to realise the value of Inter-Organisational Systems. *International Journal of Internet and Enterprise Management*, *7*(2), 153-171.

Chen, R. (2024). Sustainable supply chain management as a strategic enterprise innovation. *Advances in Economics, Management and Political Sciences*, 85, 24-29. doi:10.54254/2754-1169/85/20240831

Chuan, C. L., and Penyelidikan, J. (2006). Sample size estimation using Krejcie and Morgan and Cohen statistical power analysis: A comparison. *Jurnal Penyelidikan IPBL*, *7*(1), 78-86.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences*, Lawrence Erlbaum, Mahwah, NJ.

Dalton, D.R., Todor, W.D., Spendolini, M.J., Fielding, G.J., and Porter, L.W. (1980). Organisation structure and performance: A critical review. *Academy of Management Review*, *5*(1), 49-64.

Damanpour, F. (1991). Organisational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, *34*(3), 555-590

Dangelico, R.M., Pujari, D., and Pontrandolfo, P. (2017). Green product innovation in manufacturing firms: A sustainability-oriented dynamic capability perspective. *Business Strategy and the Environment*, *26*(4), 490-506. doi: 10.1002/bse.1932

Daugherty, P.J., Chen, H., and Ferrin, B.G. (2011). Organisation structure and logistics service innovation. *The International Journal of Logistics Management*, *22*(1), 26-51.

De Jesus Pacheco, D. A., ten Caten, C. S., Jung, C. F., Navas, H. V. G., and Cruz-Machado, V. A. (2018). Eco-innovation determinants in manufacturing SMEs from emerging markets: Systematic literature review and challenges. *Journal of Engineering and Technology Management*, *48*, 44-63. doi:10.1016/j.jengtecman.2018.04.002

De Jesus, A., and Mendonça, S. (2018). Lost in transition? Drivers and barriers in the eco-innovation road to the circular economy. *Ecological Economics*, 145, 75-89. doi:10.1016/j.ecolecon.2017.08.001

Defee, C.C., and Fugate, B.S. (2010). Changing perspective of capabilities in the dynamic supply chain era. *The International Journal of Logistics Management*, *21*(2), 180-206. doi:10.1108/09574091011071915

Dess, G.G., and Beard, D.W. (1984). Dimensions of organisational task environments. *Administrative Science Quarterly*, 52-73. doi:10.2307/2393080

Eisenhardt, K.M., and Martin, J.A. (2000). Dynamic capabilities: what are they?. *Strategic Management Journal*, *21*(10-11), 1105-1121. doi:10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO; 2-E

Ellonen, H.K., Wikström, P., and Jantunen, A. (2009). Linking dynamic-capability portfolios and innovation outcomes. *Technovation, 29*(11) 753-762. doi:10.1016/j.technovation.2009.04.005

Fartash, K., Davoudi, S.M.M., Baklashova, T.A., Svechnikova, N.V., Nikolaeva, Y.V., Grimalskaya, S.A., and Beloborodova, A.V. (2018). The impact of technology acquisition & exploitation on organisational innovation and organisational performance in knowledge-intensive organisations. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(4), 1497-1507. doi:10.29333/ejmste/84835

Felin, T., and Powell, T.C. (2016). Designing organisations for dynamic capabilities. *California management review, 58*(4), 78-96. Doi:10.1525/cmr.2016.58.4.78

Fettig, K., Gačić, T., Köskal, A., Kühn, A., and Stuber, F. (2018). Impact of industry 4.0 on organisational structures. *International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, 1-8. doi:10.1109/ICE.2018.8436284

Fornell, C., and Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50. doi:10.1177/002224378101800104

Giniuniene, J., and Jurksiene, L. (2015). Dynamic capabilities, innovation and organisational learning: Interrelations and impact on firm performance. *Procedia-Social and Behavioural Sciences*, 213, 985-991. doi:10.1016/j.sbspro.2015.11.515

Grünbaum, N.N., and Stenger, M. (2013). Dynamic capabilities: do they lead to innovation performance and profitability?. *IUP Journal of Business Strategy*, *10*(4), 68-85.

Gupta, A.K., and Gupta, N. (2019). Innovation and culture as a dynamic capability for firm performance: A study from emerging markets. *Global Journal of Flexible Systems Management*, 20, 323-336.

Gupta, H., Kusi-Sarpong, S., and Rezaei, J. (2020). Barriers and overcoming strategies to supply chain sustainability innovation. *Resources, Conservation and Recycling*, 161, 104819. doi:10.1016/j.resconrec.2020.104819

Hair J. J. F., Sarstedt, M., Hopkins, L., and Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European business review, 26*(2), 106-121. doi:10.1108/EBR-10-2013-0128

Hair J.F., Hult, G.T.M., Ringle, C.M., and Sarstedt, M. (2022). *A Primer on partial least squares structural equation modeling (PLS-SEM)*. 3 rd Edition. Thousand Oaks: Sage

Hair, J. F., Ringle, C. M., and Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-151. doi: 10.2753/MTP1069-6679190202

Hair, J. F., Risher, J. J., Sarstedt, M., and Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European business review, 31*(1), 2-24. doi:10.1108/EBR-11-2018-0203

Harun, M.D., Hogset, H., and Mwesiumo, D. (2023). Dynamic capabilities and sustainability performance: Exploring the moderating role of environmental dynamism in the Norwegian fishing industry. *Sustainable Development,* 31, 2636-2655. doi:10.1002/sd.2536

Henseler, J., Ringle, C.M., and Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modelling. *Journal of the Academy of Marketing Science*, 43, 115-135. doi:10.1007/s11747-014-0403-8

Hong, J., Zhang, Y., and Ding, M. (2018). Sustainable supply chain management practices, supply chain dynamic capabilities, and enterprise performance. *Journal of Cleaner Production*, 172, 3508-3519. 10.1016/j.jclepro.2017.06.093

Huang, J.W., and Li, Y.H. (2017). Green innovation and performance: The view of organisational capability and social reciprocity. *Journal of Business Ethics*, 145, 309-324.

Jiao, H., Alon, I., and Cui, Y. (2011). Environmental dynamism, innovation, and dynamic capabilities: the case of China. *Journal of Enterprising Communities, People and Places in the Global Economy*, 5(2), 131-144. doi:10.1108/17506201111131550.

Ju, K.J., Park, B., and Kim, T. (2016). Causal relationship between supply chain dynamic capabilities, technological innovation, and operational performance. *Management and Production Engineering Review*, 7(4), 6-15. doi:10.1515/mper-2016-0031

Klewitz, J., and Hansen, E.G. Sustainability-oriented innovation of SMEs: A systematic review. *Journal of Cleaner Production, 65* (2014) 57-75. doi:10.1016/j.jclepro.2013.07.017.

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration (IJeC)*, *11*(4), 1-10.

Kovaçi, I., Tahiri, A., Bushi, F., and Zhubi, M. (2021). Organisation as a function of management and the types of organisational structures that apply in SMEs in Kosovo. *Quality Access to Success, 22*(181), 3-6.

Krejcie, R.V., and Morgan, D.W., (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement.*

Kusi-Sarpong, S., Gupta, H., and Sarkis, J. (2019). A supply chain sustainability innovation framework and evaluation methodology. *International Journal of Production Research, 57*(7), 1990-2008. doi:10.1080/00207543.2018.1518607

Kyrdoda, Y., Balzano, M., and Marzi, G. (2023). Learn to survive crises: The role of firm resilience, innovation capabilities and environmental dynamism. *Technology in Society,* 74, 102285. doi:10.1016/j.techsoc.2023.102285

Liao, J., Kickul, J.R., and Ma, H. (2009). Organisational dynamic capability and innovation: An empirical examination of internet firms. *Journal of Small Business Management, 47*(3), 263-286.

Martínez-León, I.M., and Martínez-García, J.A. (2011). The influence of organisational structure on organisational learning. *International Journal of Manpower, 32*(5/6), 537-566. doi:10.1108/01437721111158198

Masteika, I., and Čepinskis J. (2015). Dynamic capabilities in supply chain management. *Procedia-Social and Behavioural Sciences,* 213, 830-835. doi:10.1016/j.sbspro.2015.11.485

Mikalef, P., Boura, M., Lekakos, G., and Krogstie, J. (2019). Big data analytics capabilities and innovation: the mediating role of dynamic capabilities and moderating effect of the environment. *British Journal of Management, 30*(2), 272-298. doi:10.1111/1467-8551.12343

Mintzberg, H. (1979). *The structuring of organisation*, Englewood Cliffs: Prentice-Hall.

Nahm, A.Y., Vonderembse, M.A., and Koufteros, X.A. (2003). The impact of organisational structure on time-based manufacturing and plant performance. *Journal of Operations Management, 21*(3), 281-306. 10.1016/S0272-6963(02)00107-9

O'Connor, G.C. (2008). Major innovation as a dynamic capability: A systems approach. *Journal of Product Innovation Management, 25*(4), 313-330. doi:10.1111/j.1540-5885.2008.00304.x

Rauter, R., Globocnik, D., & Baumgartner, R. J. (2023). The role of organisational controls to advance sustainability innovation performance. *Technovation*, 128, 102855. doi:10.1016/j.technovation.2023.102855

Rindova, V.P., and Kotha, S. (2001). Continuous "morphing": Competing through dynamic capabilities, form, and function. *Academy of Management Journal, 44*(6), 1263-1280. doi:10.5465/3069400

Sarstedt, M., Ringle, C.M., and Hair, J.F. (2017). Partial least squares structural equation modelling, In C. Homburg, M. Klarmann, A. Vomberg (Eds.), *Handbook of Market Research*, Heidelberg: Springer.

Singh, B., and Rao, M.K. (2016). Effect of intellectual capital on dynamic capabilities. *Journal of Organizational Change Management, 29*(2), 129-149. doi:10.1108/JOCM-12-2014-0225

Singh, R., Charan, P., and Chattopadhyay, M. (2019). Dynamic capabilities and responsiveness: moderating effect of organisational structures and environmental dynamism. *Decision, 46*(4), 301-319.

Spector, P.E. (2019). Do not cross me: Optimising the use of cross-sectional designs. *Journal of Business and Psychology, 34*(2), 125-137.

Storer, M., and Hyland, P. (2009). Dynamic capabilities and innovation in supply chains, In *Enhancing the Innovation Environment: Proceedings of the 10th International CINet Conference* (pp. 912-923). The Continuous Innovation Network (CINet).

Teece, D.J. (2000). Strategies for managing knowledge assets: The role of firm structure and industrial context. *Long Range Planning, 33*(1), 35-54. doi:https://doi.org/10.1016/S0024-6301(99)00117-X

Teece, D.J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal, 28*(13), 1319-1350. doi:10.1002/smj.640

Teece, D.J., Pisano, G., and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509-533. doi:https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO; 2-Z

Vasilenko, L., and Arbačiauskas, V. (2012). Obstacles and Drivers for Sustainable Innovation Development and Implementation in Small and Medium Sized Enterprises. *Environmental Research, Engineering & Management/Aplinkos Tyrimai, Inžinerija ir Vadyba, 60*(2), 58-66. doi:10.5755/j01.erem.60.2.1242

Verma, P., Kumar, V., Daim, T. and Sharma, N.K. (2023). Design thinking framework toward management control system in environmental dynamism: An innovation perspective, *IEEE Transactions on Engineering Management*, 71, 4955-4970. doi:10.1109/TEM.2023.3238665

Wang, C.L., and Ahmed, P.K. (2004). The development and validation of the organisational innovativeness construct using confirmatory factor analysis. *European Journal of Innovation Management, 7*(4), 303-313. doi:10.1108/14601060410565056

Wang, C.L., and Ahmed, P.K. (2007). Dynamic capabilities: A review and research agenda. *International Journal of Management Reviews, 9*(1), 31-51. doi:10.1111/j.1468-2370.2007.00201.x

Wendra, W., Sule, E.T., Joeliaty, J., and Azis, Y. (2019). Exploring dynamic capabilities, intellectual capital and innovation performance relationship: Evidence from the garment manufacturing. *Business: Theory and Practice*, 20, 123-136.

Wilden, R., Gudergan, S.P., Nielsen, B.B., and Lings, I. (2013). Dynamic capabilities and performance: strategy, structure and environment. *Long Range Planning, 46*(1-2), 1-50. doi:10.1016/j.lrp.2012.12.001

Wilhelm, H., Schlömer, M., and Maurer, I. (2015). How dynamic capabilities affect the effectiveness and efficiency of operating routines under high and low levels of environmental dynamism. *British Journal of Management, 26*(2), 327-345. doi:10.1111/1467-8551.12085

Wilkesmann, M., and Wilkesmann, U. (2018). Industry 4.0 – organising routines or innovations?. *Journal of Information and Knowledge Management Systems, 48*(2), 238-254.

Wong, K.K.K. (2019). *Mastering partial least squares structural equation modeling (PLS-Sem) with Smartpls in 38 Hours*, IUniverse.

Wu, H., Chen, J., and Jiao, H. (2016). Dynamic capabilities as a mediator linking international diversification and innovation performance of firms in an emerging economy. *Journal of Business Research, 69*(8), 2678-2686. doi:10.1016/j.jbusres.2015.11.003.

Yang, Q., Li, S., and Qiao, J. (2023). How does supply chain learning influence supply chain innovation performance? A survey based on strategy-structure-capabilities-performance perspective. *International Journal of Logistics Research and Applications*, 1-24. doi:10.1080/13675567.2023.2192913

Yıldız, E. (2021). *Structural equation modeling reflective and formative structures with SmartPLS*, 2nd Edition. Ankara: Seçkin Publishing.