

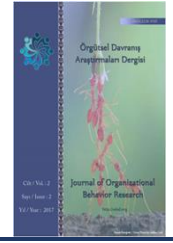


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IMPACT OF SUPPLY CHAIN TRACEABILITY ON SUSTAINABLE AND ECONOMIC PERFORMANCE WITH MEDIATING ROLE OF DYNAMIC CAPABILITY

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ABSTRACT

Supply chain management encompasses all movements and storage of raw materials, work-in-progress inventory, and finished products from the initial point to the end-consumer. Supply chain management flows from suppliers to customers, and understanding the dynamics of the system, considering all elements and interactions within the supply chain, can lead to performance improvements. This research aims to investigate the impact of supply chain traceability on sustainable performance and economic performance, with the mediating role of dynamic capability in food industry companies located in Yazd Province. The study is descriptive, survey-based, and applied in nature.

The population of this research includes employees of selected food industry companies located in Yazd Province. The sample size was calculated using an 8.8 multiplier, resulting in a sample of 201 participants. The data collection tool was a standardized questionnaire. The reliability of the questionnaire was assessed using the Cronbach's alpha method. To analyze and evaluate the data, descriptive statistics were initially examined, followed by inferential analysis using structural equation modeling. The analysis was conducted using Amos24 software.

The results indicate that supply chain traceability has a significantly positive effect on sustainable performance, economic performance, and dynamic capability in food industry companies located in Yazd Province. Additionally, dynamic capability positively influences sustainable performance and economic performance. The mediating role of dynamic capability was confirmed in the study.

Keywords: Supply chain traceability, Sustainable performance, Economic performance, Dynamic capability.

INTRODUCTION

In manufacturing systems, traceability refers to tracking a product or a batch of it throughout its life cycle and circulation. Traceability is a common theme in production, independent of the type of product and production process. The manufacturing industry, faced with the physical constraints of global trade, has embraced modern information technologies to optimize trade processes and achieve integration with supply chain partners dispersed geographically (Shambayati et al., 2022). Each process in the supply chain, including production, packaging, transportation, and distribution, holds its specific information within the supply chain for each product. For comprehensive traceability, all necessary information, ranging from raw material specifications to product sales, must be collected and made accessible. Additionally, for the analysis and optimization of production processes, complementary information must be gathered at each stage (Asadnejad et al., 2014).



Today, financial stability is among the topics that have garnered attention from researchers and economists. Therefore, it is essential to identify the variables influencing financial stability to achieve desired outcomes. The profound advancements in management knowledge and the existence of a robust financial system have become inevitable. Organizations, if lacking satisfactory financial performance, are bound to face failure. The evaluation of financial performance can serve as a guarantor for the execution of organizational goals and its development and progress. New conditions in the global economy have led to the formation of conflicting economic goals and expectations within organizations.

Financial performance is a central topic in all organizational analyses, and an organizational conception without the assessment and measurement of performance is problematic. Evaluating and measuring financial performance enhances system intelligence and motivates individuals towards desirable behavior, constituting a fundamental part of formulating and implementing organizational policies. The economic goal is to increase income, the environmental goal is to reduce greenhouse gas emissions from production and transportation, and the social goal is to reduce employment changes (Sarkeshiki et al., 2022).

Global competition encourages all industries to continuously develop their products and processes to achieve sustained performance. Knowledge is recognized as the most effective and powerful tool for long-term sustainability and growth. The adoption of the Supply Chain Visibility (SCV) system and a better understanding of the supply chain through organizational management and production have emerged as the most potent tools for improving organizational performance (Sang et al., 2019). Dynamic capabilities enable organizations to be impactful in the face of ongoing changes.

In the food products industry in Yazd Province in recent years, several industrial units have become active, offering a range of innovative products. These companies, in pursuit of improving the quality of their products and ensuring consumer health, have obtained national standards for product production, quality management standards, and research and development licenses from the Ministry of Industries in the past years. They have experienced and seasoned specialists in the quality control unit of production and, using modern methods and precise laboratory tools, examine and monitor products, delivering them to the market. What distinguishes these companies is the use of modern equipment and advanced technology, along with adherence to all hygiene principles in all stages of production. They maintain initial quality using natural and high-quality raw materials, leading their products to be in demand from all over Iran and the world. Based on this, the aim of this research is to examine the impact of supply chain traceability on sustainable performance and economic performance with the mediating role of dynamic capability.

Theoretical Foundations of the Research

Dynamic Capability

Dynamic capabilities refer to an organization's ability to integrate, build, and reconfigure internal and external capabilities in response to rapid environmental changes. In the face of changing external environments to maintain competitive advantage, organizations must renew



their valuable resources. Dynamic capabilities provide organizations with the ability to be impactful amid continuous changes (Haghighi Kafash et al., 2017).

Supply Chain Traceability Capability

Supply chain traceability capability is the ability of a system to report on the current status or history of products. In manufacturing systems, traceability refers to tracking a product or a batch of it throughout its life cycle and circulation. The necessity of identifying products, obtaining information about them to recognize healthy and high-quality products, and distinguishing them from low-quality and counterfeit products has led to the acceptance of traceability as a requirement by governments and customers for most products today (Farati et al., 2011). Mo (1998) believes that traceability is the capability to trace the history of a product throughout the production chain or a part of it, from raw materials to transportation to the factory, warehouse, production process, distribution, and sales. The definition of traceability follows a dual perspective, focusing first on the feature that enables tracking the current location of transportation and subsequently on recording and tracking parts, processes, and resources used in production using serial numbers or batch numbers.

Economic Performance

One of the crucial and vital aspects of any economic activity is the assessment of the extent to which predefined goals are achieved. Undoubtedly, with the continuous advancement of economic activities, the need for more accurate and realistic evaluation methods is felt, leading to the introduction of innovative assessment methods and the enhancement of older ones (Ferguson, 2005). Stuart claims that economic value added is a performance measurement metric aimed at calculating the value of a company. This metric indicates the remaining profit after deducting capital expenses and is an effective indicator in assessing the quality of managerial policies and the sustainability of how a company's value grows in the future. Managers believe that the process and results of calculating economic value added create a new perspective on business performance (Chen et al., 1997).

Sustainable Performance

A company can create value when its management approach includes various characteristics, especially in terms of integrating economic, environmental, and social dimensions. The presence of stakeholders with conflicting and heterogeneous interests increases the demand for multidimensional measures. According to stakeholders' perceptions of a company, it can sustain its activities by being able to create, maintain, and enhance stable and enduring relationships with all its stakeholders, which is achieved through sustainable performance measurement and management (Sajadi et al., 2014). Corporate sustainability is defined as responding to present needs without harming the ability of future generations. It encompasses five dimensions: economic, governance, social, ethical, and environmental, focusing on long-term considerations (Rezaei and Homayoun, 2014). Corporate sustainability, as an evolving management concept, is considered a suitable alternative to traditional profit maximization methods in the short term. In reality, no company is entirely sustainable, as corporate sustainability is viewed as an ongoing improvement process (Pich and Pfef, 2004).



Research Background

The research by Jalalian et al. (2021) aimed to investigate the relationship between green management and economic, environmental, and social performance. Results obtained through structural analysis indicated a significant positive correlation between green management and economic, environmental, and social performance, with the intensity of the relationship between green management and environmental performance being greater than the other two dimensions of sustainable performance.

Khodayari et al. (2021) explored the impact of environmental turbulence and dynamic capabilities on sustainable competitive advantage, considering the mediating role of entrepreneurial marketing in Kalleh Company. The results demonstrated a positive and significant effect of environmental turbulence on sustainable competitive advantage and entrepreneurial marketing. Additionally, dynamic capabilities were found to have a positive and meaningful impact on both sustainable competitive advantage and entrepreneurial marketing.

The objective of Izadyar et al.'s (2020) article was to present an evaluation model of the performance of sustainable supply chain management practices in the automotive supply chain using a dynamic systems approach. The research findings indicated that improvement scenarios in comprehensive quality management, on-time production performance, and flexible transportation lead to a more sustainable supply chain. The results suggest an enhancement of sustainability in the supply chain through the implementation of these scenarios.

Ghazinoori et al. (2019) addressed the escalating uncertainties in the environment, such as sanctions, government regulations, rent-seeking of state-owned companies, and economic instability, particularly currency rate fluctuations, which have increased the level of uncertainty and challenges in the IT industry.

Ghaedi et al. (2019) aimed to investigate the combination of sustainable supply chain management and the theory of dynamic capabilities and their impact on the economic, social, and environmental performance of Iranian steel industry companies. The results revealed that sustainable supply chain management actions positively and significantly affect economic, social, and environmental performance. However, dynamic capabilities of the supply chain only influence environmental performance, establishing a positive relationship between sustainable supply chain management actions and dynamic capabilities.

Farati et al. (2018) delved into examining the impact of hospital dynamic capabilities on collaboration with suppliers and the performance of the hospital supply chain, focusing on the direction of technological orientation. The results indicated that collaboration with hospital suppliers has a direct and significant effect on the performance of the hospital supply chain. The four dimensions of dynamic capabilities also have a meaningful impact on collaboration with hospital suppliers. Technological orientation has a direct and significant effect on collaboration with hospital suppliers, but its moderating effect between collaboration with hospital suppliers and the four dimensions of dynamic capabilities was not confirmed.

Bari et al. (2022) conducted a comprehensive systematic literature review (SLR) following the PRISMA guidelines, using the dynamic capabilities theory to demonstrate that routines and



strategic competencies, unified value chains, sustainability-based transformations, and strategic organizational developments are effective drivers for effective development.

Ghani et al. (2022) aimed to investigate the role of supply chain flexibility in mediating the relationship between a company's supply chain capability and the sustainability of supply chain performance. The results showed that supply chain capability has a positive relationship with supply chain flexibility. The supply chain flexibility of a company also has a positive correlation with its sustainable supply chain performance. Supply chain flexibility plays an intermediate role in the relationship between a company's supply chain capabilities and the sustainability of its supply chain performance.

Anvar et al. (2022) sought to provide a systematic review of the literature on various aspects of the implementation of information tracking models and supply chain sustainability in economic, social, environmental, technological, institutional, and infrastructural dimensions.

Zhao et al. (2021) aimed to explore how tracking methods precisely enhance a company's sustainable performance. The results showed that (1) input tracking performance, process tracking performance, and output tracking performance have a significantly positive effect on the sustainable performance of the company. (2) Dynamic capabilities play a partial mediating role in the relationship between the three aforementioned tracking methods and sustainable performance. (3) Environmental dynamism has a moderating effect on the relationship between dynamic capabilities and sustainable performance. With increased environmental dynamism, dynamic capabilities have a stronger positive impact on the sustainable performance of the company.

Upon reviewing library sources and reputable websites, as well as conducting interviews with managers and experts in the field, no simultaneous study on the investigation of supply chain tracking capability, sustainable performance, economic performance, and dynamic capabilities has been conducted. In conclusion, this research employs structural equation modeling as its methodology, a technique suitable for examining relationships between latent and observable variables. Using the structural equation modeling approach, it is possible to investigate the relationships between latent variables and the measurement indicators of each relevant variable.

Theoretical Framework

Sustainability has evolved into a key theme in strategic corporate programs. Elkington (1998) proposed the triple bottom line theory, suggesting the concept of balancing economic, environmental, and social issues from a holistic perspective. In recent years, companies have shown increased attention to public concerns that go beyond economic performance. Consequently, companies adopt environmental and social missions, reflecting these approaches and outcomes in their corporate social responsibility reports. Thus, sustainable performance is considered as a holistic and integrated outcome of environmental and social activities affecting a company's performance in three dimensions: economic sustainability, environmental sustainability, and social sustainability (Bleady et al., 2018).

As an extension of the resource-based view, dynamic capabilities theory introduces resources and capabilities that companies may need to address rapidly changing environments (Tseng et al., 2016). Dynamic capabilities not only help organizations acquire the ability to understand



product markets but also adapt themselves through sustainable methods (Aslam, 2020). Through such capabilities, companies can create better long-term goals, formulate strategies and management knowledge, and ultimately establish unique competitive advantages (Irfan et al., 2019). Dynamic capabilities categorize these abilities into three coherent categories: sensing, seizing, and reconfiguring (Teece, 2007).

Among these, sensing refers to identifying and evaluating opportunities for sustainability. Seizing involves mobilizing internal and external resources or capabilities to respond to opportunities and extract value from them. Reconfiguring refers to the continuous updating and scheduling of resources to keep the company's resource base compatible with changes in the business environment (Teece, 2007). By implementing tracking capabilities, companies can enhance their dynamic sensing capabilities to adapt to changes in the environment. On the one hand, tracking programs improve the ability to understand changes in the external environment (Song and Yang, 2019), enabling companies to quickly adapt to the rapidly changing market environment and contribute to identifying opportunities and threats as well as optimizing the customer experience.

Companies utilize tracking systems along with a multitude of other management, marketing, and safety/quality control tools. Alfaro and Rabadán (2009) referred to the potential of tracking systems as a marketing tool that can be used to identify market opportunities and improve product quality. On the other hand, companies can not only develop deep tracking resources but also obtain traceable technology, equipment, and knowledge that are not available externally through tracking strategies (Engelseth et al., 2014), and reconfigure these resources to ultimately improve all dynamic capabilities. The conceptual model of the research is presented in Figure (1).

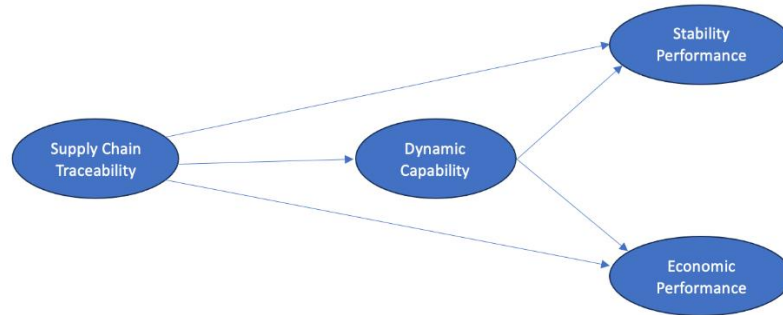


Figure 1 .Conceptual Model

MATERIALS AND METHODS

The present study is considered applied in terms of its objective and descriptive-survey in terms of its method. The target population consisted of employees from various companies under the umbrella of the Yazd Food Industries, including Neshat Avar Yazd Food Industries, Shirin Asal,

Shirin Kala, Hamrah Bahar Yazd, and Zin Food Industries, totaling 420 individuals. In structural equation modeling methodology, the sample size can be determined between 5 to 15 observations per measured variable. According to the coefficient of 8.8 times the number of questionnaire items, the sample size was determined to be 201 individuals.

Simple random sampling was used to distribute the questionnaires. Data collection was performed using questionnaires on the traceability capability variable adapted from Song and Yang (2019), the sustainable performance variable from Abed et al. (2017), and the economic performance variable from Paul and Savi (2011), and Wang and Dai (2018). The internal reliability was assessed using Cronbach's alpha coefficient, calculated using SPSS software.

Structural equation modeling software is employed for the multivariate analysis of the gathered data.

Hypotheses

1. The traceability capability in the supply chain significantly and positively affects the sustainable performance in food industry companies located in Yazd Province.
2. The traceability capability in the supply chain significantly and positively affects the economic performance in food industry companies located in Yazd Province.
3. The traceability capability in the supply chain significantly and positively affects the dynamic capability in food industry companies located in Yazd Province.
4. The dynamic capability significantly and positively affects the sustainable performance in food industry companies located in Yazd Province.
5. The dynamic capability significantly and positively affects the economic performance in food industry companies located in Yazd Province.
6. The dynamic capability significantly and positively mediates the relationship between traceability capability in the supply chain and sustainable performance in food industry companies located in Yazd Province.
7. The dynamic capability significantly and positively mediates the relationship between traceability capability in the supply chain and economic performance in food industry companies located in Yazd Province.



RESULTS AND DISCUSSION

The sample included 109 males and 92 females, totaling 201 individuals. Among them, 46% were females, and males constituted 54% of the sample population. The majority belonged to the bachelor's degree group with 98 individuals, followed by the master's degree and above group with 88 individuals. The lowest number was associated with the less than diploma and diploma group, with 15 individuals. In terms of age, the highest number was in the over 36 years old group with 98 individuals, while the lowest number was in the 20-25 years old group with 3 individuals. It is observed that 42% of the age group is 31-35 years old, 49% are over 36 years old, 7% are 26-30 years old, and 1% are 20-25 years old.

Table (1) shows that the KMO statistic is 0.906, indicating an acceptable level.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.906
Bartlett's Test of Sphericity	Approx. Chi-Square	1128.646
	df	253
	Sig.	.000

In this study, the questionnaire's validity was confirmed by industry experts. In the factor analysis, questions with low communalities were removed. By gradually performing this test, starting from the question with the lowest communalities, all questions in the final questionnaire had communalities above 0.45. Table (2) shows the value of the Cronbach's alpha reliability test.

Table 2. Test Statistic Values of Cronbach's Alpha for Research Variables

Cronbach's Alpha	Variable	Symbol
.76	Supply Chain Traceability	RZ
.707	Stability Performance	AP
.726	Economic Performance	AE
.733	Dynamic Capability	GP
.72	Total	

Figures 2 to 3 depict the output of factor loads for the model and overall research model. Figure 2 illustrates the measurement model.

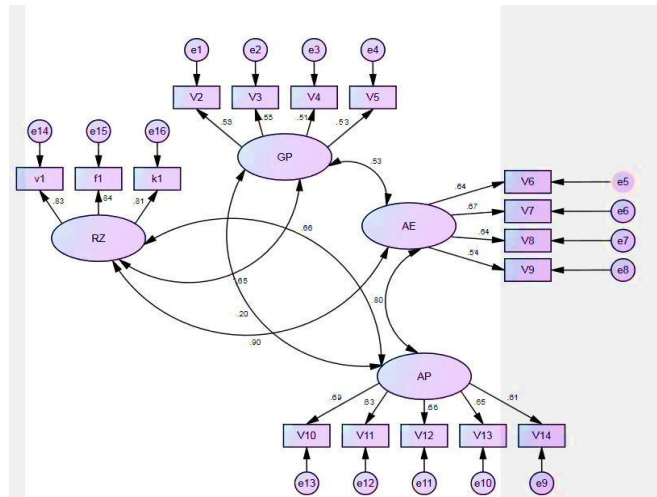


Figure 2. Initial Measurement Model

Table 3. Values of Fit Indices for Initial Model

Model	RMR	GFI	AGFI	PGFI
Default model	.053	.931	.904	.678
Model	NFI	RFI	IFI	CFI
Default model	.835	.879	.954	.952
Model	RMSEA			
Default model	.040			

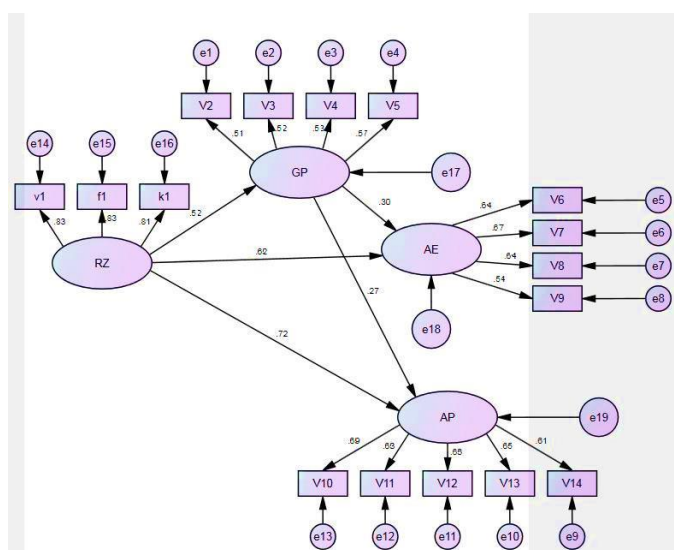


Figure 3. Software Output of the Conceptual Model in Standardized Form

Regression weights, standardized effect coefficients, and factor loads are observed in Table 4. All factor loads exceed 0.3.

Table 4. Regression Weights - Standardized Structural Coefficients and Factor Loads

			Estimate
GP	<---	RZ	.918
AE	<---	GP	.509
AP	<---	GP	.672
AE	<---	RZ	.382
AP	<---	RZ	.724

Table 5 displays the absolute fit index values.

Table 5. Absolute Fit Index Values

Value	Abbreviation	Acceptable Fit Levels
Absolute Fit Indices		
0,928	GFI	Confirm
0,902	AGFI	Confirm
0,003	RMR	Confirm
Comparative Fit Indices		
0,832	NFI	Confirm
0,900	CFI	Confirm
0,902	IFI	Confirm
Economical Fit Indices		
0,04	RMSEA	Confirm
3,026	CMIN/DF χ^2 / df	Confirm

Table 6. Hypothesis Results

Result	Path Coefficient	Critical Value	Significance Level	Hypothesis
Confirm	0,72	2,47	0,042	Traceability capability on stability performance in food industry companies located in Yazd province has a significant and positive effect.
Confirm	0,62	2,76	0,006	Traceability capability on economic performance in food industry companies located in Yazd province has a significant and positive effect.
Confirm	0,52	3,87	0,000	Traceability capability on dynamic capability in food industry companies located in Yazd province has a significant and positive effect.
Confirm	0,27	3,49	0,036	Dynamic capability on stability performance in food industry companies located in Yazd province has a significant and positive effect

Confirm	۰/۳۰	۲/۰۲	۰/۰۲۹	Dynamic capability on economic performance in food industry companies located in Yazd province has a significant and positive effect.
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CONCLUSION

The objective of the current study is to examine the impact of supply chain traceability on sustainability and economic performance with the mediating role of dynamic capability. The findings reveal that the traceability capability of the supply chain has a significant and positive effect on sustainability performance in food industry companies located in Yazd province. The tracking methods are closely related to a company's sustainability performance. Tracking systems that monitor both physical entities and their less tangible characteristics are increasingly utilized in the contemporary food supply chain to address a wide range of regulatory and business objectives, including growing ethical concerns. The traceability capability is acknowledged as a tool for managing unfair transaction practices and ensuring the safety of production processes. In addition to enhancing the efficiency of the supply chain and tracking environmental impacts, tracking methods can contribute to positive social outcomes by increasing employee capabilities, creating a conducive environment for the surrounding community, and enhancing social reputation.

By exchanging traceability capability information with key suppliers in real-time, such as unforeseen production changes, a focal company can take actions to adjust or modify production plans, maximize resource utilization efficiency, and reduce low-value activities. This finding is consistent with previous research by Lee and Klassen (2008), Zaid et al. (2018), Rahman et al. (2017), and Barling et al. (2009).

Moreover, the results demonstrate that supply chain traceability significantly and positively influences economic performance in food industry companies located in Yazd province. The impact of output traceability on the sustainability performance of a factory is primarily reflected in three aspects. Firstly, output traceability capability can lead to an improvement in economic sustainability performance. Companies that implement output traceability can quickly learn and share lower-tier inventory, logistics, and end-customer destination plans, enhancing transaction efficiency, preventing production duplication, ensuring product transparency, and protecting consumer rights for information. The company can clearly indicate potential logistics costs and product storage costs in the downstream network, which helps optimize the cost structure of products. Additionally, implementing output traceability capability can create new business opportunities by reducing product risk, improving market share, and returning capital through providing information to customers and regulators.

Secondly, by monitoring raw material and product resources, as well as production and distribution processes, to understand components or chemical elements in purchased products, companies can enhance product quality. This finding is aligned with the research of Ang and Cheng (2014), Alfaro et al. (2009), and Matcher et al. (2018).



Furthermore, the results indicate that supply chain traceability significantly and positively affects dynamic capability in food industry companies located in Yazd province. Through the implementation of traceability capabilities, companies can enhance their dynamic sensor capabilities to adapt to changes in the environment. Tracking programs improve the ability to understand changes in the external environment, allowing companies to quickly adapt to the rapidly changing market environment, identify opportunities and threats, and optimize the environment. Companies use tracking systems along with a multitude of other management, marketing, and safety/quality control tools. The tracking system can be referred to as a marketing tool that can be used to identify market opportunities and improve product quality. On the other hand, not only can they develop deep tracking resources, but they can also obtain tracking technology, equipment, and knowledge capabilities that are not readily available externally through tracking strategies. These resources can be reconfigured to ultimately improve all dynamic capabilities. This result is consistent with the research of Wang et al. (2010), Hubbs (2004), and Alfaro and Rabadan (2009).

The results demonstrate that dynamic capability has a significant and positive effect on sustainability performance in food industry companies located in Yazd province. In today's context, considering the increasing importance of knowledge-based economies and the shift away from oil-centric economies as the primary approach of governments for sustainable economic growth and subsequent economic development, knowledge-based companies, as the pulsating heart of this type of economy, are inevitably required to establish and sustain their operations. These companies, to adapt to environmental changes and dynamic conditions, and to ensure their survival and continuity in a highly competitive world accompanied by innovation intensity in technologies and the provision of knowledge-based products, need capabilities to reach key competencies and, consequently, sustainable competitive advantages through the development of these capabilities.

The results also indicate that dynamic capability has a significant and positive impact on economic performance in food industry companies located in Yazd province. Company performance encompasses all the achievements that all businesses, as organizations, obtain. Since financial performance has significant limitations in measuring the intangible performance value of a company accurately, composite indicators - instead of single indicators based on financial performance - that include non-financial performance data are used. The literature in this field indicates that perceived comparative performance, such as profitability, growth, market share, etc., serves as a good indicator of a business's superiority. The theory of dynamic capabilities aims to create an appropriate response in new conditions, considering the development, reconfiguration, and renewal of resources and capabilities of companies in turbulent environments. This result aligns with the research conducted by Noroozi et al. (2022).

Furthermore, the results show that dynamic capability significantly moderates the relationship between supply chain traceability capability and sustainability performance in food industry companies located in Yazd province. The degree of environmental changes also affects a company's ability to adapt resources to new needs. Dynamic capabilities are context-dependent, and different environments imply different effects of dynamic capabilities. Environments with higher dynamism encourage companies to use dynamic capabilities to reconfigure business



models for better alignment with the environment. This result is consistent with the research by Yuan et al. (2021).

The findings also reveal that dynamic capability significantly moderates the relationship between supply chain traceability capability and economic performance in food industry companies located in Yazd province. Dynamic capability is a key factor in achieving competitive advantage and, consequently, superior performance. Dynamic capabilities are defined as the "ongoing directional behavior of a company to integrate, reconfigure, renew, and reconstruct resources and capabilities, and most importantly, to upgrade and reconstruct the core capabilities of companies in response to a changing environment to achieve and maintain a competitive advantage." This result aligns with the research conducted by Ferreira et al. (2020).

One limitation of this research is that it is cross-sectional and responses were collected at a single point in time. Considering the results, it is recommended to formulate laws and regulations related to how corporate sustainability performance disclosure and integrated reporting should be done. Creating the necessary and effective infrastructure for potential investors to invest in growing companies in the current and future years is also recommended. Since these companies can be acquired at a lower cost and generate higher economic value-added. Identifying the knowledge needed by the organization, increasing the acquisition of necessary knowledge from external sources, identifying knowledge from internal sources used by the organization, transferring external knowledge to become internal resources, and using existing knowledge to create new knowledge are recommended. Given that knowledge management can play a role in organizational dynamism, the company should strive to create the necessary infrastructure for the proper implementation of knowledge management and access to available information among employees and stakeholders. It is advisable for the company to periodically align its goals and plans with the level of practical innovations of similar companies globally. It is suggested to employ independent work groups in specific knowledge areas during in-service courses.



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