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Innovative Design of Digital Transformation Model (Case Study: Food Packaging Industry)

Mojgan Gharibi Marzankola [1], Sayyed Mohammad Reza Davoodi [2*], Mohammad Reza Dalvi [3]

Abstract
A fundamental transformation has occurred in businesses due to digital technologies, so no business is an exception to this rule. Due to the vital role of food packaging industries from economic, social and environmental perspectives, this study was conducted with the aim of Innovative design of digital transformation model in food packaging industries. The food packaging industry has been investigated as a case study in this study.The present study was conducted based on interpretive philosophy[4] and with an inductive approach[5]. Also, the present study is an applied-developmental study in terms of objective, and it is a non-experimental (descriptive) research in terms of data collection method. A qualitative research design was used to achieve the research objective. In this study, population includes professors of management and food industry managers. Purposeful sampling (snowball method) was used and theoretical saturation was achieved with 20 participants. The participants of this research include theoretical experts (university professors) and experimental experts (food industry managers). A semi-structured interview and a decision matrix-based questionnaire were used to collect data. The results of qualitative coding were validated with the Holsti method (0.717) and Cohen's Kappa (κ) (0.659). The validity of the questionnaire was confirmed by the formal method and the reliability of the questionnaire was also confirmed by estimating the internal correlation coefficient (0.815). Analysis and coding of the text of the interviews was done using the theme analysis method in MaxQDA 20. Also, structural-interpretive modeling method and MicMac can be used to determine relationships between constructs and model design in the second part. According to the results, the investigated factors and components were grouped in seven levels. These components are: Level 7 components including business resources, digital transformation leadership and digital/sustainable foresight, Level 6 components, including digital/sustainable innovation strategies, the components of level 5, including the use of new technologies in processes and operations, core digital/sustainable capabilities, and employees' digital experience, level 4 components of the model, including a new approach to food packaging industry processes, improving sustainable food packaging functions, and designing innovative food packaging, the level 3 components, including the alignment of the digital/sustainable innovation strategy with Digital/Sustainable Capability and Business Sustainability in the Digital Age, the level 2 components, including the component of improving customer experience (digital/sustainable), and finally, the "consequences of digital transformation" component with an sustainability-driven innovation approach in the food industry.
Keywords: *Digital transformation, Innovation approach, Sustainability, Food packaging industries*

Introduction

Nowadays, a major change is happening in the world, an innovations & evolving-based technologies change that will have a significant impact on people's lives, the thinking and structure of organizations, and

[1.] PhD Candidate of Technology Management, Department of Management, Dehaghan Branch, Islamic Azad University, Dehaghan, Iran.
[2*.] Associate Professor, Department of Management, Dehaghan Branch, Islamic Azad University, Dehaghan, Iran. (Corresponding author: smrdavoodi@ut.ac.ir)
[3.] Associate Professor of Business Administration, Department of Management, Dehaghan Branch, Islamic Azad University, Dehaghan, Iran.

even the interactions of countries (Mirfallah Leyalistani and Khamseh, 2021). This era is called the digital era. Digital transformation refers to the process through which individuals can adapt to modern technologies (Mirfallah Layalestani and Khamseh, 2021). Traditional business beliefs have changed fundamentally in the digital age due to the emergence of new technologies. Keeping up with existing changes is the only option for organizations to advance; otherwise, they will be eliminated from the competitive scene (Zamani and Khamseh, 2022). Disruptive technologies lead to the digital transformation (DT) of businesses, and digital transformation has entered the business literature as a concept (Tolboom, 2016). According to some researchers, digital transformation refers to the changes that affect all aspects of human life using digital technologies. In this era, organizations must seek to make fundamental changes and transformations and create innovations based on sustainability in their digital transformations. This is essential for their survival in the competitive arena, so that they can maintain their sustainability due to digital transformation, population growth, and the shortage of natural resources, and subsequent social issues. Now, leaders, senior managers, and other stakeholders recognize that organizations, institutions, and industries are being impacted by two fundamental challenges: a) digital transformation, which leads to the creation of new opportunities, and b) sustainability, which has become the main focus of organizations, institutions, and companies. As a result, organizations, institutions, and industries are actively pursuing digital transformation to achieve sustainable development in an unstable and uncertain environment (Xu et al., 2023). In recent years, sustainability has attracted much attention through digital transformation and has been considered as a major focus of organizations and small and medium-sized industries. Digital transformation refers to an important and fundamental strategic path for companies and industries to achieve high-quality development and accelerate their transformation into first-class enterprises (Yang et al., 2024). Also, digital transformation enables organizations and industries to integrate sustainable practices into their operations, enhance resource efficiency, and minimize their ecological footprint.[6] Also, digital technologies can improve the value proposition of businesses by designing products and circular services[7], and as a result, increase product quality and longevity (Atiyeh Khodai et al., 2024). Using technologies such as data analytics, the Internet of Things, and cloud computing, artificial intelligence enables organizations and institutions to optimize energy consumption, minimize waste, and make informed decisions that support sustainable production processes. The digital transformation of industries, as the fourth generation industry, provides opportunities to realize development in new products, processes, and services, and on the other hand, digital strategies can move towards sustainability by improving operational processes as well as optimizing resource use (Verhoef et al., 2021). According to the results of previous studies, there are limitations in previous digital transformation models that as a digital transformation model for how and when an organization or company plans to make strategic improvements to core systems and processes, which do not allow these models to be replicated exactly in various industries. Almost all organizations in various industries have taken numerous steps to adopt digital technologies in recent years, but nevertheless, findings indicate that the desired benefits have not been achieved in

[6] The ecological footprint measures human demand on natural capital, i.e. the quantity of nature it takes to support people and their economies. It tracks human demand on nature through an ecological accounting system.

[7] Circular Services uses innovative technology to improve sortation, processing, and reuse of valuable commodities, including paper, metal, glass, plastics, organics, textiles and electronics for continual reuse in domestic supply chains.

proportion to the organizational investments made (Gerth & Peppard, 2016). It can be said that only 21% of executives have seen meaningful results from the digital transformation of their organization, from manufacturing services to finance and technology. On the other hand, according to the results, the main challenge is not IT, budget or access to extraordinary talent, but rather the barriers to this transformation are change management, risk-averse culture, traditional systems and organizational silos[8]. Also, the leadership, vision, skills, and approach required are often immature and underdeveloped (Genpact, 2016). Due to the growth of new technologies, population growth, scarcity of natural resources and subsequent social issues, today's organizations and industries must inevitably seek to make fundamental changes and transformations and create sustainability-based innovations in their digital transformations in order to maintain their sustainability. Now, senior managers and other stakeholders know that organizations and industries are affected by two fundamental challenges, which are: a) digital transformation that leads to the creation of new opportunities and b) sustainability that has become the main focus of organizations, institutions and companies. As a result, organizations, institutions and industries are actively pursuing digital transformation to achieve sustainable development in an unstable and uncertain environment (Xu et al., 2023). Corporate sustainability has been mainly addressed in existing models; and almost no attention has been paid to the sustainability of manufactured products. Accordingly, the company needs to shift from a marketing focus and attention to customer demands and needs to actively promoting the sale of environmentally friendly goods and services (El Lafjafari et al., 2024). According to Brown (2019), the lack of sufficient knowledge about the dimensions and various factors of this phenomenon and the lack of guidance to guide organizations has prevented organizations and industries from implementing digital transformation projects. Most managers or owners of organizations and industries, stakeholders and investors do not know how to face a digital transformation due to fear of failure and often do not even move towards transformative technologies. Unfortunately, most managers do not identify the critical capabilities of their organization or industry, these capabilities can lead the organization in process innovation, product innovation and management innovation, and lead the organization towards sustainability (Teichert, 2019).

In fact The importance of digitization[9] and digital transformation is always a subject that is increasingly discussed among researchers, researchers and scientific experts in various fields. Due to the interest of businesses in the concepts and practical benefits of digital transformation for business, the scientific world seeks to conceptualize digital transformation and its interrelationship with business management, organization, open innovation, sustainability and other concepts (Robertsone and Lapiņa, 2023: 1). Studies indicate that digital transformation has a significant impact on the production activities of companies. This phenomenon has the potential to improve internal management and reduce production costs (Deng et al., 2022) and it can offer businesses with distinct competitive advantages around the world (Pauliuk et al., 2022). It can also help companies to create dynamic capabilities to make them more compatible with changes in the external environment (Lee et al., 2021). Digital transformation leads to facilitating the improvement of existing products, services, and processes, and the introduction of new services (Wu et al., 2021) to meet rapidly changing market needs, and thereby ensuring sustainable development based on continuous innovation (Kim et al., 2021). Digital transformation

[8] In business, organizational silos refer to business divisions that operate independently and avoid sharing information.

[9] Digitalization focuses on using digital technologies to improve processes and operations.

leads to the strengthening of innovation, because it requires the acquisition of new knowledge and skills, requires new forms of cooperation in different organizations and industries, promotes the creation of new business models, and leads to the sustainable use of organizational resources (Mayakova, 2019).

Also, innovation promotes changes and makes them real (Robertson. & Lapiņa, 2023). Digital transformation naturally refers to a fundamental and fundamental change that completely revises the way companies and industries operate, design, develop, produce, sell products and provide services (Prokhin, 2020). Therefore, it is driven by innovation. Also, innovation refers to a set of small but impactful ideas for continuous improvement that help companies and industries to achieve higher levels of efficiency and sustainability. These improvement ideas can be created inside the organization or borrowed from outside (Robertson. & Lapiņa, 2023). Digital transformation removes boundaries and allows suppliers and customers to integrate in the creation of innovation (Gassmann et al., 2010), where customers are a valuable source of ideas that may lead to innovation (Oganisjana and Kozlovskis, 2019).

From a corporate point of view, sustainability is a balance between many economic, social and environmental factors affecting the company and its performance, which ensures sustainable development (Beltrami et al., 2021).

The trend of international companies has changed due to the advancement of digital technologies, such as the Internet of Things (IoT)[10], process automation[11], robotics, and 3D printing, and has contributed to their sustainability, development, and survival in the global market (Martínez-Peláez., 2023). Sustainability has emerged as a vital aspect of digital transformation in recent years, and has a significant impact on various economic sectors, including agriculture (Di Vaio, 2023). The transformative changes in digital transformation are accompanied by fundamental consequences for the performance, organizational capabilities and strategic orientation of small and medium-sized companies in the pursuit of environmental sustainability (Bartolacci, 2020). The paradigm of sustainable digital transformation should provide internal and external benefits for the company (Rupeika-Apoga, 2022). Also, it should promote greater economic, human, environmental and social responsibility through business practices. Sustainability-driven innovation[12] based on are defined as management systems, development of processes, products to meet organizational needs in economic, social and environmental dimensions (Behnam et al., 2018).

Food industry is one of the industries where sustainability is very important. For this reason, many companies active in this field have put sustainability at the top of their food product packaging (Nair et al., 2023). The use of digital technologies has saved costs, reduced waste, increased health and the possibility of recycling product packages. Therefore, digital technologies can be of great help for packaging in the food industry (Polyakov et al., 2020).

Although much research has been done on digital transformation and sometimes digital transformation models, it is essential to need a structure to create a specific digital transformation for the food packaging industry, considering the nature and specific characteristics of the food packaging industry

[10] The term IoT, or Internet of Things, refers to the collective network of connected devices and the technology that facilitates communication between devices and the cloud, as well as between the devices themselves.

[11] Process automation is defined as the use of software and technologies to automate business processes and functions in order to accomplish defined organizational goals, such as producing a product, hiring and onboarding an employee, or providing customer service.

[12] The term 'sustainability-driven innovation' describes new or improved products, services or processes that reduce the use of natural resources (such as materials, energy, water and land) and the release of harmful substances into the environment. It can also refer to marketing solutions that achieve these same goals.

(standards governing this industry, generating foreign exchange for the country, technological, uncertainty in production planning and inventory management, industry foresight, stakeholder pressure, environmental conditions, etc.). The innovation of the research includes creating a specific digital transformation model for the food packaging industry, and the other is that sustainability in economic, environmental and social matters can be achieved by creating innovation in processes and packaging. Therefore, although sustainability and digital transformation are among the most fundamental issues in the food packaging industry, and this industry is of great importance both in terms of profitability and environmental and social aspects, previous research shows that there is no model that specifically designs digital transformation for the food packaging industry. Therefore, this research seeks to design an innovative digital transformation model in the food industry. For this reason, qualitative and quantitative methods (mixed approach) of interpretive structural modeling were used to identify and examine the relationships between the factors effective in the innovative design of the digital transformation model in the food industry. Therefore, the present study answers the key question, "How is the innovative design of the digital transformation model in the food packaging industry?"

Theoretical foundations of research

Digital innovations and initiatives have become a fundamental and important challenge for organizations and industries in today's constantly changing environment. The challenge that transformative technologies are the basis of, and given the competitive environment, this challenge is not specific to a specific industry and almost all organizations and industries are involved in it. This challenge is known as digital transformation. Although the term digital transformation is widely used in the scientific literature, there is no consensus on the definition of this term (Nadeem et al., 2018). Digital transformation refers to a significant change in the performance of a country or an organization centered on transformative technologies. In a comprehensive definition, digital transformation is defined as "the use of new digital technologies such as: social media, cloud computing, mobile applications, Internet of Things, data analytics, blockchain and artificial intelligence to significantly improve business in the field of operational processes and create new business models". The entire organization or industry is the scope of digital transformation, where all dimensions must be redefined in the digital age by applying transformative technologies. But, "What exactly does digital transformation mean and why and how can industries bring about this transformation?" This transformation includes fundamental changes in operational routines, business processes, organizational capabilities, as well as a different presence in today's and new markets (Noori et al., 2019). Organizational transformation generally involves changes in structure, strategy, and distribution of power. Therefore, digital transformation is specifically the impact of information technology on information flow, organizational structure, routines, and organizational capabilities in order to adapt to technology. Therefore, the term transformation refers to the comprehensive actions that an organization must take in the face of new technologies, and this transformation is an organization-wide digital transformation strategy that goes beyond departmental thinking, and takes a holistic view of the risks and opportunities arising from technology, and this digital transformation strategy guides the organization on its journey towards digital transformation. As mentioned, digital transformation is not simply the acquisition and deployment of digital technology, but also refers to an approach to management issues such as human resources, business process redesign, and business development. It can be said that most today's organizations and industries are engaged in creating a specific model for the digital transformation

of their business, but they need to identify their strengths and weaknesses in order to properly utilize their digital capabilities before starting the digital transformation (Schwaferts & Baldi, 2018).

Digital transformation: Digital innovations and initiatives have become a fundamental and important challenge for organizations and industries in today's constantly changing and evolving environment. A transformative technologies-based challenge that is not specific to only one special industry considering the competitive environment and almost all organizations and industries are involved in it. An era where they can interact with each other and even humans through Internet connections, with the help of the Internet of Things, various applications and devices (Babaei et al., 2022).This challenge is known as digital transformation. Although the term digital transformation is widely used in scientific literature, there is no consensus on the definition of this term (Nadeem et al., 2018). The term Fourth Industrial Revolution is the Latin translation of " Industrie 4.0 (in Germany)", which was proposed in 2011 during a high-tech project in Germany's state industries in Hanover. This term expressed a new generation of industry based on intelligentization and the use of technology that emerged after the previous three periods of the industrial revolution (Adadm et al., 2024). According to Boffa and A. Maffei(2024: 2), digital transformation leads to a fundamental change in industry technologies, which provides the possibility of creating a connected smart factory. You (2022) in another study concluded that digital transformation is based on digital technology that leads to unique changes in operations, processes and value creation. Imran et al. (2021) provided another definition of digital transformation: "Digital transformation refers to the process of adapting to changes in digital technology and organizational practices to improve services and products, enhance customer experiences, gain competitive advantage, create new processes, and innovate business models.

Digital transformation refers to a deep change in the functioning of transformative technologies-based country or an organization. We can claim digital transformation when these technologies have changed the business models, the experiences of the stakeholders and the operational processes of the organization in a favorable way. Digital transformation in an organization or industry means building an organization or industry at the level of the digital age. This phenomenon in the organization refers to new organizational capabilities that can guarantee the success of that organization in this era.

Operational definition of digital transformation: Research findings show that this term refers to the score that research participants consider for the subcomponents of digital roadmap, digital governance, organization, digital resources, improvement in productivity and operations of the food packaging industry, changes in the organization, differentiation in strategies to gain competitive advantage, improvement of environmental policies and individual safety, community security and health, new digital/sustainable services and products, smart packaging technology, and optimal food packaging design.

Innovation approach: Researchers have examined innovation from different angles. Innovation can be defined as "turning opportunities into new ideas and bringing those ideas to practical application and finally to the market" (Tidd& Bessant, 2011). Innovation strategy refers to a management term that supports a set of potentially innovative external and internal activities and functions. It oversees a set of structured, comprehensive and creative activities that are developed in order to support the future growth of the organization (Carrasco et al., 2023). The innovation strategy must be aligned with the company's overall strategy to be most effective. Also, companies can differentiate their innovation strategy based on two types of exploitation strategy, which refers to current technologies and tasks, and exploratory strategy, which consists of new

or radical technologies and tasks (Koehgivi, 2021). According to recent developments, innovation is a compelling means to increase sustainability in businesses (Horn and Brem, 2013).

Operational definition of innovation approach: Research findings show that this term refers to the score that research participants consider for the subcomponents of creating digital innovations, creating sustainable innovations, creating digital innovation value, digital innovation processes, green process innovation, customized and personalized packaging, sustainable and environmentally friendly food packaging design, interactive packaging design, optimal packaging design, coordination, balance, and complementarity.

Sustainability: The term sustainability refers to continuity and stability, but in the 21st century, it refers to peaceful cooperation between human life and the environment. Sustainability is a process that involves policymakers, individuals, organizations, the environment and natural resources and includes changes in trends, behaviors, purchasing habits, consumption patterns and how the environment is perceived and valued by society.

The sustainability movement quickly included various organizational concepts, including product packaging (Trinh et al., 2023). Packaging is very important and refers to the imagery of the product. Packaging forms the first direct contact with the customer, which is largely responsible for providing a favorable mental imagery of the product.

This package includes identifying, describing, protecting, displaying, promoting, facilitating product movement and product cleanliness (Elkhattat & Medhat, 2022). Sustainable packaging refers to environmentally friendly practices used to package, store, ship, or shelf products. It is a new way of packaging products, which is made of recyclable and environmentally friendly materials (Liu et al., 2023). Sustainable packaging refers to environmentally friendly practices used to package, store, ship, or shelf products. It is a new way of packaging products that is made of recyclable and environmentally friendly materials (Liu et al., 2023).

Operational definition of sustainability: Research findings show that this term refers to the score that research participants consider for the subcomponents of political-legal, economic, application of new technologies, socio-cultural, functional food packaging, sustainable computing, sustainable execution, sustainable attachment, product and service, social factors, environmental factors, digital marketing mix.

Food packaging industries: packaging is known as one of the principles of product supply and has been accompanied by many changes over the years, which is still changing (Ramji and Sabbaghpour Langroudi, 2019: 6). In the past, the only protection of a product, the packaging, was considered acceptable, while after some time, the advantages of durability, printability and beauty were added to it (Asadi Khansari and Dehghani Firouzabadi, 2013). The industrial revolution faced the world with the introduction of various industrial goods. The development and expansion of packaging led to the independence of this industry from other industries and the competition and need caused the packaging industry to allocate a significant share of the budgets of manufacturing companies. Today, the packaging industry has become a powerful technology.

An industry called the food packaging industry was introduced to the world due to the human need to maintain the health and quality of consumed food, which has developed with the increasing population (Drago et al., 2020). So far, several definitions have been presented. of packaging, but in general, packaging can be defined as "protection to preserve the health of the packaged product and ultimately guarantee the health of the consumer from the time of receipt to the time of consuming the product (Eskandari et al., 2022: 17). Packaging while protecting the product from

the adverse effect of biological, physical and chemical factors makes it easier to transport and reduce its costs, increase economic productivity, reduce waste and increase marketability (Eskandari et al., 2022: 17). The food packaging industry is very wide in the world and is considered one of the industries that the modern lifestyle needs a lot. In the field of food packaging, in addition to the fact that the product is prepared for storage, marketing and distribution, it faces a problem called packaging hygiene. Hygiene in all areas of packaging is a factor that should be considered, but it is especially important in the field of food packaging. Food packaging refers to the art and science of preparing food for storage and eventual sale. Packaging should be as simple and cheap as possible, and it should also have the primary purpose of packaging, i.e. protection and attractiveness. Food packaging is of great interest in the marketing of the food industry as well. Also, it is used to prevent damage and possible food manipulations during transportation.

The food packaging industry is very wide in the world and is considered one of the industries that the modern lifestyle needs a lot. In the field of food packaging, in addition to the fact that the product is prepared for storage, marketing and distribution, it faces a problem called packaging hygiene. Compliance with hygiene in all areas of packaging is considered as a factor that should be taken into account, but it is especially important in the field of food packaging. Food packaging is defined as "the art and science of preparing food for storage and eventual sale". The packaging should be as simple and cheap as possible, and should also have the primary purposes of packaging, i.e. protection and attractiveness. Food packaging is of great interest in the marketing of the food industry as well. Also, it is used to prevent damage and possible food manipulations during transportation.

Research Background

Modarresi Yasman et al. (2023) designed a conceptual framework for digital soft components using content analysis. This study was qualitative, and was conducted using content analysis and its information sources included articles from reputable international databases and journals. 43 samples were selected using purposive sampling. The resulting conceptual framework includes the overarching themes of culture, skills, organization manager, and digital leadership. According to the results, the organization relies on the organization manager as the person who guides and steers the organization's ship for success in digital transformation. Amini et al. (2022) presented an improved methodology for digital transformation of business models in a study. The method of narrative review and action research were used in this study. This improved methodology was used in strategic planning for digital transformation of business model of Resis Sazeh Asia Company. According to the results, the improved framework was used to draw the target company's digital transformation roadmapafter improving the Schallmo framework, the current state, the desired state, the digital gap analysis, and the digital transformation roadmap of the company were developed and approved by the company's expert team for implementation. Firouzbakht and Rezaian (1401) designed and explained the digital transformation model of project-oriented organizations in the Iranian oil and gas industries. This study was an applied research with a mixed exploratory approach. Its qualitative part was carried out by collecting data through in-depth interviews and analyzing data using grounded theory and screening components with the fuzzy Delphi technique. Firoozbakht and Rezaian (2022) designed and explained the digital transformation model of project-oriented organizations in the Iranian oil and gas industries. This study was an applied research with an exploratory approach. The qualitative part was carried out by collecting data through in-depth interviews and analyzing data using grounded theory and screening components with the fuzzy Delphi technique. The interpretive structural modeling technique was used, and PLS

structural equation modeling was used to validate the model. In the quantitative part, the model was designed. Digital transformation causes fundamental changes in the leverage points of operational processes, project services and products, project knowledge, increasing reliability and increasing employee satisfaction and project stakeholder experience. Robertson and Lapina (2023) conducted a study on digital transformation as a facilitator for sustainability and innovation. This study identifies the interrelationships between digital transformation, open innovation, and sustainability. A three-stage methodology was used in this study. A limited review was conducted to develop basic principles and conceptual frameworks for sustainability, digital transformation, open innovation, and their interrelationships to expand the existing body of literature and identify knowledge gaps. As a result, the framework of the interrelationships between digital transformation, open innovation, and sustainability development suggests that digital transformation is an enabling factor for sustainability and open innovation. Martínez-Peláez et al. (2023) examined the role of digital transformation in achieving sustainability: The mediating role of stakeholders, key capabilities and technology. This study aims to identify "how shareholders, leaders, owners or senior managers of SMEs and industries can initiate a sustainable digital transformation project". A systematic literature review was conducted, which included 59 publications from 2019 to 2023. The research identifies the first steps that SMEs can take to get started. Big data technology can provide the most important advantage for SMEs, as it enables the analysis of data (any type). Zhiying Jie et al. (2023) investigated the impact of digital transformation on corporate sustainability: Evidence from listed companies in China. This study investigated "Does digital transformation improve corporate sustainability?". A new analytical framework combines the resource-based view (RBV), the institution-based view (IBV), organizational efficiency theory, and dynamic capability theory to explain the relationship between digital transformation and corporate sustainability. According to the findings, digital transformation is considered an important tool to improve corporate sustainability, but this relationship is affected by heterogeneous factors of ownership, industry, and location.Ilaria Guandalini (2022) reviewed a paper titled "Sustainability through Digital Transformation: A Systematic Literature Review to Guide Research". This paper identified the relationships between sustainability and digital transformation to further focus companies and organizations on the topic of "How can digital transformation help improve and advance sustainability?". This study pioneered a systematic review of 153 academic articles with the aim of a) integrating existing research, b) understanding thematic connections between different studies, and c) identifying research gaps in the study of "digital sustainability".According to the results of the review of past studies and literature, especially in the country, industries should pay more attention to sustainability issues due to adverse environmental conditions. Considering the fact that corporate green production is increasing with emphasis on environmental sustainability and social responsibility (Wang.X and Shi.X, 2024: 3). Food packaging industries are required to comply with this point, also companies should reduce their environmental impact as the main consumers of resources and pollutants (Ran et al..: 2023). According to the results of the past literature, the subject of sustainable packaging has been less studied from the perspective of digital transformation with an innovative view, and there is also a consensus regarding the issues of packaging sustainability. Therefore, this study seeks to design a digital transformation model with an innovation approach based on sustainability in the food packaging industry using an approach based on an exploratory mixed research design.

Research Methodology

The present is based on interpretive philosophy from a philosophical perspective, and was done with an inductive approach. Also, in terms of its purpose, it is an applied-developmental study that seeks to design a digital transformation model with an innovation approach based on sustainability in the food packaging industry. This study is considered as a non-experimental (descriptive) research from the point of view of the data collection method. A qualitative research design was used to conduct the research. In this study, the population includes theoretical experts (university professors) and experimental experts (food industry managers). According to the view of Miller et al. (2010), five criteria of keyness, popularity, theoretical knowledge, variety, motivation to participate were used to select the participants. The selection criteria for theoretical experts are at least ten years of teaching in the field of marketing and food industry or having scientific publications in the form of books and articles in this field. Also, well-known, motivated and experienced activists and managers of the food industry who had graduate degrees were also selected.

The samples were selected in the qualitative part of this study using purposive sampling and by snowball method. The sampling process continued until reaching theoretical saturation. Repetition was observed in the coding results after 19 interviews, but to avoid false theoretical saturation, 1 more interview was also conducted, and at the end after 20 interviews, it was ensured that theoretical saturation was achieved. Interviews and questionnaires were used to collect research data. Since semi-structured interviews are more suitable for qualitative studies that are conducted with the purpose of exploration and pattern design (Danaeifard et al., 2021), semi-structured interviews with experts were used in this research as well. Then, a decision matrix - based questionnaire was also used to design the structural model of the research. The validity of the qualitative part was evaluated and confirmed from the judges' point of view based on Guba and Lincoln's proposal, Four-Dimensions Criteria (FDC) of credibility, dependability, confirmability and transferability. Holsti's method[13] was used to check the reliability of the qualitative part and coding of the conducted interviews. The text of the interviews conducted in two stages was coded for this purpose. Then, the percentage of observed agreement (PAO) was calculated:

$$\mathrm{PAO} = \frac{2\mathrm{M}}{\mathrm{N1} + \mathrm{N2}} = \frac{2 * 214}{319 + 278} = 0.717$$

In the above formula, M is the number of common coding cases between two coders. In this equation, N1 and N2 are the number of all coded items by the first and second coders, respectively. PAO value is between zero (no agreement) and one (complete agreement) and if it is greater than 0.6, it is favorable. The value of PAO in this study is 0.717, which is greater than 0.6. Also, Cohen's kappa was estimated to be 0.659 and greater than 0.6. Therefore, the reliability of the qualitative part is desirable. Also, the internal Intraclass correlation (ICC) was estimated at 0.815 to determine the reliability of the structural-interpretive modeling, which is between 0.75 and 0.9 and shows that there is a good reliability. The theme analysis method is the main method used in the qualitative section, and by using this method, the themes of the innovative Desingn Model of the digital transformation model were identified. MaxQDA 20 was used, and the structural-interpretive modeling method was used to perform theme analysis. In the second part. MicMac was used to perform structural-interpretive modeling calculations.

[13] Holsti's method is a way to measure how much coders agree with each other when they are not coding the exact same sections of the data.

Findings

The demographics of food industry experts are presented in Table 1:

Table 1.
Demographic characteristics of food industry experts

Percentage	Frequency	Demographic characteristics	
30%	6	Theoretical experts (university professors)	**Expertise**
70%	14	Experienced experts (food industry managers)	
75%	15	Male	**Gender**
25%	5	Female	
10%	2	Less than 40 years	**Age**
40%	8	40 to 50 years	
50%	10	50 years and more	
40%	8	Master's degree	**Education level**
60%	12	Ph.D	
50%	10	15 to 20 years	**Work experience**
50%	10	Over 20 years old	
100%	20	Total	

The text of the interviews was coded and analyzed using thematic analysis (theme) with the the six-step method of Attride-Stirling (2001). 210 codes were identified in the open coding stage. In the end, 14 main themes and 61 basic themes were obtained through axial coding. Table 2 shows the innovative design themes of digital transformation model extracted from the interviews using thematic analysis method.

Table 2.
Innovative Design Thems of the Digital Transformation Model

Sub-theme	Main theme
1. Political-legal	Digital/Sustainable Foresight
2. Economic	
3. Using new technologies	
4. Socio-cultural	
5. Functional food packaging	
6. Digital roadmap	Digital transformation leadership
7. Digital governance	
8. Organization	
9. Digital resources	
10. Financial resources and conditions	Business resources
11. Organizational resources	
12. Digital resources	
13. Creating digital innovations	Digital/sustainable innovation strategies
14. Creation of sustainable innovations	
15. Creating the value of digital innovation	
16. Digital innovation processes	
17. Green process innovation	
18. Marketing, selling digital products and services	Using new technologies in processes and operations
19. Digital support	
20. Digital marketing mix	
21. Digital factory	
22. Digital innovation infrastructure	Core digital/sustainable capabilities
23. Digital innovation capabilities	
24. Organizational capability to promote sustainable development	
25. Strategy	Employee digital experience

Sub-theme	Main theme
26. Leadership	
27. Technology	
28. Physical environment	
29. Cultural	
30. New food packaging methods and techniques	A new approach to food packaging industry processes
31. Improving the executive process of the food packaging industry using artificial intelligence	
32. Recovery of existing processes with an innovative approach	
33. Improving the processes of the food packaging industry	
34. Improving skill performance	Improving the sustainable performance of food packaging
35. Improving protection performance	
36. Improving the performance of the retainer	
37. Improving transportation performance	
38. Improving the notification function	
39. Improving sales performance	
40. Improving safety and health	
41. Customized and personalized packaging	Designing innovative food packaging
42. Sustainable and environmentally friendly design of food packaging	
43. Interactive packaging design	
44. Optimum packaging design	
45. Coordination	Alignment of digital/sustainable innovation strategy with digital/sustainable capabilities
46. Balance	
47. Complementarity	
48. Stable computing	Business sustainability in the digital age
49. Sustainable implementation	
50. Stable attachment	
51. Products and services	Improvement in customer experience (digital/sustainable)
52. Social factors	
53. Environmental factors	
54. Digital marketing mix	
55. Improvement in productivity and operations of food packaging industries	Consequences of digital transformation
56. Changes in the organization	
57. Differentiation in strategies to gain competitive advantage	
58. Improving environmental policies and safety of people, security and health of society	
59. New digital/sustainable services and products	
60. Smart packaging technology	
61. Optimal design for food packaging	

The Interpretive structural modelling (ISM)[14] was used in order to present the research model. The relationship pattern between the identified indicators was determined using the symbols listed in Table 3.

[14] Interpretive structural modelling (ISM) is a well-established methodology for identifying relationships among specific items, which define a problem or an issue. This approach has been increasingly used by various researchers to represent the interrelationships among various elements related to the issue.

Table 3.
Symbols used in interpretive structural modelling (ISM)

O	X	A	V	Symbol
There is no significant relationship.	Two-way relationship	Construct j has a significant effect on i.	Construct i has a significant effect on j.	Relationship

The relationships of comprehensive structures are characterized by four symbols V (variable I has a significant effect on j), A (variable j has a significant effect on i), X (two-way relationship), and O (There is no significant relationship.) (Habibi and Afridi, 2021). A structural self-interaction matrix (SSIM) was formed by identifying the relationships of the indicators. The Structural Self-Interaction Matrix, SSIM is presented in Table 4.

Table 4.
The Structural Self-Interaction Matrix, SSIM of the research model

D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	SSIM
V	V	V	V	V	V	V	V	V	V	V	X	X		D01
V	V	V	V	V	V	V	O	V	V	V	X			D02
V	V	V	O	V	V	V	V	V	V	V				D03
V	V	V	V	V	V	V	V	V	V					D04
V	O	V	V	V	V	V	X	X						D05
V	V	V	V	V	V	V	X							D06
V	V	V	V	V	V	V								D07
V	V	V	V	X	X									D08
O	V	V	V	X										D09
V	V	V	V											D10
V	V	X												D11
V	V													D12
V														D13
														D14

The Reachability matrix, Reachability matrix (RM): The reachability matrix is obtained by transform- ing the structural self-interaction matrix into a two-valued matrix of zero and one. In the RM, the main diameter is equal to one. Also, secondary relationships should be controlled for certainty. That is, if A leads to B and B leads to C, then A must lead to C. That is, if direct effects should have been included based on secondary relationships, but this did not happen in practice, the table should be corrected, and the secondary relationship should also be considered. The final access matrix is presented in Table 5.

Table 5
The final access matrix of the research model

D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	RM
1	1	1	1	1	1	1	1	1	1	1	1	1	1	D01
1	1	1	1	1	1	1	0	1	1	1	1	1	1	D02
1	1	1	0	1	1	1	1	1	1	1	1	1	1	D03
1	1	1	1	1	1	1	1	1	1	1	0	0	0	D04
1	0	1	1	1	1	1	1	1	1	0	0	0	0	D05
1	1	1	1	1	1	1	1	1	1	0	0	0	0	D06
1	1	1	1	1	1	1	1	1	1	0	0	0	0	D07
1	1	1	1	1	1	1	0	0	0	0	0	0	0	D08
0	1	1	1	1	1	1	0	0	0	0	0	0	0	D09

D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	RM
1	1	1	1	1	1	1	0	0	0	0	0	0	0	D10
1	1	1	1	0	0	0	0	0	0	0	0	0	0	D11
1	1	1	1	0	0	0	0	0	0	0	0	0	0	D12
1	1	0	0	0	0	0	0	0	0	0	0	0	0	D13
1	0	0	0	0	0	0	0	0	0	0	0	0	0	D14

"Achievement set" and "prerequisite set" should be identified after forming the access matrix to determine relationships and level indicators. For the Ci variable, the Achievement set (output or effects) includes the variables that can be reached through the Ci variable. The prerequisite set (inputs or effects) consists of the variables through which the variable Ci can be reached.

Table 6.
Set of inputs and outputs to determine the level

D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	TRM
1	1	1	1	1	1	1	1	1	1	1	1	1	1	D01
1	1	1	1	1	1	1	1*	1	1	1	1	1	1	D02
1	1	1	1*	1	1	1	1	1	1	1	1	1	1	D03
1	1	1	1	1	1	1	1	1	1	1	0	0	0	D04
1	1*	1	1	1	1	1	1	1	1	0	0	0	0	D05
1	1	1	1	1	1	1	1	1	1	0	0	0	0	D06
1	1	1	1	1	1	1	1	1	1	0	0	0	0	D07
1	1	1	1	1	1	1	0	0	0	0	0	0	0	D08
1*	1	1	1	1	1	1	0	0	0	0	0	0	0	D09
1	1	1	1	1	1	1	0	0	0	0	0	0	0	D10
1	1	1	1	0	0	0	0	0	0	0	0	0	0	D11
1	1	1	1	0	0	0	0	0	0	0	0	0	0	D12
1	1	0	0	0	0	0	0	0	0	0	0	0	0	D13
1	0	0	0	0	0	0	0	0	0	0	0	0	0	D14

According to the results of the calculations, the sequence of constructs in this research is as follows:

The "Consequences of digital transformation with a sustainability-driven innovation approach in the food industry (D14)" construct is at level 1.

The "Improvement in customer experience (digital/sustainable) (D13)" construct is at level 2.

The "Alignment of digital/sustainable innovation strategy with digital/sustainable capability (D11)" construct is at level 3.

The "Business sustainability in the digital era (D12)" construct is at level 3.

The "New approach to food packaging industry processes (D08)" construct is on level 4.

The "Improving sustainable practices of food packaging (D09)" construct is at level 4.

The "Innovative food packaging design (D10)" construct is at level 4.

The "Using new technologies in processes and operations (D05)" is at level 5.

The "Core Digital/Sustainable Capabilities (D06)" construct is at level 5.

The "Employee Digital Experience (D07)" construct is at level 5.

The "Digital/sustainable innovation strategies (D04)" construct is at level 6.

The "Digital/Sustainable Foresight (D01)" construct is at level 7.

The "Digital Transformation Leadership (D02)" construct is at level 7.

The "Business Resources (D03)" construct is located at level 7.

The research model is presented in Figure 1:

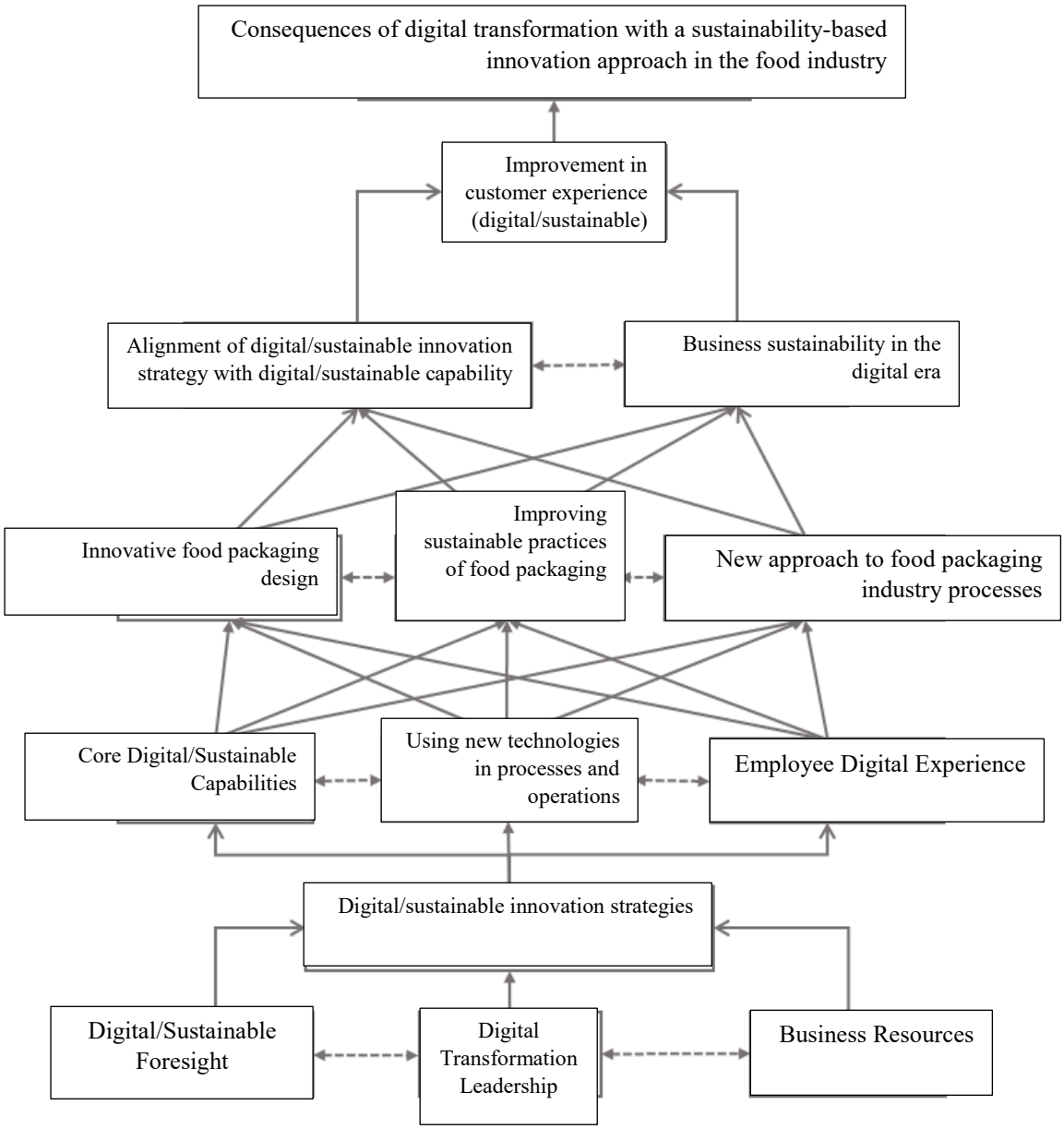

Figure 1. *Innovative design of a Digital transformation model in the food packaging industry*

The set of inputs and outputs for each element is used in the formation of the influence-dependence matrix (MICMAC analysis). The influence-dependence matrix was presented in Table 7. In the model (ISM), the interrelationships and influence between the criteria and the relationship of the criteria of different levels were well shown, which leads to a better understanding of the decision-making environment by managers. In order to determine the key criteria, the influence and dependence of the criteria are formed in the final access matrix.

Table 7.
Influence power and dependency degree of the research model

Level	Influence power	Dependence degree	Research structures
7	14	3	Digital/Sustainable Foresight (D01)
7	14	3	Digital transformation leadership (D02)
7	14	3	Business Resources (D03)
6	11	4	Digital/sustainable innovation strategies (D04)

Level	Influence power	Dependence degree	Research structures
5	10	7	Using new technologies in processes and operations (D05)
5	10	7	Core Digital/Sustainable Capabilities (D06)
5	10	7	Employee Digital Experience (D07)
4	7	10	A new approach to food packaging industry processes (D08)
4	7	10	Improving sustainable practices of food packaging (D09)
4	7	10	Designing innovative food packaging (D10)
3	4	12	Alignment of digital/sustainable innovation strategy with digital/sustainable capabilities (D11)
3	4	12	Business sustainability in the digital age (D12)
2	2	13	Improvement in customer experience (digital/sustainable) (D13)
1	1	14	Consequences of digital transformation (D14)

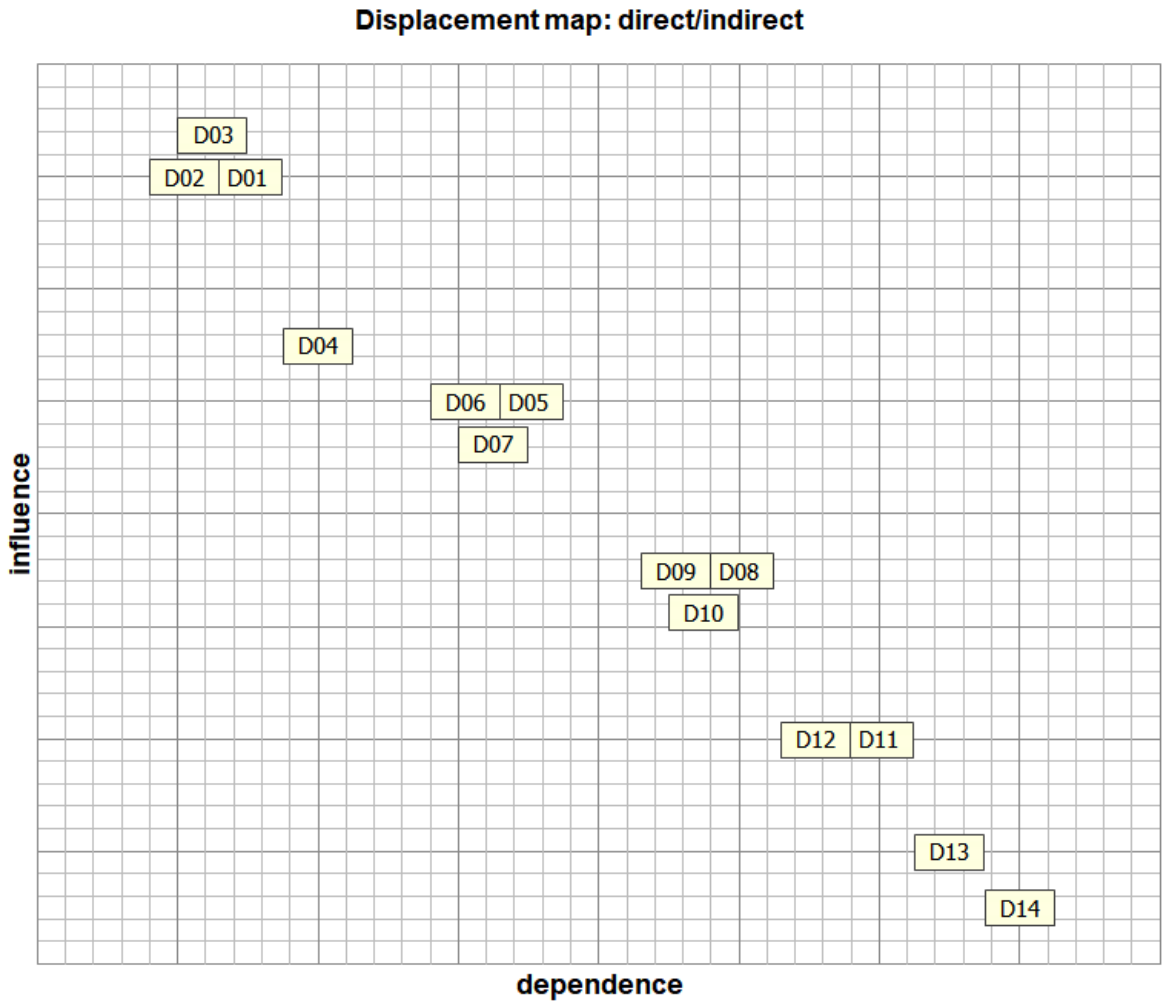

Figure 2. *Influence power and dependency degree diagram of the research model*

According to the Influence power and dependency degree diagram, the constructs of "digital / sustainable foresight" (D01), "digital transformation leadership " (D02), "business resources "(D03), "digital / sustainable innovation strategies" (D04), "using new technologies in processes and operations" (D05), "Core Digital/Sustainable Capabilities" (D06), "Employee Digital Experience" (D07) have high influence power, and low dependency, and were placed in the category of independent constructs.

The constructs of "A new approach to food packaging industry processes" (D08), "Improving Sustainable Food Packaging Practices" (D09), "Designing Innovative

Food Packaging" (D10), "Aligning Digital/Sustainable Innovation Strategy with Digital/Sustainable Capability" (D11), "Business Sustainability in the digital age" (D12), 'improvement in customer experience (digital/sustainable)" (D13), "consequences of digital transformation" (D14) also have high dependence but low influence, so they are in the dependent constructs section. No construct was placed in the first quadrant, which is the Autonomous area, and the third quadrant, which is the connected area.

Conclusion and Discussion

The present study was conducted with the aim of designing an innovative digital transformation model.. The results of this analysis show that the level 7 components including business resources, digital transformation leadership and digital/sustainable foresight have a significant impact on the level 6 component including digital/sustainable innovation strategies. According to the results presented by Denicolai, Stefano & Previtali (2023): Digital innovation is a product-oriented approach that includes a combination of physical and digital characteristics to present and produce a new product. It was also shown that the mentioned component has a significant impact on level 5 components, including the use of new technologies in processes and operations, core digital/sustainable capabilities, and employees' digital experience .In this regard, the results of the study by Xing Jie et al. (2023) showed that digital transformation is considered an important tool for improving corporate sustainability, but this relationship is influenced by heterogeneous factors of ownership, industry and location.. The previous components have a significant impact on the components of level 4 of the model, including a new approach to the processes of the food packaging industry, improving the sustainable functions of food packaging and designing innovative food packaging, and they have a significant impact on the components of level 3, including the alignment of the digital/sustainable innovation strategy with Digital/sustainable capability and business sustainability in the digital age. In this regard, the results of the study by Martinez-Plaza et al. (2023) showed that big data technology can provide the most important advantage for small and medium-sized companies, as it allows for the analysis of data (any type).

In this regard, Koh Givi (1401) showed in a study that the innovation strategy is actually a framework for innovations, ideas and creativity to ensure that the effort, energy and cost of the company are spent in the right direction. This strategy must be aligned with the company's overall strategy to be most effective. Also, companies can differentiate their innovation strategy based on two types of "exploitation strategy", which refers to current technologies and tasks, and "exploratory strategy", which consists of new or radical technologies and tasks.

Finally, the results showed that the aforementioned components had a significant impact on level 2, including the component of improving the customer experience (digital/sustainable), and finally, all components lead to achieving the results of digital transformation with a sustainability-driven innovation approach in the food industry.

In this regard, the results of the study by Firouzbakht and Rezaian (2022) showed that digital transformation has created fundamental changes in the leverage points of operational processes, project services and products, project knowledge, increased reliability, and increased employee satisfaction and project stakeholder experience.

According to the results of the research, the following recommendations are presented:

In the field of "digital/sustainable foresight", it is suggested that the economic dimension in the food Packing industry should also be taken into account while paying attention to the political-legal dimensions. The best way to achieve economic development is to pay special attention to comparative economic advantages, as all planning and spending in

this area will fail in the absence of a systematic perspective (Dolabi et al., 2020). In this regard, it is important to examine the state of competition laws, the state of social security and pay attention to the legal rights of customers, and the degree of stability of the government and its support of foreign trade facilitation regulations to achieve the goals of digital/sustainable foresight.

In the field of "digital transformation leadership", it is suggested to develop a digital vision first and then develop a digital strategy to create a digital road map. Planning and coordination and supervision and control and monitoring are required to achieve digital governance in this field and can be achieved with the help of organization that includes digital leaders, organizational structure, digital work environment, digital partners and digital culture.

In the field of "business resources", it is suggested to check the economic status of the organization, the financial status for digital transformation activities in order to strengthen financial resources and conditions. Also, it is important to strengthen the existing organizational structure, employee relations, digital skills of employees, support of the senior manager, which are considered organizational resources as well as business resources. Providing digital resources based on organization's infrastructure and equipment, organization's hardware and software resources, organization's current technology programs are also recommended to improve performance in this field.

In the field of "digital/sustainable innovation strategies", it is suggested to create sustainable innovations by creating digital innovations and digital technology management (transaction platform development, innovation platform development, two-speed information technology, innovation risk management). This type of innovation includes product innovation, environmental innovation, production innovation, social innovation and industry technology innovation.

In the field of "using new technologies in processes and operations", it is suggested to provide digital product support while considering marketing, selling digital products and services. In this context, it is important to create digital buying and selling channels with the help of smart information technology and application website design.

In the field of "core digital/sustainable capabilities", it is suggested to address digital innovation capabilities while strengthening the infrastructure of digital innovation and things such as access, transparency and information security, advanced analysis of artificial intelligence and automation of activities. This important issue has gained meaning with the capacity to absorb and accept digital innovation and predict trends and technologies, and create organizational capability to promote sustainable development also has a significant impact on the establishment of digital transformation with a sustainability-driven innovation approach in the food packaging industry.

In the field of "digital employee experience", it is suggested to pay attention to strategy and leadership more than any other action. Improving the digital experience of employees is possible by using strategic elements focused on the digital experience of employees, continuous re-engineering of processes with the help of a long-term approach along with clarifying and operationalizing goals, continuous investment in people and managers and supporting different ideas of employees and it leads to the improvement of the performance of the food packaging industry. It is also recommended to consider the technology factor and elements such as the attractiveness of technology, technology acceptance and service convenience and ease of using technology. In addition to the mentioned cases, it is important to create a physical and cultural environment and elements such as physical and technological facilities and equipment according to the needs of employees, intelligence of the work environment along with flexibility and agility.

In the field of ‘a new approach to the processes of the food packaging industry”, it is suggested that the improvement of the implementation process of the food packaging industry with the help of artificial intelligence is also investigated while promoting the new methods and techniques of food packaging.

In the field of improving the sustainable performance of food packaging, it is suggested that appropriate measures be taken to improve the skill performance and improve the protection performance based on the industry. Skill performance improvement from industry perspective refers to enabling product distribution and from customer perspective refers to packaging or physical properties of packaging.

In the field of "innovative food packaging design", it is suggested to get guidance from specialists and experts in this field for customized and personalized packaging along with sustainable and environmentally friendly design of food packaging. In fact, personalization is the process by which your packaging is designed to meet the needs of the consumer in a customized and exclusive way.

In the field of "alignment of digital/sustainable innovation strategy with digital/sustainable capabilities", it is suggested to take necessary measures to coordinate between business needs and digital innovation, the dynamics of problems and solutions in the organization, and finally create a sustainable competitive advantage with digital/sustainable innovations. The mentioned items along with the consistency and coherence of the allocation of resources to digital capability and innovation, the flexibility of digital capability is meaningful in interaction with the innovation strategy and the transparency of powers and responsibilities in the field of digital/sustainable innovation, and can be achieved with the complementarity of innovation and digital capability programs and measures, support of innovation programs by digital capabilities and adjustment of innovation programs and digital capabilities.

In the field of "business sustainability in the digital era", it is suggested to pay special attention to the field of sustainable computing and sustainable execution. Green computing (the mutual relationship between the environment and digital technologies), social computing (the mutual relationship between society and digital technologies) and business computing (the mutual relationship between business and digital technologies) have a significant impact on digital transformation with an innovation approach based on sustainability in the industry. food packaging, and lead to the creation of stable attachment and pillars such as environmental attachment, customer attachment and social attachment.

In the field of improvement in customer experience (digital/sustainable), it is suggested to pay attention to the dimension of social factors while paying attention to the dimension of products and services (technological features (utility dimension), product/service experience, customer support, customized services, service environment, experience sensory, stable or intelligent and controllable product). In this dimension, the aspects of communication, quality of interaction, social experience, social environment, customer interaction with providers, service, social experience with other customers, the presence of other customers and the quality of exchange are of great importance and are influenced by environmental factors such as the service environment experience), online environment, amenities and sensory factors.

Finally, positive consequences such as improvement in productivity and operations of food packaging industries, changes in the organization, differentiation in strategies to gain competitive advantage, improvement of environmental policies and safety of people, security and health of society, new digital/sustainable services and products, intelligent packaging technology, optimal design of food packaging will not be far from expected through the use of digital marketing

mix and paying attention to the effective elements in the digital transformation model with an innovation approach based on sustainability in the food packaging industry.

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