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Key Barriers to Achieving Innovation in Edible Oil Companies: An Importance–Performance Map Analysis (IPMA) in a Developing Country

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Keywords:
Innovation barriers, Importance-performance map analysis (IPMA), Content validity ratio (CVR), Edible oil.

Objective: This study aimed to identify innovation barriers in Iranian edible oil manufacturing companies, screen the most relevant barriers, and prioritize them for improvement and resolution.

Methodology: A literature review and expert interviews were conducted to identify 33 innovation barriers. Subsequently, the Content Validity Ratio (CVR) method was employed to screen the barriers, resulting in the retention of 22 relevant items. Finally, a questionnaire survey was administered among Iranian edible oil companies, and Importance–Performance Map Analysis (IPMA) was applied to prioritize the identified barriers.

Results: The findings revealed that barriers associated with the network and ecosystem dimension required the greatest managerial attention. At the indicator level, low inter-organizational trust, weak ties with research institutions, weak monitoring of global innovation developments, restriction of employees' freedom in idea development, and organizational resistance to change and innovation were identified as the highest-priority barriers for improvement.

Conclusion: In industries such as edible oil manufacturing, which are characterized by extensive value chains and strong dependence on external knowledge sources, innovation challenges extend beyond financial and resource constraints and are more closely associated with organizational, institutional, and knowledge-network factors. Therefore, external collaborations, knowledge exchange mechanisms, and supportive organizational environments play a critical role in strengthening innovation capabilities.

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Introduction

In today's dynamic environment, characterized by substantial change, innovation is a critical factor for a firm's flourishing and the attainment of competitive advantage (Talegeta, 2012). Innovation can address the evolving demands of such an environment (Hueske & Guenther, 2015) and pave the way for growth, prosperity, and expansion (Talegeta, 2012). Through the development of standards and prevailing developmental trends, it can strengthen the foundations of competitive advantage (Sieradzka, 2014). Innovation constitutes a combination of a wide range of capabilities (D'Este et al., 2012); therefore, to realize these benefits, firms must make a series of managerial decisions and adopt a clear strategy to pursue innovative objectives (Corchuelo Martínez-Azúa & Sama-Berrocal, 2022). Today, such innovative behaviours are observed in the industries of developed countries (Adeyeye et al., 2018). By creating new markets, offering superior products, and increasing corporate shares in international markets (Feldens et al., 2012), these industries not only secure success for themselves but also produce substantial productivity differentials between developed and developing or underdeveloped countries (Talegeta, 2012).

Innovation arises from change within a complex system that includes product and service, market, knowledge, and society (Corchuelo Martínez-Azúa & Sama-Berrocal, 2022), and it represents a distinctive issue in each firm, industry, or society. Consequently, no uniform rule or clear procedure exists for its attainment (Necadova & Scholleova, 2011). For this reason, industries in developing or underdeveloped countries may, contrary to what occurs in developed countries, encounter barriers to innovation that distort their innovative performance (Lewandowska, 2014). This phenomenon is particularly evident in industries with extensive value chains (De Marchi et al., 2018). For instance, the food sector, which has complex supply and value chains, is more likely to confront such barriers, because in these industries, achieving innovation constitutes a system composed of multiple interrelated innovations (Corchuelo Martínez-Azúa & Sama-Berrocal, 2022). Accordingly, firms face risks, uncertain costs, and a lack of guaranteed returns (Ceccagnoli, 2009; Koellinger, 2008), which may discourage participation in innovation and lead to persistence in traditional routines (Indrawati et al., 2020). Edible oil manufacturing companies within the food industry are among those in which innovation plays a particularly important role, and remaining within these traditional routines creates numerous problems. For example, traditional presses (such as manual or simple hydraulic presses) convert a considerable portion of the seed or fruit oil into press cake. Field studies in Africa have shown that traditional presses lose approximately 18% to 35% of the oil (Poku, 2002). Moreover, failure to employ gentle processes, such as cold pressing, results in the loss of vitamins and nutrients (Jomo & Michael Rock, 1998). In addition, conventional methods produce large volumes of oily wastewater, the treatment of which involves higher costs and energy consumption, whereas reports indicate that newer technologies, such as the two-stage condenser, reduce oily wastewater volume by approximately 50% (Parvand & Rasiah, 2021).

Evidence from reports published by edible oil manufacturers in developed countries indicates that they have addressed these challenges through the introduction of novel innovations. Examples of these include coagulation for seed protein flocculation, ultrasonic technology in degumming and dewaxing processes, and methods for reducing oil viscosity and facilitating oil extraction (Ishak et al., 2025; Özdikicierler et al., 2021; Zhang et al., 2023). However, in the least developed countries, some barriers impede the practical implementation of these innovations, exposing managers to multiple challenges (Castaneda et al., 2023; Jjagwe et al., 2024; Zarandi et al., 2024). These findings suggest that the study of factors that obstruct the attainment of innovation is of considerable importance. To date, numerous studies have examined various determinants of firms' innovative performance; nevertheless, very few investigations have specifically examined the challenges or barriers confronting firms in achieving innovation. Studies addressing innovation barriers have generally adopted a one-dimensional perspective and often lack a comprehensive view of the factors hindering innovation. This issue is particularly evident in developing countries, where a larger number of interrelated variables and contextual challenges influence the innovation process (Arboleda-Muñoz et al., 2026).

Oyila Company, as an edible oil producer in Iran, was selected as the case study for this research because the principal issues noted above are also observable within this firm. The processing and production of various edible oils using conventional and outdated equipment and practices have resulted in reduced oil-extraction yields, diminished final product quality, and increased energy and chemical costs for the company. Accordingly, the objective of this paper is to answer two consecutive questions:

RQ 1. What are the key barriers to achieving innovation in edible oil manufacturing companies in a developing country context?

RQ 2. Which of these barriers should be prioritized for improvement based on the Importance–Performance Map Analysis (IPMA)?

To address these research questions, in the first phase, a literature review and expert interviews were conducted to identify the set of barriers that hinder the achievement of innovation. In the second phase, using the Content Validity Ratio (CVR) technique and with the participation of experts, those barriers whose resolution is of greater necessity for edible-oil manufacturing firms were identified and subsequently employed for modeling in the third phase of the research. In the third phase, the IPMA method was applied to obtain valuable insights regarding the priorities for improving and resolving these barriers. The results of this method indicate both the significance of the identified barriers and the current performance of firms in addressing them. The findings from this three-phase process are significant for two reasons. First, from a policy perspective, they enable policymakers in the food industry, particularly in edible oil production firms, to design appropriate measures to address systemic failures in technology development and innovation that otherwise discourage firms from engaging in innovative activities. Second, from the perspective of innovation management, identifying barriers commonly encountered by firms involved in innovation activities is important, as it generates critical insights for managers and academic experts to become familiar with a range of strategies for overcoming innovation barriers. Therefore, both theoretical and managerial contributions are aimed at.

In the following section, two reviews of the literature, including prior studies that examined innovation barriers. Section Three provides a general description of the research methodology, followed by an explanation of the techniques employed and their corresponding results. Finally, Sections Four and Five present a discussion of the findings and elaborate on the implications of the study for both academics and industry managers.

Literature Background

Innovation

Innovation is a complex and multifaceted concept that is commonly associated with meaningful change in products, services, processes, or organizational practices that create value. Because the concept of "newness" is inherently subjective, many scholars emphasize implementation and practical application as the essential distinguishing feature of innovation. In this regard, the Oslo Manual (OECD, 2018) defines innovation as "a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes" and has been made available to potential users. Furthermore, recent studies have highlighted that innovation extends beyond incremental modifications and may involve transformational or systemic changes that expand the dimensions and capabilities of an existing system (DeJong & de Vries, 2025).

Generally, innovation is described as changes within a complex and interconnected system encompassing the final product and knowledge (Corchuelo Martínez-Azúa & Sama-Berrocal, 2022). Accordingly, it can be argued that innovation requires the application of new knowledge or a novel combination of existing knowledge (Carvache-Franco et al., 2022). For this reason, knowledge and innovation exhibit substantial overlap (Saeida Ardakani et al., 2010; Torres de Oliveira et al., 2022). This perspective suggests that innovation is fundamentally a knowledgedriven process through which organizations generate value by integrating new ideas, capabilities, and technologies into their operational and managerial systems. This concept is also aligned with the common definition of innovation, which refers to the expansion of the range of products, services, and their associated markets through the institutionalization of new production methods, changes in management practices, improvement of working conditions, and enhancement of employee skills (Sieradzka, 2014). Numerous scholars have endeavored to define innovation; however, there exist several prevailing definitions that simplify its conceptualization, which are presented in Table 1.

Table 2. Innovation Definition

Reference	Definition of innovation
(Drucker, 1987)	Innovation is a specific tool for entrepreneurs, a means through which they leverage change as an opportunity to develop distinct businesses or services.
(Tidd, 1997)	Innovation is the process of transforming opportunities into new ideas and widely applying them in practice.
(Garcia & Calantone, 2002)	The concept of innovation in the business environment is associated with performing something new or different.
(Santamaría et al., 2009)	Innovation is defined as either the creation of something new or the improvement or modification of something that already exists.
(Edwards-Schachter, 2018)	Innovation represents a series of developments in creative capabilities directed toward invention, aimed at achieving change in technological, social, or cultural domains.
(Yeboah, 2023)	Innovation is the process of creating something new that has significant value to an individual, a group, an organization, an industry, or a society.
(Sampaio & Sebastião, 2024)	Innovation is a multifaceted concept studied across various disciplines, including economics, management, sociology, and psychology. It not only involves the development of new products or the commercialization of inventions but also encompasses social, economic, behavioral, and institutional changes.

Innovation barriers

Innovation requires the integration of knowledge, technology, organizational capabilities, and market adaptation. For this reason, firms frequently encounter obstacles that limit their ability to successfully generate and implement innovative ideas (Nikiforova et al., 2024). In fact, organizations encounter numerous barriers throughout the innovation process (Torres de Oliveira et al., 2022). These barriers may include limited financial resources, lack of managerial support, insufficient technological capabilities, resistance to change, market uncertainty, and weak institutional support systems (Pellegrino, 2018). Therefore, the emergence of innovation barriers can be attributed to the inherently complex and uncertain nature of innovation activities. Innovation processes often require substantial organizational change, financial investment, technological capabilities, managerial support, and access to external knowledge and resources. As a result, firms may face various internal and external obstacles that limit their ability to generate, adopt, and implement innovative ideas effectively (Coad et al., 2016). With this definition, innovation barriers refer to all factors that prevent, delay, or reduce firms' innovation activities and performance (Torres de Oliveira et al., 2022).

Research background

Some researchers have addressed this issue, examining innovation barriers and their impact on firms' innovative performance (Madeira et al., 2017). Table 2 presents the most significant studies conducted in this area.

Table 3. Research background

Reference	Purpose	Methodology	Industry	Findings
(Hartono & Kusumawardhani, 2019)	Examine the nature of innovation barriers and their impacts on different types of innovation and overall firm innovation performance.	Factor analysis; Logit regression; Tobit regression	Manufacturing (Indonesia)	Four innovation barriers were identified: market/institutional, employee/organizational attitude, finance/risk, and knowledge/cooperation. Finance/risk was the most significant obstacle, and perceptions differed between innovative and non-innovative firms.
(Lewandowska, 2014)	Assess the influence of innovation barriers on innovation performance and on firms' international competitiveness.	Multivariate regression; inferential statistical tests	Food processing (Poland)	A significant relationship was identified between innovation barriers, innovation performance, and international competitiveness, highlighting the complex and multidimensional nature of the innovation process.
(Chan et al., 2015)	Identify and prioritize the barriers to the successful implementation of Advanced Manufacturing Technologies (AMT) in SMEs.	Survey; ranking analysis	Manufacturing SMEs (Klang Valley, Malaysia)	A ranking of implementation barriers showed that inadequate training was the most critical barrier, indicating that improving training is essential for enhancing AMT adoption in Malaysian SMEs.
(Indrawati et al., 2020)	Identify the inhibiting factors of technological innovation in SMEs and develop strategies to support their innovation activities.	Survey; Focus Group Discussion (FGD); in-depth interviews; observations (mixed methods)	SMEs — Manufacturing (Riau, Indonesia)	Five major barriers to innovation were identified, including inadequate government support, low-quality human resources, limited funding for technological innovation, unfavorable economic conditions, and weak business partnerships. Among these, limited funding was the most significant barrier.

Reference	Purpose	Methodology	Industry	Findings
(DeMaria & Zezza, 2020)	Examine drivers and barriers to process innovation in the food sector with emphasis on energy policy impacts.	Survey; Logistic (logit) regression	Food industry (European Union)	Firm size, internal organization, and collaboration were identified as key drivers of process innovation, while institutional support and access to public resources helped reduce innovation barriers and promote innovation adoption.
(Fadda et al., 2022)	Identify drivers and barriers to the adoption of advanced technologies in palm oil mills.	Survey; Logistic (logit) regression	Palm oil milling (Malaysia)	Senior management support and firm size were key drivers of adoption, whereas high costs, technical complexity, limited resources, and insufficient government support were identified as major barriers.

A review of Table 2 reveals that prior research has primarily addressed industries at a general level, with limited focus on specific industries or firms. For example, some scholars (Hartono & Kusumawardhani, 2019) broadly examined manufacturing industries, and generally considered the food industry (DeMaria & Zezza, 2020). In contrast, the present study specifically focuses on edible oil manufacturing companies, which constitute a subset of the food industry. From a methodological perspective, most previous studies have relied on cross-sectional designs, providing little information on the dynamic evolution of barriers or their long-term effects on innovation. In fact, these studies are mostly distributional and correlational; the lack of longitudinal and causal research in specific industries (particularly edible oils) has limited systemic understanding of barriers, thereby impeding the development of actionable knowledge. Accordingly, the results of these studies cannot be directly applied to the formulation of practical policies. In this research, results are presented using the Importance–Performance Matrix as a practical map for managers. This approach allows them to obtain a systemic understanding and a summarized overview of innovation barriers while also assisting in identifying priorities for improvement and barrier resolution. These insights help managers determine which barriers require greater focus to prevent resource wastage.

On the other hand, existing innovation models and research in this domain have primarily focused on the firm's role as either a driver or barrier to innovation, leading to analyses that consider innovation at the industry, company, or individual level. However, since a portion of innovation depends on relationships and interactions among various factors, the formation of networks, and the processes of learning and diffusion, the analysis of barriers to achieving innovation must extend beyond organizational and individual levels. In this context, it is evident that recent studies have rarely examined the roles of the supply chain, inter-firm collaborations, and the innovation ecosystem. Therefore, it is necessary to clarify the influence of factors external to the organization. The literature review and expert interviews are employed to identify technical and intra-organizational as well as extra-organizational barriers to innovation more comprehensively than prior research.

Considering the points discussed, it can be argued that prior studies are fragmented in terms of content and that significant gaps remain in this field. By adopting a three-phase process, this research provides a realistic depiction of the barriers to innovation in edible oil manufacturing companies. Therefore, it can be asserted that this study addresses the identified gaps by generating practical and actionable data with the participation of experts, producing results that are applicable for both policymaking and managerial decision-making.

Materials and Methods

The focus of the study is to identify the innovation implementation barriers, particularly in edible oil manufacturing companies, by employing a cross-sectional mixed-methods design. Accordingly, insofar as the findings are intended to be used to address an existing problem within a particular domain, the research is classified as applied research, including a three-stage mixed approach, as presented in Figure 1.

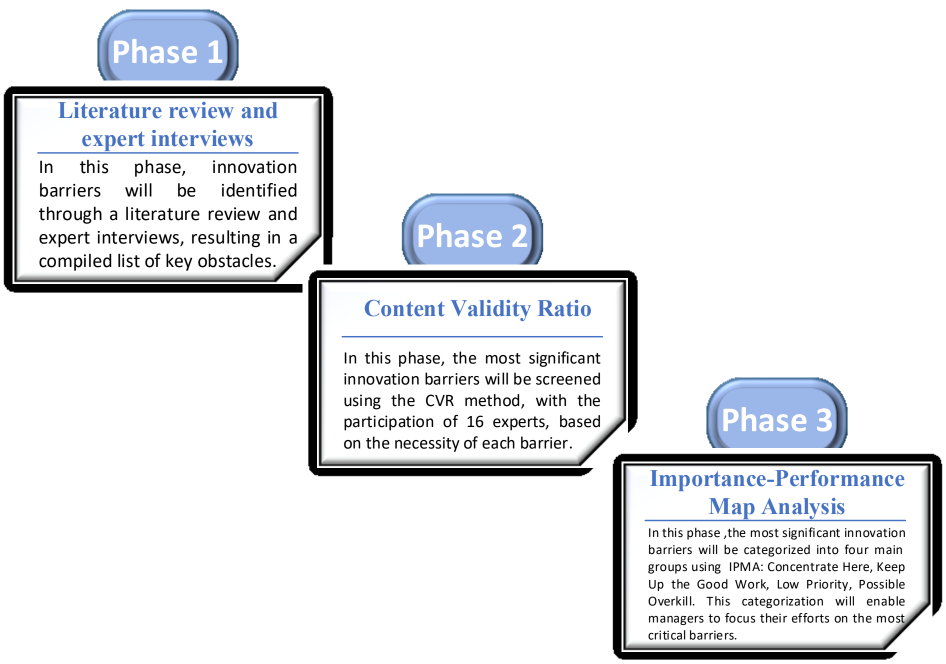

Figure 1. Research Process

Phase 1: Literature review and expert interviews

Qualitative data in this research were obtained through two avenues. First, published studies indexed in reputable scientific databases that pertain to barriers to achieving innovation were reviewed, and a catalogue of these barriers was compiled. Secondly, interview sessions employing semi-structured interviews were convened, during which experts were requested to articulate their ideas regarding the barriers to achieving innovation in the edible oil companies. The study population comprised academic experts and practitioners who had engaged in scientific and executive activities within this domain, who possessed experience and understanding of edible oil product manufacture and the delivery of services to such companies, or who had the requisite background to influence the formulation of these companies' operational strategies. Accordingly, a pool of individuals was identified and, using homogeneous sampling, 16 of them were selected as the study's final experts. Detailed information on these individuals is presented in Table 3.

Table 4. Profile of research experts

No	Education	Area of Expertise	Age	Work Experience
1	MSc Innovation Management	Product Development	32	8
2	MSc Industrial Engineering	Process Optimization	29	6
3	PhD Technology Management	R&D Strategy	38	12
4	MSc Business Administration	Organizational Behavior	35	10
5	MSc Information Systems	Digital Transformation	31	7
6	PhD Innovation Studies	Knowledge Management	42	15
7	MSc Mechanical Engineering	Product Design	30	6
8	MSc Marketing	Consumer Behavior	33	9
9	MSc Software Engineering	AI & Machine Learning	28	6
10	MSc Industrial Management	Process Improvement	36	11
11	PhD Entrepreneurship	Startup Development	40	14
12	MSc Engineering Management	Project Management	34	9
13	MSc Innovation & Technology	Innovation Strategy	37	12
14	MSc Organizational Leadership	Change Management	39	13
15	MSc Data Science	Business Analytics	29	6
16	PhD Management Science	Strategic Innovation	41	16

Phase 2: Content Validity Ratio (CVR)

After identifying the barriers, the next step involves screening them to determine which barriers warrant greater priority for resolution. The principal steps of this method, based on (Lawshe, 1975), are as follows.

Step 1. Questionnaire design and administration

The questionnaire in this phase was completed with the participation of the experts whose information is presented in table 3, and who had also participated in the preceding phase. In the questionnaire asked to indicate, for each item, one of the following options: 1) it is essential that the item be examined as a barrier in edible oil manufacturing companies; 2) it constitutes a barrier, but the item doesn't have to be examined in edible oil manufacturing companies; or 3) it is neither an essential nor a barrier. These response options were developed from the principal options of the CVR method (Lawshe, 1975).

Step 2. CVR calculation

To calculate the CVR for each barrier, formula 1, as proposed (Lawshe, 1975), was used.

$$\mathrm{CVR} = \frac{ne - \frac{N}{2}}{\frac{N}{2}} \tag{1}$$

ne: Number of experts who selected the "the item must be examined as a barrier in edible oil manufacturing companies " option

N: Number of experts

Step 3. Comparison with the threshold limit

The CVR value obtained ranges from −1 to +1 (Ibrahim & Mohd Matore, 2025). Values closer to +1 indicate that the majority of experts agree that the item is essential to be examined as a barrier in edible oil manufacturing companies. However, to determine whether a barrier should be retained or eliminated, the obtained CVR value must be compared with the critical CVR threshold (Almanasreh et al., 2019). According to Lawshe (1975), the CVR value lower than 0.42 should be removed.

Phase 3: Importance-Performance Map Analysis (IPMA)

In the previous two phases, based on the selection of research experts, the barriers whose resolution is of greater necessity for edible oil manufacturing companies will identify. The objective of the third phase is to determine the priority of improvement among these barriers. This objective is addressed using the IPMA method. To this end, a sample of edible oil manufacturing companies is selected. The required sample size was calculated using G*Power software (version 3.1.9.4) (Memon et al., 2020). By applying an effect size of 0.15, an error level of 0.05, a statistical power of 0.95, and considering six independent variables (k = 6), the minimum required sample size should be 153 respondents.

After determining the sample size, using a purposive sampling approach, the authors selected 185 individuals from the study population based on their knowledge and judgment, and a questionnaire designed to assess the structural effects of the research hypotheses was distributed among them. The distribution of 185 questionnaires exceeded the minimum required sample size by 20% to compensate for potential invalid responses. The questionnaires were distributed through two channels: physically via in-person visits and online via questionnaire sharing. Of the 185 distributed questionnaires, 174 were returned. However, six questionnaires were excluded from further analysis due to incomplete responses, resulting in a total of 164 valid responses, corresponding to an 88% usable response rate.

The questionnaire consisted of two main sections and a total of 36 items. The first section included several items related to the demographic information of the participants. This section collected data on age, gender, educational qualification, and work experience. The demographic characteristics of the research respondents are presented in Table 4.

Table 5. Demographic information

Category	Gender		Education			Age			Experience			
Level	Male	Female	Bachelor	Master	PhD	20-30	30-40	+40	1-5	6-10	11-15	+15
Frequency	126	38	98	47	19	53	57	54	27	46	50	41
Percent (%)	76.83	23.17	59.76	28.66	11.59	32.32	34.76	32.93	16.46	28.05	30.49	25.00

The second section included items that measured the main variables of the study. The items measuring the innovation variable were adapted from (Hong et al., 2019), while the items related to assessing the barriers to achieving innovation were derived from the results of the second phase. In all items of the second section, participants were asked to respond using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), to indicate the extent to which they agreed or disagreed with each given statement.

For testing hypotheses (outlined in Table 5) and to assess the fitness of the conceptual model depicted in Figure 2, a Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed through the SmartPLS 3 software (Maware & Parsley, 2023).

Table 6. Research hypotheses

Hypotheses	Definition of hypothesis	Marker
H1	There is a significant relationship between financial and investment barriers and the company's achievement of innovation (IN).	FAI -> IN
H2	There is a significant relationship between technological and knowledge barriers and the company's achievement of innovation.	TAK -> IN
H3	There is a significant relationship between network and ecosystem barriers and the company's achievement of innovation.	NAE -> IN
H4	There is a significant relationship between external environmental barriers and the company's achievement of innovation.	EXE -> IN
H5	There is a significant relationship between human resource barriers and the company's achievement of innovation.	HR -> IN
H6	There is a significant relationship between organizational and managerial barriers and the company's achievement of innovation.	OAM -> IN

Accordingly, the research model consists of six predictor constructs and one construct representing the ultimate target variable, as depicted in Figure 2.

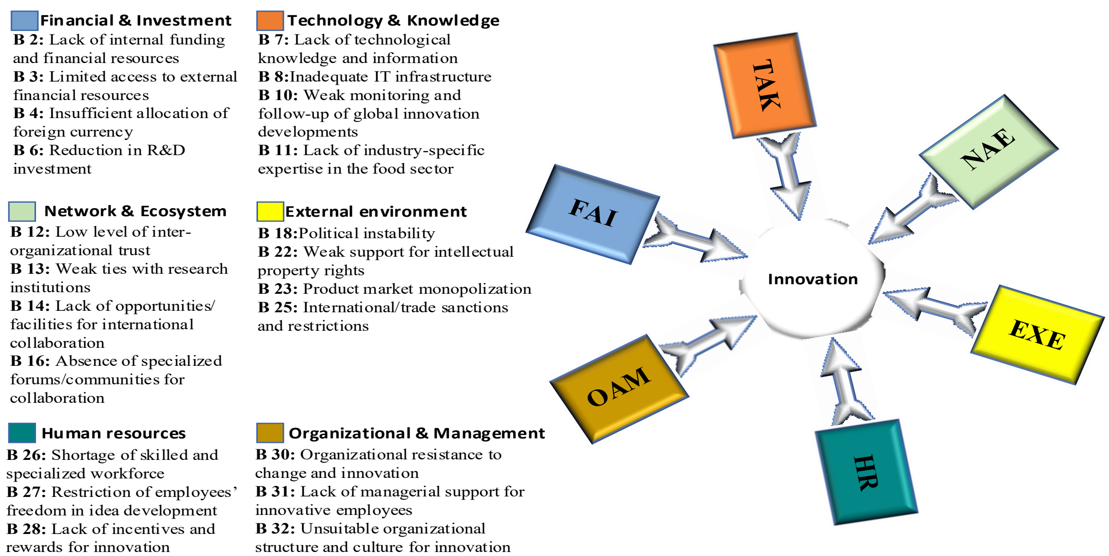

Figure 2. Conceptual model

For data analysis, the two-stage approach proposed by Wong (2013) was employed. In the initial stage, the measurement model is evaluated to assess the validity and reliability of the constructs, and in the second stage, the structural model is fitted.

After the measurement and structural model, the data is analyzed and interpreted through the IPMA method. IPMA is a combination of the Importance–Performance Analysis (IPA) and SEM approaches. Traditionally, IPA was a business research technique developed as a tool for examining and proposing managerial strategies (Martilla & James, 1977). This method provides insights into which areas managers should focus on (Abalo et al., 2007; Chu & Choi, 2000). The technique classifies the factors under investigation into a two-dimensional plot based on two criteria: performance and importance, organized into four categories or quadrants (Martilla & James, 1977). Researchers have made considerable efforts to advance the IPA method (Caber et al., 2012; Feng et al., 2014; Girma et al., 2022; Tailab, 2020). In all these developments, the lack of statistical criteria has weakened the predictive and validation power of the IPA technique. Therefore, researchers concluded that a method to enhance the validity and reliability of IPA was necessary (Azzopardi & Nash, 2013). This need led to the development of IPMA through integration with statistical methods.

IPMA extends the conventional reporting of path coefficient estimates by introducing an additional dimension that accounts for the mean scores of latent variables. This enables the comparison of the importance of independent constructs represented by their total effects on a target construct, with their performance, reflected in the mean scores of the corresponding latent variables (J. Hair et al., 2022).

Accordingly, to find the key barriers in the relationship analysis of independent constructs (innovation barriers) with the dependent construct (innovation), IPMA was employed through a five-step approach developed by Ringle & Sarstedt (2016).

Step 1. IPMA requirements

Before conducting IPMA, three conditions must be satisfied. First, rescaling the scores of latent variables to a range of 0 to 100 requires that all indicators in the Partial Least Squares (PLS) path model use a metric or quasi-metric scale (Sarstedt et al., 2023). Accordingly, the questionnaire items were designed so that the responses were captured on an interval scale ranging from 1 to 5. Second, all indicator codings must follow the same directional scale: the minimum value must represent the worst outcome, and the maximum value the best outcome of an indicator (Ringle & Sarstedt, 2016). Based on this principle, in the present study, higher values consistently indicated greater agreement. Third, regardless of whether the measurement model is specified as formative or reflective, the estimates of outer weights must be positive. If the outer weights are negative, the latent variable scores will not fall within the 0 to 100 range, but, for example, between -5 and 95 (Ringle & Sarstedt, 2016). The results of examining the signs of the outer weights in the figure above demonstrate that all outer weight signs are positive. Therefore, all requirements for performing IPMA are met, and the analysis can be continued.

Steps 2 and 3. Calculating importance and performance values

The second step concerns the calculation of importance values, and the third step pertains to the calculation of performance values. In this section, both of these measures are computed. The importance of a construct originates from the constructs that are directly or indirectly related to it and is derived from the total effect of the relationship between the independent and dependent variables (Ringle & Sarstedt, 2016). The data from the indicators determine the scores of the latent variables and, consequently, their performance. In fact, when conducting IPMA at the indicator level, the mean value of an indicator reflects its average performance (Ringle & Sarstedt, 2016).

Step 4. Importance-performance map

After calculating the values of importance and performance, all the necessary information for constructing the importance–performance map becomes available. In a graphical representation, IPMA compares the total effects (horizontal axis) with the scores of the latent constructs (vertical axis) (Salleh et al., 2017). To determine the optimal thresholds that divide the diagram into quadrants, the mean values of the observed importance data and the ranking of performance were employed, in accordance with previously proposed methods (Sever, 2015).

Step 5. Calculating the importance and performance values of the indicator level

Since the analysis at the variable level does not reveal the specific attributes requiring further improvement, step five proceeds with the extension of IPMA at the indicator level. Extending IPMA to the indicator level enables the identification of more targeted and domain-specific areas for improvement (Ringle & Sarstedt, 2016).

Results

33 factors were identified as barriers to achieving innovation. Some of these barriers, although apparently described by different definitions, referred to identical underlying concepts. Accordingly, with the participation of the experts, they were classified into six principal dimensions. Table 6 presents the results of the first phase of the study.

Table 7. Barriers to achieving innovation

Code	Dimensions	Barriers	Reference
B 1	Financial and investment (FAI)	High cost of innovation	(Necadova & Scholleova, 2011)
B 2		Lack of internal funding and financial resources	(Madeira et al., 2017)
B 3		Limited access to external financial resources	(Carvache-Franco et al., 2022)
B 4		Insufficient allocation of foreign currency	Interview
B 5		Inadequate allocation of dedicated financial resources for innovation	Interview
B 6		Reduction in R&D investment	Interview
B 7	Technology and knowledge (TAK)	Lack of technological knowledge and information	(D'Este et al., 2012)
B 8		Inadequate IT infrastructure	(Hartono & Kusumawardhani, 2019)
B 9		Difficulty finding suitable collaboration partners	(Pellegrino, 2018)
B 10		Weak monitoring and follow-up of global innovation developments	Interview
B 11		Lack of industry-specific expertise	Interview
B 12	Network and ecosystem (NAE)	Low level of inter-organizational trust	(Cinar et al., 2019)
B 13		Weak ties with research institutions	)Madeira et al., 2017; Madrid-Guijarro et al., 2009(
B 14		Lack of opportunities/facilities for international collaboration	Interview
B 15		Scarcity of international scientific collaborations	Interview
B 16		Absence of specialized forums/communities for collaboration	Interview
B 17	External environment (EXE)	Excessive governmental intervention in R&D	(Torres de Oliveira et al., 2022)
B 18		Political instability	(Adegbite & Govender, 2022)
B 19		Dominance of foreign companies in the market	(Lewandowska, 2014)

B 20		Low export levels	Interview
B 21		Social and economic uncertainties	(Duarte et al., 2017)
B 22		Weak support for intellectual property rights	(Madrid-Guijarro et al., 2009)
B 23		Product market monopolization	Interview
B 24		Lack of global market competitiveness	Interview
B 25		International/trade sanctions and restrictions	Interview
B 26	Human Resources (HR)	Shortage of skilled and specialized workforce	(Duarte et al., 2017)
B 27		Restriction of employees’ freedom in idea development	(Madrid-Guijarro et al., 2009)
B 28		Lack of incentives and rewards for innovation	(Madrid-Guijarro et al., 2009)
B 29		Decline in employees’ creative performance	(Adegbite & Govender, 2022)
B 30	Organizational and management (OAM)	Organizational resistance to change and innovation	(Indrawati et al., 2020)
B 31		Lack of managerial support for innovative employees	(Cinar et al., 2019)
B 32		Unsuitable organizational structure and culture for innovation	(Cordeiro & Vieira, 2012; Talegeta, 2012)
B 33		Weak idea-sharing within the organization	(Madrid-Guijarro et al., 2009)

The CVR was calculated for each barrier, and the results are presented in Table 7.

Table 8. CVR results

Indicator	B 1*	B 2*	B 3**	B 4**	B 5*	B 6**	B 7**	B 8**	B 9*
CVR	۰/۳۱	۰/۷۴	۰/۶۸	۰/۸۷	۰/۲۱	۰/۹	۰/۷۳	۰/۴۹	۰/۱۱
Indicator	B 10**	B 11**	B 12**	B 13**	B 14**	B 15*	B 16**	B 17*	B 18**
CVR	۰/۵	۰/۸۳	۰/۷۳	۰/۶۱	۰/۶۶	۰/۳۳	۰/۸۹	۰/۲۸	۰/۶۳
Indicator	B 19*	B 20*	B 21*	B 22**	B 23**	B 24*	B 25**	B 26**	B 27**
CVR	۰/۲۴	۰/۳۱	۰/۲۳	۰/۸۱	۰/۷۲	۰/۱۳	۰/۴۷	۰/۵۲	۰/۶۸
Indicator	B 28**	B 29*	B 30**	B 31**	B 32**	B 33*			
CVR	۰/۹۶	۰/۱۹	۰/۶۴	۰/۷۵	۰/۴۸	۰/۱۱			
* Eliminated ** Retained									

As the results presented in table 7 indicate of the 33 barriers identified in the first phase, 22 barriers have CVR values greater than or equal to 0.42. This implies that these 22 barriers warrant greater priority for examination.

In the first stage of the measurement model, the outer loadings were calculated to assess the reliability of the indicators (Khodabakhshi Parizi et al., 2025). The results are shown in Figure 3.

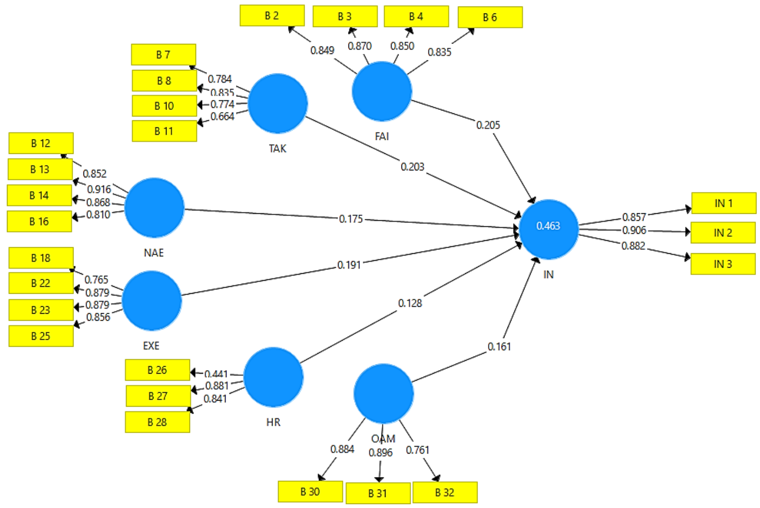

Figure 3. Measurement model

According to established standards, outer loadings should exceed 0.4 for each indicator (J. Hair et al., 2022). The results indicate that the outer loadings for all indicators are acceptable, and there is no need for item removal. The second stage involved evaluating the internal consistency of the model, which was examined using three indices: Cronbach's alpha, composite reliability (CR), and the average variance extracted (AVE). All constructs should have a Cronbach's alpha greater than 0.6 (J. F. Hair et al., 2019), as well as CR and AVE exceeding 0.50 (J. Hair et al., 2014; Sarstedt et al., 2023). The results for each index are presented in Table 8.

Table 9. Reliability and validity indicators of the measurement model

Varieble	Cronbach's Alpha	CR	AVE
FAI	0.873	0.913	0.724
TAK	0.77	0.85	0.588
NAE	0.885	0.921	0.744
EXE	0.867	0.909	0.716
HR	0.646	0.78	0.56
OAM	0.808	0.885	0.721
IN	0.857	0.913	0.778

As shown in Table 8, the CR values exceed the standard threshold, indicating that the model constructs are reliable. The assessment of the AVE demonstrates that all constructs have AVE values above 0.50, meaning that each construct can explain at least 50% of the variance of its indicators within the model; therefore, convergent validity is established (Andy et al., 2022; Saeida Ardakani et al., 2010).

After confirming the validity and reliability of the data, the final step in the measurement model involves assessing and testing discriminant validity using the Heterotrait-Monotrait ratio of correlations (HTMT) (Table 9). The recommended threshold for the HTMT ratio is less than 0.9 (J. F. Hair et al., 2019), indicating that each construct's indicators are conceptually distinct.

Table 10. HTMT results

Variable	FAI	HR	IN	NAE	OAM	EXE
HR	0.118					
IN	0.572	0.285				
NAE	0.455	0.139	0.480			
OAM	0.149	0.146	0.350	0.180		
EXE	0.504	0.240	0.566	0.319	0.177	
TAK	0.629	0.305	0.654	0.492	0.270	0.658

Table 9 indicates that all HTMT values are below 0.9, demonstrating that each construct's indicators are conceptually distinct (J. F. Hair et al., 2019). Therefore, all indicators possess sufficient discriminant capability to assess their respective constructs, and all indicators in this research model are specifically reliable and valid for measuring their corresponding constructs.

The assessment of the Variance Inflation Factor (VIF) represents an essential initial step in evaluating the structural model, as it helps to prevent potential biases caused by multicollinearity among predictors. According to Hair et al. (2022), VIF values of 5 or below indicate an acceptable level of collinearity and suggest the absence of serious multicollinearity issues within the model. The computed inner VIF values for all constructs were below 5, confirming compliance with the recommended thresholds. The subsequent evaluation focused on assessing the path model. After performing a full bootstrapping test with 3,000 subsamples and without applying the sign-change option, the results were obtained as presented in Figure 4.

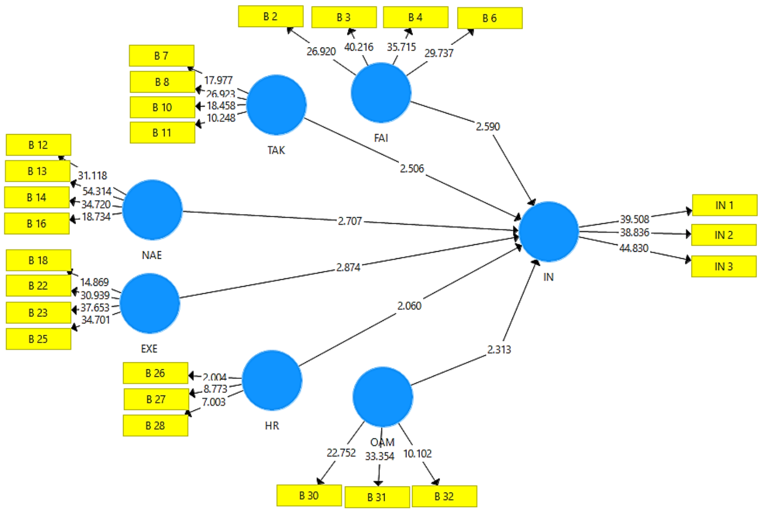

Figure 4. Structural model

Figure 4 shows that the observed path coefficients (t-statistics) for all paths exceed ±1.96. Therefore, the hypothesis tests are significant at the 95% confidence level, and the research hypotheses cannot be rejected. As previously indicated, the primary objective of testing the hypotheses in this study was to ensure the adequacy of the structural model for conducting the IPMA analysis. The results of calculating importance and performance at the variable level are presented in Table 10.

Table 11. Importance and performance of the variable

variable	FAI	HR	NAE	OAM	EXE	TAK	Mean
Construct Importance for IN	0/198	0/128	0/178	0/145	0/197	0/209	0/176
Construct Performance for IN	58/787	54/005	37/28	50/4	64/155	58/107	53/789

Figure 5 presents the graphical output of IPMA at the level of the main constructs.

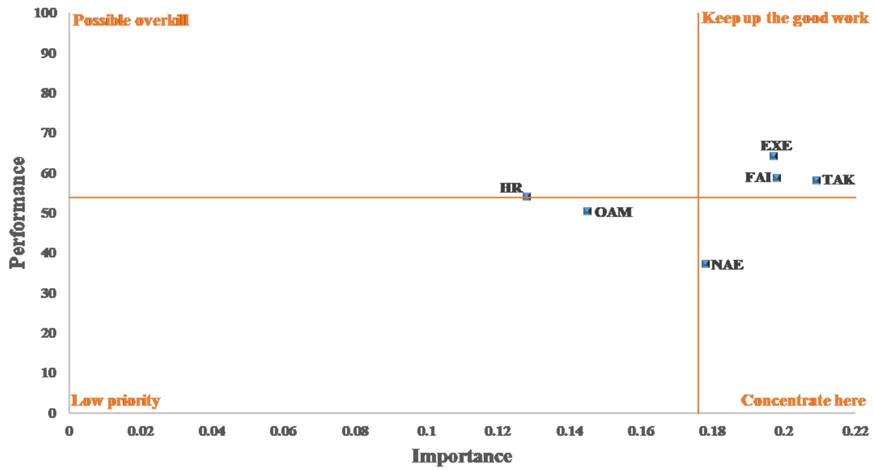

Figure 5. Importance-performance map of variable level

Figure 5 illustrates that only the NAE falls within the fourth quadrant, indicating that greater attention should be devoted to these barriers. The EXE, FAI, and TAK criteria are positioned in the first quadrant, suggesting that the current approach regarding them should be maintained. The HR criterion is located in the second quadrant, implying that while these barriers may be influential, the company demonstrates satisfactory performance in addressing them. Finally, OAM barriers are situated in the third quadrant, indicating that they hold relatively low importance.

The results of the calculated importance and performance values at the indicator level are presented in Table 11.

Table 12. Importance and performance of the indicator

variable	B 10	B 11	B 12	B 13	B 14	B 16	B 18	B 2	B 22	B 23	B 25	B 26	B 27	B 28	B 3	B 30	B 31	B 32	B 4	B 6	B 7	B 8	Mean
Construct Importance for IN	0/054	0/032	0/049	0/049	0/044	0/036	0/039	0/048	0/054	0/053	0/051	0/009	0/068	0/051	0/054	0/062	0/048	0/035	0/053	0/043	0/056	0/068	0/048
Construct Performance for IN	46/28	47/321	38/244	33/929	39/286	38/095	59/375	59/821	63/542	68/155	64/286	47/917	51/935	57/887	61/012	51/637	46/726	53/274	57/143	56/845	70/238	62/649	53/436

Following the same approach applied for the graphical representation of IPMA at the variable level, a graphical representation at the indicator level has also been prepared, as illustrated in Figure 6.

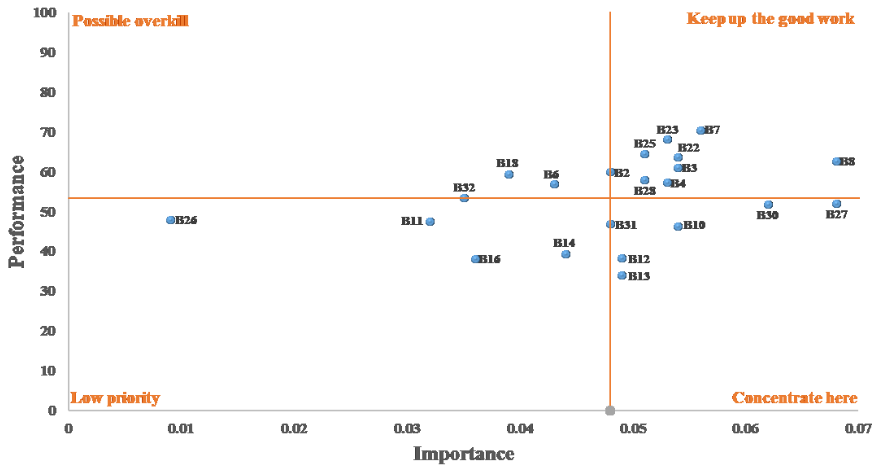

Figure 6. Importance-performance map of indicator level

Figure 6 provides a deeper analysis of the barriers to achieving innovation. Barriers such as the low level of inter-organizational trust (B12), weak ties with research institutions (B13), weak monitoring and follow-up of global innovation developments (B10), restriction of employees' freedom in idea development (B27), and organizational resistance to change and innovation (B30) fall within the fourth quadrant and are therefore highly critical. The next category of barriers includes international/trade sanctions and restrictions (B25), lack of incentives and rewards for innovation (B28), weak support for intellectual property rights (B22), product market monopolization (B23), limited access to external financial resources (B3), insufficient allocation of foreign currency (B4), lack of technological knowledge and information (B7), and inadequate IT infrastructure (B8). These are positioned in the first quadrant. Barriers such as lack of internal funding and financial resources (B2), reduction in R&D investment (B6), and political instability (B18) fall within the second quadrant. Finally, barriers including lack of managerial support for innovative employees (B31), unsuitable organizational structure and culture for innovation (B32), lack of opportunities/facilities for international collaboration (B14), absence of specialized forums/communities for collaboration (B16), lack of industry-specific expertise (B11), and shortage of skilled and specialized workforce (B26) are located in the third quadrant.

To complete the SEM-PLS analysis, the explanatory power of the model is evaluated as the final stage. The coefficient of determination for the sole dependent variable of the study, ie, innovation, was 0.463. Accordingly, the model possesses a high explanatory power. In addition, the predictive power of the model was assessed using the PLSpredict procedure, as recommended in recent methodological research (Sarstedt et al., 2023). PLSpredict is executed with 10 repetitions and 10 folds. The findings showed that the SEM-PLS predicts a lower prediction error (Root Mean Square Error: RMSE) than the linear path model, indicating stronger predictive power.

Discussion

The integration of innovation and the adoption of advanced technologies within a firm's processes frequently encounter challenges (Sieradzka, 2014), which may diminish the firm's propensity to innovate or even preclude it altogether (Madeira et al., 2017). This phenomenon is particularly evident in developing countries. Iranian edible oil companies have likewise faced challenges that have impeded their capacity to innovate and have resulted in problems concerning product quality. Understanding such challenges, which operate as barriers to innovation, is important from several perspectives. First, it can inform the development of public policies that encourage innovation and foster a culture of innovation. Second, it constitutes one of the determinants of firm survival (Perel, 2002). Third, it contributes to the refinement of theoretical frameworks that explain why some firms are unwilling or unable to engage in innovative activity(Amara et al., 2016). As a result, identifying these barriers is essential because they disrupt a firm's ability to introduce and sustain a new product or process (Madeira et al., 2017) or lead to the cessation of the firm's innovative activities (Torres de Oliveira et al., 2022).

Without a purposeful, evidence-based analysis, any fragmented efforts to achieve innovation may prove costly and inadequate. Therefore, as an initial step, the existing barriers must be defined and, concurrently with the formulation of prioritized plans, strategies to counter these barriers should be designed (Adeyeye et al., 2018). Specifically addressing barriers to innovation in companies that produce edible oil, the research responds to both of these concerns. In the first phase of the research, a set of barriers was identified through a literature review and interviews with experts; in the second phase, the barriers were screened using the CVR method according to their essentiality for resolution. Consequently, 33 barriers were identified in phase one and, after screening in phase two, 22 of them remained for further analysis. In the third phase, the IPMA method was employed to complete the data analysis and discussion and to inform managers about which of the barriers they should prioritize. Using this method, all barriers, at both the dimensions and indicator levels, were classified into four quadrants. The classification was based on the importance of resolving each barrier and on the current performance in addressing it. Under this definition, the first quadrant denotes critical barriers that have been well managed; the second quadrant identifies barriers that, despite adequate control, are of low importance and therefore represent potential sites of resource waste; the third quadrant comprises low-importance barriers that do not require immediate concern; and the fourth quadrant (Concentrate here) includes barriers of high importance and poor management that should be pursued immediately with corrective programs.

Concentrate: the fourth quadrant denotes the principal barriers that warrant concentrated attention. Barriers classified within this category require sustained investment to be resolved. At the dimensions level, NAE were located in the fourth quadrant. This category of barriers demands substantial focus, and managers should prioritize the resolution of NAE barriers. NAE barriers constitute a set of factors that constrain a firm's ability to interact effectively with external actors (suppliers, universities, stakeholders, and partners) as well as the internal capacity to exploit those interactions (Hieu, 2021). From this definition, it can be inferred that if indicators associated with the network and ecosystem are weak, technologies will not be transferred or scaled rapidly, and innovative projects will be implemented belatedly or unsuccessfully. Therefore, the prioritization of managerial resources should be directed toward repairing or strengthening the network and ecosystem, because the greatest return on innovation investment is achieved through this pathway (Russo-Spena et al., 2017).

At the indicator level, five barriers were located in the fourth quadrant. A Low level of inter-organizational trust (B12) inhibits the formation of collaborations, data sharing, and the execution of pilot projects with partners such as suppliers or research institutions (Firouzabad et al., 2024). Accordingly, technological collaborations, knowledge transfer, and joint projects emerge with difficulty, and, because each organization seeks to perform all tasks independently, innovation is impeded or halted (Rutten et al., 2016). Weak ties with research institutions (B13) likewise constrain access to up-to-date knowledge and product development capacities and result in Weak monitoring and follow-up of global innovation developments (B10). The global market for the edible oil production industry (from production through packaging and distribution) is influenced by technological change, environmental requirements, and consumption patterns; therefore, it is essential to track innovation developments at the international level to avoid overlooking opportunities, delaying the benchmarking of efficient technologies, and forfeiting competitive advantage.

In addition, there are intra-organizational barriers that belong to this category and, according to the results, their significance even surpasses that of extra-organizational barriers. Restriction of employees' freedom in idea development (B27) is one such barrier. This barrier obstructs the flow of intra-organizational innovation, suppresses creativity, and reduces employees' motivation to participate in process-improvement activities (Le, 2024). In some cases, Restriction of employees' freedom in idea development arises from a motivational conflict between employer and employee, which ultimately results in Organizational resistance to change and innovation (B30) (Das et al., 2018). Therefore, under such conditions, it is necessary to implement changes or new policies that encompass the design and construction of a new culture, or the reconceptualization of prior norms and values, to prevent intra-organizational barriers to innovation (Fischer et al., 2019).

Possible overkill: The next category of barriers whose analysis is of high importance comprises those situated in the second quadrant. This segment includes barriers of low importance for which the firm demonstrates strong performance in mitigation. Addressing the barriers categorized here consumes a certain amount of cost, effort, and time that could be reallocated to other priorities (Ringle & Sarstedt, 2016). For example, the monetary and temporal resources devoted to managing these barriers could instead be invested in resolving barriers in the fourth quadrant. In the dimensions, the HR criterion was positioned in the second quadrant. The placement of Human Resources barriers in the second quadrant does not imply their absolute insignificance; rather, it indicates that a reorientation of HR's role with respect to innovation is advisable. In other words, HR performance should be redirected toward enabling innovation (Le, 2024).

At the indicator level, the barriers of internal financial resources (B2), Reduction in R&D investment (B6), and Political instability (B18) are also situated within this category. Internal financial resources (B2) constitute the funds and facilities that a firm mobilizes internally, without recourse to loans or external capital, to finance its activities and projects (Seyoum, 2024). Occasionally, portions of these resources are allocated to low-impact or repetitive activities, whereas they could be redirected toward addressing more consequential barriers. However, the complete elimination or imprudent reduction of these resources is not recommended, because internal financial resources perform an operational support function and help to ensure organizational stability. For example, a portion of these funds could be redirected toward investment in R&D, thereby addressing the barrier denoted as Reduction in R&D investment (B6), because preserving fundamental R&D capacity is essential for future innovation and long-term competitiveness; furthermore, a complete decline in R&D may precipitate a loss of competitive advantages in the medium term (Rađenović et al., 2023). With respect to Political instability (B18), it should be noted that in developing countries, this factor affects not only innovation but also many aspects of business performance (Rashid & Rashid, 2024). Political instability, through the political and institutional risks and instabilities it generates, can retard or halt the pace at which firms access innovation (Nadeem et al., 2020). Although this factor is largely beyond managerial control, the data indicate that the firm's performance in coping with this barrier has been satisfactory; its placement in the second quadrant therefore suggests that, given its lower importance relative to other indicators, it may be deprioritized if other indicators are improved and managed optimally. Nevertheless, one must never adopt a complacent attitude toward this issue, since it can rapidly escalate into a crisis and disrupt all innovative endeavours.

Keep up the good work: The first quadrant denotes barriers that possess high importance but for which the firm's performance in addressing them has been satisfactory; consequently, the current approach should be maintained (Ringle & Sarstedt, 2016). At the dimensions level, EXE, FAI, and TAK were assigned to this quadrant. EXE encompasses relationships with regulatory bodies, market conditions, access to export markets, legal frameworks, and supportive or restrictive policies; because legal regulations, health standards, and the target market are determined within this domain, weak performance may impede the capacity to produce innovative products (Arroyabe et al., 2024). Barriers related to FAI hinder or restrict the provision of financial resources and new or developmental investments (Carvache-Franco et al., 2022; Madeira et al., 2017). Given that innovation inherently requires financial expenditures, this barrier is therefore of considerable importance. TAK is also highly significant, and satisfactory performance in addressing them is necessary to prevent them from becoming obstacles to innovation. These three constructs should be preserved and reinforced as strategic assets.

The analysis conducted at the indicator level likewise indicates that a substantial number of the barriers identified are situated in the first quadrant. Each of these indicators represents a component of the structural and institutional impediments to innovation. International/trade sanctions and restrictions (B25) signify constraints on access to markets, technologies, and external inputs. Lack of incentives and rewards for innovation (B28) refers to the absence of financial incentives and to inadequate policy measures designed to promote innovation (Torres de Oliveira et al., 2022). Weak support for intellectual property rights (B22) reflects insufficient legal and contractual mechanisms for protecting inventions, trade secrets, and research and development outcomes. Product market monopolization (B23) denotes the dominance of a limited set of actors in the market, which diminishes competitive pressure and the incentive to innovate. Limited access to external financial resources (B3) manifests the difficulty of attracting foreign investment and international financial leverage (Duarte et al., 2017; Hartono & Kusumawardhani, 2019; Lewandowska, 2014). Insufficient allocation of foreign currency (B4) points to restrictions and inadequacies in the provision of foreign exchange for the importation of new equipment. Lack of technological knowledge and information (B7) indicates the absence of technical know-how and the learning capacities required for technology development (Pellegrino, 2018; Talegeta, 2012). Finally, Inadequate IT infrastructure (B8) denotes weaknesses in networks, tracking systems, and data-analytical capabilities (Cinar et al., 2019). Collectively, these indicators operate as external and internal barriers that constrain units' abilities to access, absorb, and exploit technologies and innovative collaborations.

Low priority: In conclusion, the third quadrant encompasses barriers where the company demonstrates weak performance, yet these factors are not of high importance. Managers should not be overly concerned with these characteristics, as they represent low-importance barriers, and poor performance in these areas does not pose a major issue (Cinar et al., 2019). At the dimensions level, OAM falls within this category. At the indicator level, the barriers include lack of managerial support for innovative employees (B31), unsuitable organizational structure and culture for innovation (B32), lack of opportunities/facilities for international collaboration (B14), absence of specialized forums/communities for collaboration (B16), lack of industry-specific expertise in the food sector (B11), and shortage of skilled and specialized workforce (B26).

Some of these barriers, particularly those located in the fourth quadrant, can create adverse experiences during the development of innovative activities and projects, exerting negative effects on business success in terms of product, process, and organizational innovation. Therefore, in the presence of such barriers, the implementation of innovative activities appears unlikely, and the pursuit of innovation is perceived as unnecessary (Madeira et al., 2017).

Knowledge Implication

To date, the primary focus and application of the IPA method and its extended approaches, such as IPMA, have centered on categorizing factors related to customer satisfaction (Madeira et al., 2017). In recent years, however, this method has also been employed to identify challenges and barriers in various domains. For example, (Ogaji, 2022) applied importance–performance analysis to identify challenges in primary healthcare centers. (Deng et al., 2017) utilized this method to classify challenges facing rural communities. (Coad et al., 2016) adopted it to examine the reasons for resistance to innovation in domestic robots. Nevertheless, these studies have not addressed the identification of barriers within a specific industry and manufacturing companies. Accordingly, the first scholarly contribution of this research lies in the application of this method to identify innovation barriers in a specific industry (the food sector) and in edible oil manufacturing companies. Furthermore, the use of a mixed-methods modeling approach and the design of a comprehensive methodology further enhance the knowledge contribution of this article.

The second scholarly contribution of this research lies in the identification and synthesis of a set of barriers that have been referenced in prior studies. From this perspective, the contribution of this research is not only in providing a more precise and dimensionalized definition of innovation barriers in this field, but also in clarifying theoretical pathways for future research by compiling a collection of innovation barriers from prior studies and from interviews with experts. This research-based addition goes beyond studies that merely highlighted “financial constraints” or “lack of training”. (Chan et al., 2015).

The third scholarly contribution of this research pertains to its precision and granularity at the indicator level. Many previous studies have reported barriers in the form of lists or presented broad dimensions, whereas the present study, through its three-phase approach (identification, customizing, and IPMA at both the construct and indicator levels), demonstrates which of the identified barriers are characterized by “high importance” and “low performance” in practice. In effect, through IPMA, we have identified both theoretical and practical priorities based on the combination of importance and performance, which is of significant relevance for advancing research in this domain.

Managerial Implication

The results demonstrate that innovation in edible oil manufacturing companies is highly dependent on the quality of firms' interactions with external actors and the broader industrial ecosystem. Weak collaborative networks, limited institutional connectivity, and insufficient engagement with scientific and international partners reduce firms' ability to access new knowledge and convert it into innovative outcomes. Therefore, managers and industry policymakers should move beyond isolated organizational strategies and instead develop ecosystem-oriented innovation policies that reinforce inter-firm cooperation and knowledge circulation. In this regard, creating transparent collaborative frameworks and formal mechanisms for sharing risks and benefits among firms can increase trust and reduce uncertainty in joint innovation activities (Gao et al., 2025). Furthermore, companies should institutionalize long-term cooperation with universities, research centers, and international knowledge partners through mechanisms such as joint research laboratories, industry–university contracts, and project-based internship programs. These initiatives can facilitate the transfer of applied knowledge, strengthen firms' absorptive capacity, and improve their ability to achieve innovation (Perkmann & Walsh, 2007). From a broader managerial perspective, the establishment of specialized industrial forums and professional innovation communities can also create a shared environment for identifying common technological problems, exchanging experiences, and coordinating collective innovation efforts across the industry (D'Este et al., 2012).

The indicator-level barriers identified in the fourth quadrant reveal that many obstacles to innovation originate from organizational environments that neither support effective knowledge exchange nor encourage employees to participate actively in creative and improvement-oriented activities. In such conditions, valuable operational knowledge often remains fragmented and unutilized, while rigid organizational structures reduce employees' willingness to share ideas and engage in innovation-related initiatives. To overcome these challenges, companies should simultaneously strengthen their knowledge management infrastructure and redesign organizational change processes. From a managerial standpoint, knowledge management systems should not merely store information; rather, they should facilitate the continuous creation, integration, and dissemination of operational and technical knowledge across organizational units. This can be achieved through participatory mechanisms that allow employees at different levels of the company to contribute their experiences and operational insights to innovation activities. As a result, tacit employee knowledge can gradually be transformed into process improvements, technological solutions, and operational innovations throughout the organization (du Plessis, 2007). At the same time, managers must recognize that organizational resistance to innovation (B30) is often rooted in uncertainty, fear of failure, and attachment to established routines. Therefore, implementing innovation-related initiatives requires structured change-management practices capable of creating acceptance and behavioral commitment among employees. In this regard, frameworks such as Kotter's eight-step model (Kotter, 2012) and the ADKAR model(Awareness, Desire, Knowledge, Ability and Reinforcement) (Hiatt, 2006) are particularly appropriate because they emphasize creating urgency, building commitment, securing short-term wins, and institutionalizing change, which together can support the gradual implementation of knowledge management initiatives and, in turn, improve innovation outcomes.

Conclusion

In the food industry, and particularly in edible oil manufacturing companies, which face global competition, price volatility, environmental pressures, and stringent safety and regulatory requirements, innovation is not only a pathway to growth and cost reduction but also a prerequisite for survival. In some companies, however, achieving innovation and reaping these advantages is confronted with significant challenges (Ameen et al., 2024). Reports indicate that such companies often operate in developing or underdeveloped countries and are characterized by extensive supply and value chains. This study focused on edible oil-producing companies in Iran to identify the barriers preventing these companies from achieving innovation and to determine which of these barriers should be prioritized for improvement and resolution.

The importance of examining these issues lies in the fact that identifying innovation barriers is a prerequisite for understanding how innovation processes develop within organizations and for designing effective managerial responses to overcome them (Hueske & Guenther, 2015). In practice, firms that systematically identify and address innovation barriers are better positioned to strengthen their competitive advantage, improve operational adaptability, and enhance long-term business sustainability through more targeted allocation of resources and managerial interventions (John & Sultan, 2024). Based on this rationale, 33 innovation barriers were initially identified in the first phase of the study. After the screening stage in the second phase, 22 barriers were recognized as sufficiently relevant for investigation in edible oil manufacturing companies. In the third phase, the IPMA method was employed to analyze and interpret the relationships among these barriers by classifying them according to their importance and performance.

The IPMA results revealed that, at the construct level, NAE was positioned in the fourth quadrant, indicating a critical area requiring managerial attention. At the indicator level, five barriers were also located in this quadrant. The first barrier, low inter-organizational trust (B12), reflects firms' reluctance to engage in collaborative activities due to concerns about opportunistic behavior and information misuse (Cinar et al., 2019). Weak ties with research institutions (B13) indicate limited interaction between firms and universities or research centers, which restricts access to scientific knowledge and applied technological solutions (Madeira et al., 2017). Weak monitoring and follow-up of global innovation developments (B10) refers to companies' insufficient attention to emerging international technologies, market trends, and innovative industrial practices, reducing their ability to respond proactively to environmental changes. Restriction of employees' freedom in idea development (B27) highlights organizational environments in which employees have limited autonomy or insufficient managerial support to propose and develop innovative ideas (Madrid-Guijarro et al., 2009). Finally, organizational resistance to change and innovation (B30) represents behavioral and structural resistance within firms that slows the adoption of new processes, technologies, and innovation-oriented practices (Indrawati et al., 2020). Together, these findings suggest that many of the critical barriers are rooted not only in resource limitations, but also in organizational culture, external knowledge connectivity, and managerial attitudes toward innovation.

Compared to previous studies, the findings of the present research are in some respects consistent with, and in others divergent from, earlier work. From a consistency perspective, a key point of alignment is that previous studies have also highlighted the importance of networks and collaboration in driving innovation. This consistency indicates that without strengthening inter-organizational linkages and intermediary institutions, the flow of external–internal knowledge and the capacity to absorb technology are weakened; thus, our findings corroborate and reinforce this aspect of the literature (DeMaria & Zezza, 2020). On the other hand, important differences and contradictions also emerge. While several prior studies have identified "financial constraints and risk" as the most significant and decisive barrier to innovation, for example, reports cite technological funding shortages as the primary obstacle (Indrawati et al., 2020) and cluster analyses showing the negative impact of financial/risk clusters (Hartono & Kusumawardhani, 2019). The findings indicate that, in the edible oil manufacturing companies examined, financial issues are not a priority for intervention. This divergence may reflect the contextual and sectoral characteristics of the present research. In certain segments, particularly those with extensive value chains and high dependency on supply networks and external knowledge, the main challenge is not merely financing, but the absence of institutional and network mechanisms that enable the flow and utilization of knowledge.

Finally, we note that the presence of innovation barriers may stem from systemic factors that are difficult to overcome and can be seriously detrimental (Coad et al., 2016). Accordingly, a limitation of this study is its failure to consider the causal relationships among innovation barriers and their impact on the target construct. It is therefore recommended that future research examine the causal links between barriers and innovation outcomes. Furthermore, to better explain these contextual differences and to test the causality of the proposed pathways, longitudinal and intervention-based studies in other companies within the food industry, as well as cross-country comparisons, are necessary. Such investigations would allow the identification of conditions under which financial barriers prevail over network-related barriers, and vice versa, and which combination of managerial and policy interventions yields the greatest effectiveness in enhancing innovative performance.

Author Contributions

All authors contributed equally to the conceptualization of the article and writing of the original and subsequent drafts.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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Conflict of interest

The authors declare no potential conflict of interest regarding the publication of this work.

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