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10.2 Analysis of key factors and barriers to the implementation of innovations in Ukraine's food industry

Today, Ukraine's food industry plays a decisive role in the country's economy, ensuring food security and influencing the development of related sectors. At the same time, rapid globalization, increasing competitive pressure, and accelerated technological change necessitate the introduction of innovations in production and management processes. Contemporary scientific research proves that innovations enable businesses to significantly reduce costs, improve product quality, and better adapt to the ever-growing demands of consumers [341]. However, institutional constraints, a shortage of investment resources, the lack of appropriate infrastructure for commercializing scientific developments, and an underdeveloped practice of public-private partnerships create barriers to innovation. Additionally, the situation regarding personnel training remains a key factor, requiring the simultaneous development of traditional scientific and technical competencies alongside the digital skills needed to implement modern technological solutions.

Given the above, analyzing the key factors and barriers to innovation in Ukraine's food industry becomes particularly relevant, as it provides the basis for developing effective recommendations to enhance competitiveness and ensure the sustainable development of this economic sector. Successful modernization of domestic enterprises involves not only technical and technological changes but also recognition of the importance of marketing, systematic interaction between business and government, and the establishment of an adequate educational foundation that enables effective integration of new technologies into production processes.

Ukraine's food sector is characterized by a high dependence on external conditions while simultaneously demonstrating internal heterogeneity in terms of technological level, organizational culture, and management's readiness to implement new developments [342]. In today's environment of intensified competition and the need to quickly respond to demand fluctuations, the implementation of innovations has become a crucial element in ensuring a stable market position for enterprises.

At the same time, both the organizational and financial capabilities of companies themselves and government programs aimed at stimulating innovation play a significant role. Overall, the key factors influencing the development of innovations in the food industry typically include both internal and external conditions. Internal factors are primarily associated with management approaches, staff qualifications, the volume of available financial resources, and the enterprise's strategic vision for development. External factors mainly reflect industry- and macroeconomic-specific features, including global trade trends, the nature of the competitive environment, and the presence or absence of government incentives. It is also important to note that the level of regulatory and legal stability can play a critical role, as investors and businesses tend to choose markets where the "rules of the game" do not undergo abrupt and unpredictable changes. The main groups of factors involved in implementing innovations in the food industry are presented in Table 1.1.

Table 1.1 Main Groups of Factors in Implementing Innovations in the Food Industry

Group of Factors	Content and Examples	Potential Impact
Internal (Organizational)	- Management structure - Innovation culture - Financial resources - Staff qualifications	Facilitate a rapid response to changes, provided there is sufficient motivation and available funding
External (Market)	- Competitive environment - Consumer demand - Global trade trends	Can either stimulate or hinder innovation, depending on the openness of the markets
External (Regulatory)	- Regulatory framework - Tax regimes - Subsidies, grants - Quotas and standards	Can create favorable conditions (e.g., through incentives) or limit the development of new technologies

As shown in the table, internal factors include not only traditional indicators such as profitability or production capacity but also various aspects related to innovation culture and staff qualifications. If top management and employees are willing to experiment, are receptive to change, and have a clear vision of the benefits of new

developments, this creates a favorable environment for expanding scientific, technical, and marketing potential. Conversely, an organization will lack a stable foundation for innovative projects if a bureaucratic management style prevails or if there is no motivation among employees.

External market factors can have a positive impact on the pace of updates if there is a clear demand for new products, technologies, or service formats. In the food sector, this is particularly evident in trends toward healthy eating, organic products, or eco-friendly packaging. All these areas can encourage companies to invest in innovation to stay ahead of competitors and meet consumer needs. On the other hand, an oversaturated market or a low purchasing power of the population may reduce businesses' willingness to take risks and invest in experimental projects.

The regulatory dimension is no less significant. In the food industry, this involves the presence or absence of transparent certification rules, clear quality standards, tax benefits, or grant programs for production upgrades. Unstable or overly fragmented regulation leads to increased transaction costs and uncertainty at the innovation planning stage [343]. Meanwhile, the national innovation potential is closely linked to the state's ability to create long-term incentives for the development of science and technology [344]. If funding for scientific research is low or if there are no effective public-private partnership mechanisms, the scope and depth of innovation in the food sector are severely limited.

Global trends, which manifest through changes in logistics, the emergence of new sales channels, and the proliferation of the "open innovation" model where companies collaborate with universities, research centers, or even competitors to jointly develop products and technologies also play a significant role. Such a format of cooperation is particularly effective when national legislation and tax regimes do not restrict, but rather encourage, such partnerships.

The effectiveness of innovation in the food industry directly depends on how harmoniously a company's resources and capabilities align with the overall conditions and rules of market operation. On the one hand, the internal environment fosters a management system, financial base, and human resources that enable the generation of

new ideas and their practical implementation. On the other hand, the external environment either facilitates or restricts access to financing, regulates product quality and safety standards, and determines the level of demand and competition in the industry [345]. Let us take a closer look at the specific components of this set of factors and how they interact.

The success of innovation in food enterprises primarily depends on having sufficient financial capacity to cover the costs of developing new products or technologies. If a company has its own resources and can invest in modernization, this reduces dependence on external creditors or shareholders, allowing for riskier decisions and faster responses to market needs. However, if funds are scarce even if the company has a high potential for innovation it may be unable to promptly acquire the necessary equipment, implement cutting-edge technological developments, or finance research.

An important internal factor is also human resources. The degree to which employees are qualified, ready to master modern technologies, and able to collaborate in multidisciplinary teams determines how quickly and easily new developments are integrated into production processes. Contemporary studies confirm that well-coordinated internal communication and the active implementation of training programs significantly increase the likelihood of successful innovation. On the other hand, if a conservative culture prevails among staff or management does not support employees' initiatives, even the most promising projects can stall at the idea stage.

Special attention should also be paid to technological capacity. Food enterprises with outdated equipment often face challenges when implementing innovations, as any upgrade requires additional funds, substantial process restructuring, and retraining of personnel. Conversely, if the basic production platform is flexible and includes automated quality control and analytics blocks, integrating new solutions becomes faster and less costly. Here, having individual advanced machines is not enough; a comprehensive technological strategy focused on continuous improvement is crucial.

Another internal factor is the organizational structure, which determines how effectively research and production experiments can be carried out and how well the

innovation process can be managed. The presence of a specialized department responsible for tracking trends and generating new ideas significantly boosts innovative activity. If a company maintains a rigid management hierarchy with bureaucratic barriers, innovations are typically implemented in a piecemeal manner and without the necessary systematic impact.

While internal potential determines a company's ability to realize innovative ideas, the external environment either provides or, on the contrary, restricts favorable conditions for such changes. One of the key factors is government regulation, which establishes quality standards, certification rules, and sanitary-hygiene requirements. This is particularly noticeable in the food industry, as it is often impossible to enter new markets or introduce innovative technologies without adhering to strict food safety standards. Transparent and stable regulatory regimes give enterprises greater confidence in long-term planning, whereas frequent changes in legislation create additional risks.

The state of the market competition, consumer demand trends, and global developments in the food sector also plays an important role. If consumers are open to new products that increase convenience or distinguish themselves by being environmentally friendly, companies are more likely to invest in research and marketing experiments. However, if price remains the determining factor and innovations do not offer substantial savings for the end consumer, businesses may be less interested in pursuing them. A country's technological and logistical infrastructure significantly influences the ability of enterprises to deploy large-scale innovation projects. Undeveloped transportation hubs, insufficient warehouse facilities, or limited IT services can hinder the rapid scaling of even the best solutions. In the context of the food industry, this can mean lengthy and costly product delivery to the consumer, export difficulties, or a lack of online sales platforms, thereby causing a loss of potential market opportunities.

Despite the clear benefits of innovation in terms of improving the efficiency and quality of food products, in real-world conditions, their implementation faces a number of barriers that significantly slow the process of modernization and renewal of the

industry's technological base. These obstacles can be considered complex, as they arise at various levels from regulatory and legal frameworks and access to financing, to staffing issues and technological limitations within enterprises. All of this ultimately affects companies' ability to respond adequately and promptly to competitive pressures, as well as to meet the needs of today's consumer, who constantly raises demands for both the quality and variety of food products.

One of the most significant factors hindering innovative progress in the food industry is the irregular and often inconsistent updating of legislative and regulatory acts. Lack of coordination between various government agencies, the absence of a unified, comprehensive innovation support policy, and complex licensing procedures create additional barriers for enterprises particularly small and medium-sized ones. In many cases, companies end up spending more resources on bureaucratic processes and inspections than on actually implementing new technologies. It is important to note that the food industry faces especially stringent requirements for product safety and adherence to global standards. If the government does not offer a transparent certification system and quick access to permits, businesses risk wasting time and money trying to adapt to each new regulation. As a result, even those companies with sufficient internal resources for innovation may shy away from large-scale upgrades due to unjustifiably high transaction costs and a lack of guarantees regarding a stable legal environment.

In a globally competitive environment where export potential is significant, the absence or low effectiveness of such support programs renders domestic companies less flexible and less capable of competing with international players that have access to cheaper resources [346]. Sometimes, enterprises have to completely overhaul their production chains, a complex and costly process so many limit themselves to piecemeal solutions, which do not yield a systemic impact.

Another complicating factor is the low level of digitalization. Although the modern agricultural sector is increasingly adopting IoT (Internet of Things), Big Data, and artificial intelligence, many food companies still rely on "paper-based" record-keeping and manual data entry. This reduces process transparency, makes defect

tracking more difficult, and leads to efficiency losses [347]. Moving to new forms of production organization where IT systems are integrated into every link from raw material procurement to the sale of finished products requires significant capital investment and staff retraining, which is not always feasible for small businesses.

Innovation in Ukraine's food industry depends directly on coordinated cooperation among all stakeholders: government bodies, private businesses, scientific and educational institutions, and international organizations that can support innovative projects. Skillfully combining government initiatives, market incentives, and applied research can enable a significant breakthrough, especially regarding the introduction of cutting-edge technologies and the enhancement of product quality and environmental safety.

Transparent funding programs tailored to food enterprises of various sizes can significantly lower the barriers to innovation. Such programs may include grants for developing new products, tax incentives for investing in high-tech equipment, and support for research centers specializing in biotechnology or IT solutions for the agricultural sector. "Green" innovations aimed at reducing environmental impact are becoming increasingly relevant. This encompasses not only the adoption of environmentally friendly production methods but also innovative approaches to packaging, logistics, and waste management. Experience from leading countries shows that companies actively working in this area tend to have higher market capitalization and can more readily attract international investment [348]. A particularly effective model is the clustering approach, in which organic producers, researchers, and IT specialists collaboratively develop solutions that meet European environmental standards and enable them to enter global markets with unique offerings.

Technological modernization remains a promising direction as well, involving automation, robotics, and digitalization. The introduction of IoT solutions, artificial intelligence, and big-data analytics systems can significantly simplify supply-chain management, improve demand forecasting accuracy, and minimize raw material storage losses. These measures not only increase operational efficiency but also open

up additional opportunities to develop high value-added products particularly pertinent for export-oriented companies.

One of the key prerequisites for innovations to become a decisive factor in growth is a well-designed marketing strategy. If an enterprise adopts modern e-commerce channels in a timely manner, leverages social media marketing (SMM), and employs neuromarketing tools, it stands a better chance of effectively conveying the value of its new products to end consumers. Marketing plays an especially critical role when launching products that require shifts in habitual consumer behavior for instance, promoting healthy eating, organic products, or gluten-free and vegan lines.

A review of positive global experience in food industry innovation in various countries has enabled the identification of their main characteristics and the effectiveness of these approaches. Table 1.2 presents the key features derived from this analysis.

Table 1.2 Comparison of Global Innovation Practices in the Food Industry

Country	Key Features	Outcomes	Recommendations for Ukraine
Netherlands	- High density of innovative, agribusiness-focused farms - Close cooperation between universities and businesses	- Leading position in exporting high-tech vegetables and flowers - Reduced water and fertilizer use through precision farming	- Establish regional clusters uniting farmers, scientists, and tech companies - Encourage collaboration via grants and tax benefits for joint R&D projects
USA	- Major tech companies actively invest in biotechnology and IT solutions for the food industry - Developed venture ecosystem for agri-startups	- Wide range of innovative products (e.g., plant-based “meat,” alternative protein solutions) - Successful scaling of ag-tech startups thanks to venture capital	- Develop venture funds and accelerators focused on ag-tech - Strengthen cooperation between government agencies and IT corporations to implement digital solutions in the food sector
Germany	- Government innovation funding programs (ZIM,	- High level of organic production and a well-developed processing	- Introduce specialized funds to support agri-processing and organic production

Continuation of table 1.2

	BMBF) - Close integration of industrial enterprises with universities.	infrastructure - Established sustainable sales channels in both domestic and foreign markets	- Strengthen university–enterprise joint projects with clear performance criteria to embed scientific developments in production
Japan	- Strong emphasis on robotics and production automation - Focus on exports through high quality standards	- Increased productivity thanks to robots in greenhouses and warehouses - Enhanced competitiveness in Asian markets due to consistent product quality	- Promote the introduction of robotic lines in small and medium-sized enterprises - Develop export programs for high value-added products (premium goods, unique technologies)
Denmark	- Flexible regulations encouraging eco-friendly innovations - Well-developed cooperatives as a form of agribusiness organization	- Among the highest global standards for food safety - Success in promoting eco-friendly brands in international markets	- Advance certification of organic and “green” products, aligning with international standards - Encourage the creation and growth of agricultural cooperatives by providing preferential loans and tax incentives for such business models

As the table shows, innovations can take various forms: from establishing national clusters and promoting scientific-production cooperation (the Netherlands, Germany) to supporting agri-tech startups through venture financing (the United States) and actively adopting robotic solutions (Japan). For Ukraine, it would be especially useful to take into account Denmark’s experience, which combines eco-friendly initiatives with a cooperative movement, thereby gaining additional competitive advantages on the global market.

In the context of our country, the priority is to improve access to affordable sources of financing and to strengthen public-private partnerships. This will not only enable the creation of local growth points (startups or innovation hubs) but also facilitate the development of fully fledged clusters where agricultural companies, universities, and local authorities collaborate to develop and scale technological solutions. At the same time, focusing on exports and adhering to global safety and

environmental standards will allow Ukraine to secure higher positions in value chains. Hence, the future of innovation in Ukraine's food industry is tied to creating favorable conditions for technological renewal, developing "green" solutions and digitalization, actively collaborating with educational and scientific institutions, and building a unified market for goods on a global scale. Realizing these objectives must be a shared responsibility among all market participants from government agencies to business leaders and local innovation hubs. Such a systemic approach will enable the full potential of the food sector's innovative capacity, boost competitiveness, and open new avenues for economic growth.

Given the existing obstacles and the potential for developing innovations in the food industry, the proposed measures can be grouped into three key areas: improving the regulatory framework and state support, enhancing management efficiency within enterprises themselves, and expanding cooperation among all market participants, including research institutions and international partners. Below is a set of recommendations aimed at eliminating or minimizing current barriers:

1. Improving the Regulatory Environment and the System of State Support:

– Simplification of Licensing and Certification Procedures. Many countries employ a "one-stop shop" approach, where an enterprise contacts a single coordinating body and completes all necessary formalities quickly and transparently. This model reduces both the time and costs associated with bureaucratic procedures and facilitates the implementation of experimental projects.

– Implementation of Targeted Innovation Funding Programs**.** At the ministerial and local government levels, it would be advisable to develop grant competitions, tax incentives, and preferential loans that allow small and medium-sized enterprises to attract additional resources for equipment upgrades and the adoption of new technologies.

– Creation of a Transparent Legal Framework for Public-Private Partnerships. Such a framework would enable the government, businesses, and academic institutions to combine efforts in joint projects, sharing both the risks and benefits of implementing innovations.

2. Enhancing Internal Management Mechanisms at Enterprises:

– Establishment of R&D Departments or Teams. Even small teams that continuously monitor global trends and analyze modernization opportunities can significantly drive a company's development.

– Investment in Employee Training. Seminars, professional development courses, and internship programs at leading innovation centers and companies help expand specialists' expertise and integrate modern approaches into supply-chain management, quality control, and market research.

– Business Process Digitalization. The use of ERP, CRM, monitoring, and Big Data analytics systems makes it possible to optimize costs and increase transparency, including in quality monitoring and demand forecasting.

3. Strengthening Cooperation and Integration into the Innovation Environment:

– Development of Scientific-Industrial Clusters. Clustering brings together businesses, research institutions, and educational organizations, enabling the creation of joint research labs, pilot projects, and exchanges of expertise. The result is synergy, where each participant contributes to boosting the industry's overall competitiveness.

– Attracting International Organizations and Funds. Collaboration with European and global funds provides enterprises with access to grants, investments, and expert support. This can speed up the introduction of eco-friendly and digital solutions, improve product quality, and enhance marketing tools for entering global markets.

– Exchanging Best Practices and Experiences. Regular conferences, exhibitions, workshops, and industry events allow interested parties to learn about effective innovation implementation methods, establish new contacts, and build a shared network of partners and clients.

A key principle of all these measures is comprehensiveness and long-term focus. Occasional initiatives such as one-time grants or short-term training programs cannot fundamentally change the situation. In contrast, a systemic approach that involves improving the regulatory framework, investing in human capital, and supporting research activities leads to the emergence of "innovation ecosystems." In such a system, both small companies and large agro-industrial holdings have the incentives

and the real opportunities to continuously improve their technologies and methods of operation.

In conclusion, the implementation of the recommendations outlined above will help create a favorable environment for large-scale innovation, enabling Ukraine's food industry to move to a higher level of development. This will be reflected in increased production efficiency and product quality, as well as in greater consumer and international partner trust, opening up broader opportunities for entering global markets.

An analysis of the internal and external factors influencing innovation processes in Ukraine's food industry indicates both a substantial potential for modernization and a number of systemic obstacles. On the one hand, enterprises have access to financial resources, qualified personnel, and a desire to update their production lines. On the other hand, government regulation, the investment climate, and technological infrastructure do not always foster rapid innovation. As a result, new solutions are often introduced selectively and at a slower pace, especially in small and medium-sized companies. Human resource issues and the level of organizational culture play a significant role: even with sufficient budgets, enterprises may fail to realize promising projects due to a lack of competent specialists or a lack of internal motivation for change. At the same time, inadequate cooperation with scientific institutions impedes the transfer of cutting-edge developments to the real sector.

Among the external factors, the stability and predictability of the legal framework, the availability of financial instruments, and the market conditions and consumer demand for innovative products are decisive. If consumers are receptive to new products and regulatory policies encourage equipment upgrades and the adoption of digital solutions, the industry gains an additional impetus for dynamic growth. However, in the absence of preferential financing and amid complex licensing procedures, companies are forced to act more cautiously, favoring traditional technologies. Comparisons with global practices confirm the effectiveness of approaches such as public-private partnerships, clustering, and environmentally focused strategies. The introduction of "green" technologies, active cooperation

between businesses and scientists, and the involvement of venture capital and accelerators can create conditions for a genuine innovation breakthrough. Ukraine would benefit from adapting these mechanisms, taking into account regional specificities and focusing on enhancing the competitiveness of its food products.

Ultimately, recommendations for overcoming existing barriers must address both improvements to the regulatory framework and the provision of targeted funding programs, as well as the strengthening of the internal potential of the enterprises themselves. Establishing R&D departments, fostering a culture of innovation, investing in staff training, and digitalizing processes can radically alter the industry's development trajectory. If these measures are combined with sustainable partnerships among businesses, government agencies, and international funds, Ukraine's food industry will not only be able to meet the challenges of today's market but also set new standards of quality and efficiency.