

A Framework for the Export Development of Nanotechnology Products of Knowledge-based Companies in the Construction Industry: A Grounded Theory Approach

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Abstract:

The present study aimed to provide a framework for identifying the determinants affecting the export development of nanotechnology products of knowledge-based companies in the construction industry. Methodologically, the research was conducted qualitatively using a grounded theory approach. Data collection was conducted through document review and interview. The purposive and snowball sampling continued until theoretical saturation. The data analysis results were obtained in three steps of open, axial, and selective coding. During the open coding process, categories such as causal, contextual, intervening factors, strategies and actions, and consequences of export development of nanotechnology products were extracted. Then, in the axial coding stage, a link between these categories was identified within the coding paradigm. In the selective coding stage, all components of the coding paradigm were explained, and the theory was developed. After the coding process, the main categories were extracted by conducting fifteen in-depth and semi-structured interviews with practitioners and experts of nanotechnology knowledge-based companies in the construction industry. The benefits of exporting knowledge-based products and services made this a strategic issue for the industry. According to the results, the export of knowledge-based products and services had benefits, including job creation, wealth creation, economic prosperity, comprehensive corporate development, synergy, and increased exports

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Introduction

Today, one of the main challenges for marketers is market globalization, which has led to increased global competition. Under such circumstances, companies are looking for opportunities in international markets to achieve their goals and protect their market position (Wu, 2016). The incentive for internationalizing business activities varies. These incentives include increasing sales, providing multiple markets to sell products, gaining resources (Kotler, 1984), making a profit (Simões & Crespo, 2002), taking advantage of foreign market opportunities and resources in foreign markets (Di Gregorio and et al., 2008), intensifying competition, risk diversification, gaining international experience, and developing a business network. Internationalization refers to the expansion and development of economic activities outside the economic borders of a country. Domestic business puts pressure on companies to look for opportunities in overseas markets. By operating abroad, companies will cope with periodic fluctuations in domestic markets, maintain growth, diversify their market portfolios, and have a competitive position (Maqsoom et al., 2014). Companies must continually provide solutions to global competition (Maleki MinBashRazgah & Siahsarani Kojouri, 2017). Numerous developing countries are heavily dependent on raw materials as their main source of export revenue. Countries exporting manufactured products are growing faster than countries exporting raw materials (Sheridan, 2014), and for economic growth, many developing countries are looking to diversify their exports (Massol & Banal, 2014; Sekkat, 2016). Export is the most common mode for businesses to enter international markets. There is the least business risk in this international business, commitment to limited domestic resources is less felt, and flexibility is high in this market (Uner et al., 2013; Ngo et al., 2016). Companies also use a growth strategy to stimulate internationalization to increase their competencies, expertise, and knowledge and help the national economy's function (Ayob& Friexanet, 2014). One of the areas affecting the country's GDP is non-oil exports, which can influence the GDP through various channels. This issue is of special importance for Iran. This issue is of special importance for Iran because its dependence on oil revenues has always faced the destructive impact of oil revenue instability due to international political and economic issues, especially oil sanctions on macroeconomic indicators (Mohamadkhani et al., 2020). One of these cases is the export of nanotechnology products of knowledge-based companies. Export in general, and the knowledge-based export in particular, is a very complicated activity with its capacities. Rapid changes in knowledge and technology, short product life cycles, and fierce global competition have accelerated the creation and expansion of a competitive environment in most countries, and the pressure on countries to continuously develop new knowledge and technology has increased for long-term competitive survival and success. In this regard, one of the challenges facing most successful countries in exports is

gaining and maintaining a competitive advantage by supporting knowledge-based activities. Therefore, expanding and improving the quantitative and qualitative level of knowledge-based export products is of considerable importance. Appropriate policies are necessary to form a strong sector in the long run, and these policies cannot be implemented without identifying the effective factors. Moving towards more knowledge-based products and more exports of high value-added products will lead to technological advances and higher economic growth rates, one of the macroeconomic goals (Mirjalili et al., 2019). The development document plan of the nanotechnology application has been developed to achieve a one to two percent share of the global nanotechnology market by Iranian-made nanotechnology products in 2025. On the other hand, increasing the share of high-tech goods in industrial exports is one of the development indicators. The export development of knowledge-based goods and products with a high share of advanced technology is one of the important goals of the long-term export development strategy. The new center for exporting knowledge-based goods and services has been added to the main centers for non-oil exports, including petrochemicals and gas condensate, agricultural products, carpets and handicrafts, technical and engineering services, and industrial and mineral products. Statistics show the gap between domestic sales of nano-based products and exports of these products. Only 18% of all nano-based products are exported to foreign countries, and 82% of this share is domestic sales. According to the nanotechnology application development document, efforts have been made to gain a one to two percent share of the global nanotechnology market. To achieve this, the export development of these products has a special place (Special Staff for Nanotechnology Development, 2018). Therefore, this research seeks to recognize the factors influencing the export development of nanotechnology products of knowledge-based companies in the construction industry. Construction has been selected among the various industrial fields producing nanotechnology goods, with a larger share of products and industrial companies than other industries.

Theoretical Foundations and Literature Review

In order to compete in foreign markets or expand foreign markets, managers need to have a broad and deep understanding of business practices and policies in foreign markets. Free trade, as a driver for growth, develops the economy and raises living standards. At the macro level, there is a direct relationship between trade and income (Lin, 2015), and exporting companies are important for the trade of many countries (Serra et al., 2012). In a global economy, exports are no longer a demand but a necessity (Haar & Buonafina, 1995). Exports as an element influencing economic development, both economically and politically, play a key role in advancing goals. In different countries, the export portfolio

varies. In general, it has two parts: the export of raw materials, including gas, oil, and precious stones, and the export of non-raw materials (factory goods). Today, the production and export of factory products are considered as a measure of economic development. Therefore, the expansion of non-oil exports is of interest to politicians and economists in different societies. In general, the most important problem of developing countries is their dependence on raw materials. A large share of these countries' foreign exchange earnings comes from exporting only one or more raw materials, and in the long run, they have a shaky structure in the face of political and economic pressures. Although large oil revenues can provide financial benefits and the opportunity to build a strong economic structure for oil-rich countries, they can also be an obstacle to the growth of their economic quality. Over the years, with the expansion of oil sales resources in Iran, the oil foreign exchange earnings have faced fluctuations and price shocks. Also, reliance on oil revenues has led to a disregard for income-generating economic activities and natural and industrial capacities, which will result in increased imports versus oil exports. This situation is the main obstacle to production. As a result, it seems that the best way to prevent the negative impact of oil price fluctuations is to develop plans for the long-term expansion of non-oil exports (Monsef et al., 2017). In formulating an export development plan, the added value and profit margin appropriate for the export of products and viability and reliability is significant, and policymakers must try to plan in a way that can get the most out of their efforts. Therefore, high-tech products have a special place. These products have more added value than other products because of the knowledge in their production. It is more difficult to copy and create a competitor for them in the market. Therefore, their long-term or continuous presence in the market can be guaranteed (Khaleghian, 2011). Developing countries have no choice but to use advanced production practices and reduce production costs to successfully increase the production and export of their industrial goods according to international standards. Technology is one of the main factors in economic and industrial development. High technology is of special importance because it greatly impacts the development and promotion of the industry and plays a significant role in overtaking global trade competitors. This industry creates high added value, and this technology affects various sectors of the economy and improves and enhances it. Identifying the factors affecting the export of these products is necessary to increase the export of industries or high technology. According to Article 37 of the Fourth Development Plan Law, in order to create a favorable environment for strengthening competition, achieving non-oil economic growth of 10.7% increasing the export of high-tech goods from non-oil exports from 2% to 6%, the government is obliged to establish a proper legal, economic, private, commercial, and technical system to enable the country to export high-tech industries. Preventing the mono-cultural economy and diversity in export goods, especially the export of industrial products and high-

tech goods, is necessary for developing countries. According to international trade theories, improving competitiveness and expanding exports depends on countries' technical and industrial progress (Mehregan et al., 2011). Nanotechnology has become one of the leading and scientifically advanced disciplines in many fields of science and engineering, including healthcare, medical diagnostics, communications, electronics, renewable energies, aerospace, and construction. Although nanotechnology research and experiment began in the early 1980s, its incredible impact on R&D has attracted major countries and made nanotechnology one of their top research priorities in the early 21st century. Iran also started its nanotechnology activity in 2000, when it was ranked 57th in the world. At present, Iran has made great progress in the nanotechnology sector, so that in 2014, it reached the seventh rank in the production of nanotechnology in the world. In 2000, Iran ranked even lower than some Arab countries, but today, compared to other countries in the region, it accounts for half of the nanoscience production in the Middle East. It is ranked first in nanoscience production (Special Staff for Nanotechnology Development, 2015).

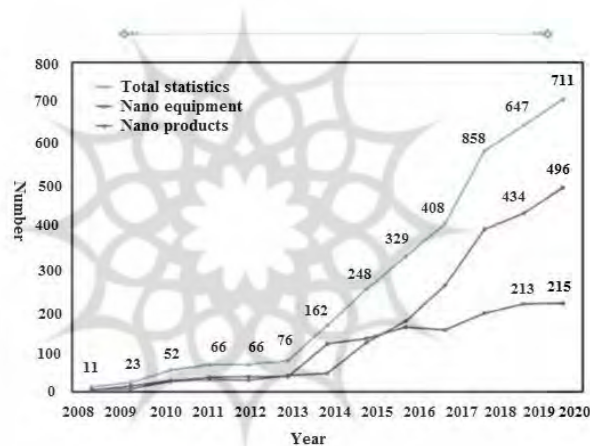


Fig.1. Number of nanotechnology products and equipment
(Source: Iranian Nanotechnology Products Database (2020))

The sectors that are leading in nanotechnology during the next ten years were selected based on two criteria of significant priorities of science and technology in country's scientific map, nanotechnology's needs, opportunities, benefits, and problems in six topics: (1) healthcare, (2) energy, (3) environment, (4) construction, (5) equipment and machinery, and (6) nano-materials (Iranian Nanotechnology Products Database, 2020). The utilization of nanotechnology in the construction industry has led to the production of multipurpose building

materials with high efficiency and added value and improved the durability and quality of building materials. This technology helps the construction industry in two ways: (1) optimizing and improving the performance of available technologies and (2) providing a new set of technologies and functions that did not exist before nanotechnology. Therefore, the advantages of utilizing nanotechnology in the construction industry are: improving the quality of materials, decreasing energy consumption, and thus reducing costs. According to research results, in ten cases of application of nanotechnology, the construction industry is ranked eighth. The nanotech application in the construction industry is small compared to the scope of the construction industry. Although nano-materials are used to a limited extent in the construction industry today, considering the characteristics of these products, we can expect dramatic changes in the use of these materials in buildings. Examples include applying nanotechnology in paint, insulation, glass, tiles, concrete, cement, and others (Special Staff for Nanotechnology Development, 2015).

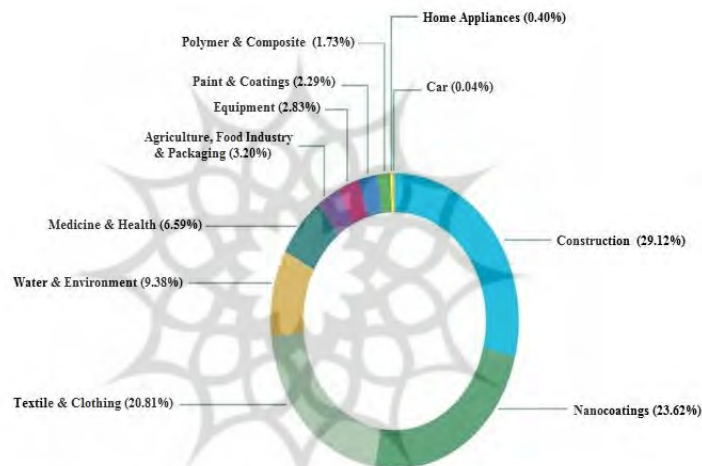


Fig.2. The share of various industrial sectors in exporting nanotechnology goods, services & equipment in 2018
(Source: Special Staff for Nanotechnology Development (2018))

Previous studies show that identifying the factors affecting the export development of nanotechnology products of knowledge-based companies in the construction industry has not been explicitly considered for Iran. Only the factors affecting the overall export value of high-tech products in different countries have been studied. Another critical point that has not been addressed in any previous studies is the “nanotechnology products of the construction industry.” A review of domestic studies on the export of nanotechnology products shows that the factors affecting high-tech exports in the construction industry have not been studied in previous studies. Due to the above research gaps, this study identifies

the factors affecting the export development of nanotechnology products of knowledge-based companies in the construction industry. In the following, we will review some relevant studies on this field.

Mohamadkhani et al. (2020) conducted a study, "*Measuring the Short-Term and Long-Term Effects of Factors Affecting the Export of High-Tech Product Groups in Iran.*" Their study aimed to investigate the factors affecting the export of high technology products based on four-digit ISIC codes in Iran during 1996-2018 using the *Panel Autoregressive Distributed Lag (ARDL)* approach. The study results showed that domestic R&D costs, foreign R&D accumulation, short-term and long-term commercialization, and the degree of openness of the economy and human capital, in the long run, significantly affected the exports of high-tech products in Iran. The exchange rate also had an insignificant effect on the export of high-tech products in the short run and a negative and significant effect on the export of high-tech products in the long run. However, inventions did not significantly affect the export of high-tech products in the short and long term.

Akbari et al. (2019) conducted a study titled "*The Impact of Knowledge Workers on Exporting Innovative Goods and Services: The Moderating Role of Competition in Countries' Development.*" The study investigated the impact of knowledge workers on the export of innovative goods and services with a moderating role of competition in developed and developing countries during 2011-2016. Information on sample countries was extracted from the Global Innovation Index report. The present study used panel data to fit the models, which was implemented using Eviews software. The results showed that knowledge workers had a positive and significant effect on exporting innovative goods and services. Also, in both developing and developed countries, competition plays a moderating role in the relationship between knowledge workers and the export of innovative goods and services.

Khorshidi et al. (2017), in a research report, "*A Study to Design and Explain the Export Development Model in Iran's Free Trade Zones,*" sought to assess the direct and indirect effects of export development plans developed by the government and internal and external environmental factors on the export performance of exporting firms. This study used a hybrid-heuristic approach to identify and explain the export development model in free trade zones. According to the proposed research model, 79 indicators were extracted and reported in eight sub-factors and two main factors for export development. Therefore, the researchers obtained a theoretical model tested with comprehensive indigenous features. In this model, the two main factors considered micro and macro environment characteristics, export structure of free trade zones, resources, organizational capabilities, managerial competencies, competitive strategy, export marketing strategies, export value, export volume growth, and export market share of environment and company.

Mahmodi Meimand et al. (2014) conducted a study titled “*export development management; identification and leveling up of the export incentives (Case study: Auto Part Manufacturing Industry)*.” This study identified the auto parts industry’s export drivers, and the relationships between them were leveled up and determined within interpretive structural modeling (ISM). The study’s population consisted of senior managers of companies exporting auto parts in Tabriz City. The leveling results showed that the four drivers of delegation to the provinces and decentralization in export planning and development, development of trade and export infrastructure, transparency of laws and elimination of redundant regulations in the export process, and formation of specialized export committees were the primary factors of developing auto parts exports. Five drivers were considered as the final motivators of the integrated export incentive leveling model in the automotive parts industry: (1) development of export firms, (2) market research and marketing in export target countries, (3) reform of the export product pricing process, (4) development and promotion of parts packaging, (5) and development and attraction of foreign investment in the auto parts manufacturing industry.

In a study, Mehregan et al. (2011) examined the behavior of developed and developing countries in the export of high-tech industries. Using the generalized least squares (GLS) approach in panel data for the period 1990-2005, they identified the factors affecting the export of high-tech industries according to price and non-price determinants. This study showed that the variables of R&D, foreign direct investment, real effective exchange rate, degree of economic openness, and trade experiences in developed and developing countries had a positive and significant effect on the export of high-tech industries. Economic growth in developed countries only affected the export of high-tech industries.

In a study, Panzabekova Aksanat (2021) argues that every government stimulates its economy by exporting in the nanotechnology sector. Surprisingly, there are few experimental studies on the determinants of nanotechnology exports. This study analyzes Central and Eastern Europe (CEE) and the Commonwealth of Independent States (CIS). For this purpose, the Balasa index is used based on the concept of obvious comparative benefits. The study examined 73 product groups in the automotive, chemical, mechanical engineering, electronics, and electrical engineering industries in 27 countries during 1995-2018. The principal component analysis helped generate a competitive index for high-tech industries, with CEE and the Baltic states making significant strides in developing high-tech economic sectors.

In contrast, CIS countries have made virtually no progress. According to the results of this study, the factors driving export growth in the nanotechnology industry of the studied countries are wage level, resource prices, open economy to foreign trade, tax rate, unemployment rate, and the quality of human capital. Also, the study results did not confirm the positive effect of inflation, foreign

investment inflows, and R&D costs on the export volume of nanotechnology products in the studied countries.

In their research, Mehrara et al. (2017) state that considering the importance and role of nanotechnology products in economic growth, it is necessary to identify determinants affecting exports. Accordingly, they examined the determinants of nanotechnology product exports to 24 developing countries during 1996-2013 based on the Bayesian model averaging (BMA) and the weighted-average least square (WALS) technique. The results showed that institutional quality, human capital, imports, and GDP were the main determinants affecting the export of nanotechnology products in developing countries.

QIU et al. (2017) argue that in recent years, due to the adjustment of the export structure, the issue of competition for the export of nanotechnology products has been considered by many domestic and foreign researchers. This study examines the relationship between the main factors of nanotechnology product exports and competition during 1985-2013. The results show a long-term and stable relationship between recurring deposit (RD) investment, human capital, technological innovation, foreign direct investment, and competition. RD investment and human capital can significantly increase the competitiveness of nanotechnology products in the long run. Technological innovation and foreign direct investment play a minor role in increasing the competitiveness of nanotechnology products. Therefore, increasing RD investment, accelerating and improving technological innovation are effective ways to strengthen the export competitiveness of nanotechnology products.

Sandu and Ciocanel (2014) have examined the relationship between exports of high and medium technology products and the determinants of innovation in Europe. In this study, R&D costs, including public and private sector costs, human resources working in knowledge-based activities, and international trade relations, are considered essential factors affecting the increase in exports of high-tech products in European countries. Based on the results, the causal relationship between these variables and the level of high-tech exports in European countries was confirmed. In addition, the positive effect of R&D costs on the private sector was more potent than the effect of public R&D costs.

In a study, Tebaldi (2011) examined the determinants affecting the export of high-tech products to the International Atlantic Economic Society (IAES) during 1980-2008. According to the results of this study, human capital, foreign investment flows, and the degree of national economic openness are very influential factors on the performance level of high-tech industries in the global market. The results also showed that although the political climate and institutional component directly affect the export of high-tech products, they can also indirectly affect human capital and foreign direct investment.

Research methodology

In this study, the qualitative method, and in particular, Strauss and Corbin's (1990) 's grounded theory approach, are used to identify the determinants affecting the export development of nanotechnology products of knowledge-based companies in the construction industry. Since the grounded theory is based on a purely inductive method, the researcher develops a theory instead of testing existing theories. Therefore, the study's variables will be identified and explored based on the theoretical framework and categories. The field study is used for data collection, and the data collection tool is an interview. The researcher used in-depth and semi-structured interviews based on a heuristic study. This method performed data analysis using open coding, axial coding, and selective coding systems. According to the research purpose, the population included practitioners and experts of nanotechnology-based companies in the construction industry and university professors. Sampling was also done theoretically. Theoretical sampling is a method in which a researcher collects relevant data to extract and construct the categories needed to build a theory (Charmaz, 2011). Theoretical sampling is the best way to develop a theory (Creswell & Poth, 2016). The sampling was also non-probabilistic. Data were collected through interviews with fifteen managers, practitioners, and experts of nanotechnology knowledge-based companies in the construction industry.

Findings

"Coding" is a systematic method, and Strauss and Corbin (1998) developed it to explore features and categories. This research developed a theoretical model based on coding to explain export development. It is worth noting that in this method, data collection and analysis are done simultaneously and in a zigzagging way. The data collection will continue until the researcher reaches the data saturation level. The export development concepts mentioned by the various interviewees are repeated, and no new items are added to the model. The researcher has moved purposefully and continuously between open and axial coding to extend the export development theoretical model through the data analysis process. According to Strauss and Corbin (1990), open and axial coding are not two consecutive steps in an analytic process. The coding process is dynamic and floating. At the beginning of the coding process, an attempt is made to identify the categories through the open coding method. In the axial coding process, the categories are linked together. After identifying the relationship between categories in open and axial coding, the general categories, subcategories, and relationships between categories are homogenized through the selective coding method, and a theoretical model is developed. After coding and extracting the essential items most emphasized by the interviewees, the main categories resulting from the formation of the categories were extracted to identify the parameters affecting the export development of nanotechnology

products of knowledge-based companies in the construction industry. The results are given in Tables 1 to 5, respectively.

Table1: Identified concepts and categories for causal conditions

General category	Concept	Final codes
Causal conditions of export development	Governance structure	Legislation, government political structure, government policies, government processes and structures, administrative processes, government processes, cumbersome laws, regulatory system, political stability, structural change, freedom of expression, quality of laws, government effectiveness, corruption control, support for knowledge-based companies, favorable policy-making, laws and regulations, government policies, government support, legal structures, sanctions, political stability, communication at the national level, abnormalities in the country, open trading, political communication
	Managerial factors	Poor management
	Marketing	Creating a new market, poor marketing
	Technological infrastructure	IT infrastructure, IT and ICT capacity, type of technology, industry infrastructure
	Specialized human resource	Employing specialized HR, hiring marketers and sellers in companies, recruiting traditional marketers, utilizing practitioners' knowledge and experience
	Product	Product advantages, product innovation, fair pricing, product quality, product advantage over similar products, compliance with international standards, the value of export products, added value, diversification
	Resources and facilities	Equipment, advanced industrial equipment, raw materials
	Communications	Communications, telecommunication structure
	R&D	R&D Department
Transportation system	Transport system, transport system improvement	

Table 2: Identified concepts and categories related to grounded conditions

General category	Concept	Final codes
Grounded factors of export development	International factors	Actions of the Ministry of Foreign Affairs, establishing and improving relationships with other countries, considering the international market
	Organizational factors	Executive team, organizational structure, HR expertise, managerial performance, incentive plans, creative thinking, organizational culture, supervision, support systems
	Cultural factors	Culturalization, culturalization consumption, communication at the national level, cultural communication with other countries, promotion through culturalization, cultural perspective on knowledge-based products, participatory work culture, organizational culture, accountability culture, responsibility culture, government managers' culture

	Economic factors	Product cost, currency price, rial and dollar value difference, fixed income, domestic market conditions, fixed exchange rate, customs duties, tax exemptions, currency fluctuations, insurance, tax, incentive programs, domestic and foreign investment, financial security, financial transparency, businesses, financial support, economic openness, economic structures, increased liquidity
	Social factors	The relationship between technology and society, social considerations
	Knowledge and technology factors	Knowledge infrastructure, company-university relationship, technology, technical knowledge promotion, technical development, technical knowledge transfer
	Environmental factors	Environmental factors
	Ethical factors	Ethical considerations

Table 3: Identified concepts and categories related to intervening conditions

General category	Concept	Final codes
Intervening factors in export development	Sanctions	Sanctions
	Rules and regulations	Elimination of cumbersome laws, non-implementation of laws, unnecessary governance laws, insurance laws
	Market	Domestic market constraints, domestic market pessimism, and distrust, international black market, inability to market and trade, problems entering target markets
	Administrative processes	Complex administrative processes, difficulty in obtaining certificates, commercialization process, problems in obtaining operating licenses, problems in obtaining legal licenses, long steps in registering companies, administrative bureaucracy, parallelization of relevant institutions
	Financial issues	Lack of timely financing, high cost of obtaining foreign licenses, high export costs, difficulty in financial exchange, costly R&D, high bank interest rates, lack of financial resources, exchange rate fluctuations, inadequate facilities, inflation and economic instability, high investment risks, difficulty in international financial relations
	Resources and facilities	Lack of sufficient facilities, limited access to quality equipment, limited access to required raw materials

Table 4: Identified concepts and categories related to strategies and actions

General category	Concept	Final codes
Export development actions and strategies	Removing export barriers	Working group on removing export barriers, removing export barriers, eliminating restrictive laws, reducing customs tariffs, adjusting tariffs and export laws, speeding up administrative affairs, facilitating certificates and standards, resolving transportation issues, avoiding cumbersome laws, law enforceability, facilitation of licensing, and export principles
	Foresight	Policy-making for the future, foresight in this area, the unpredictability of the future, planning

	Marketing	Teaching business principles, advertising and launching products to target markets, establishing purposeful communication, participating in trade fairs, establishing offices in other countries, understanding global markets, learning and utilizing modern marketing practices, learning and using modern practices of international relations, utilizing skilled HR, market needs assessment, attending specialized Nano events, international branding, innovative changes in product manufacturing, correct marketology and market making, needs assessment, establishing export offices in target markets
	Comprehensive support for knowledge-based companies	Improving government financial support, corridor support, providing facilities, passing protection laws

Table 5: Identified concepts and categories related to consequences

General category	Concept	Final codes
Export development consequences	Job creation	Increases employment, increased job creation
	Wealth creation and economic prosperity	Foreign exchange earnings to the country, positive effects on the economy, increased corporate profitability, earning dollars, economic growth, and development, high turnover, sustainable revenue generation, reducing advertising costs
	Comprehensive corporate development and synergy	Companies' comprehensive development, providing the ground for the entry of companies operating in the industry, synergy, cooperation between old companies and knowledge-based companies, changing companies from the traditional state, awakening some industries from dormancy and recession, technology development, HR development
	Increase in exports	Market expansion, avoiding one-dimensional oil exports, balancing supply and demand, increasing exports, expanding the foreign market, expanding the domestic market
	Value creation	Product quality improvement, value creation, product promotion
	Reducing dependence on exporting natural resources and raw materials	Non-dependence on oil

According to the findings, Fig.3 is drawn as the proposed research framework.

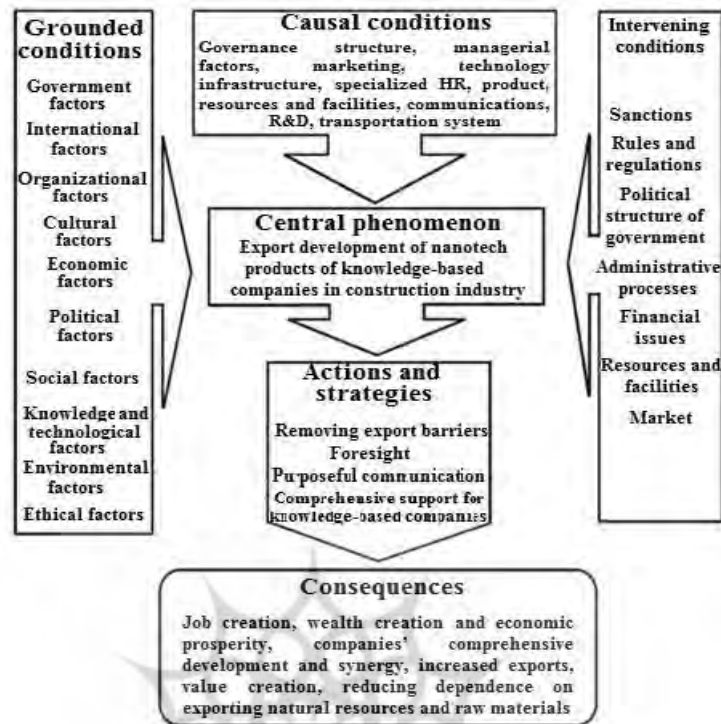


Fig.3. Export development framework for nanotechnology products of knowledge-based companies in the construction industry

Discussion and conclusion

This study aimed to identify factors affecting the export development of nanotechnology products of knowledge-based companies in the construction industry. Therefore, the export development components were identified using experts' opinions, and finally, the theoretical research model was presented. Due to the study's basic approach and accurate analyzability, the nanotechnology knowledge-based companies' experts in the construction industry evaluated each of the model sections through applied studies and proposed practical implications for nanotechnology knowledge-based companies. By considering the essential components, concepts, and dimensions, this article provided some practical solutions for the export development of nanotechnology products of knowledge-based companies in the construction industry through separate studies and analyses.

The proposed model obtained from qualitative findings was explained based on six dimensions. In this model, causal conditions are binding for the export

development of nanotechnology products of knowledge-based companies in the construction industry. Factors that may be less considered in the current situation are governance structure, management factors, marketing, technological infrastructure, skilled HR, product, environmental factors, resources and facilities, communications, R&D, and transportation structures. The governance structure was one of the causal conditions on which the experts emphasized more than other factors. The governance structure affects the global trade environment. How to establish and implement a legal system influences the demand for exports. Evidence suggests that poor governance will lead to insecure influence in the product market. As a result, international import demand will decline. Grounded conditions include governmental, international, organizational, cultural, economic, political, social, knowledge and technology, and ethical factors. The grounded conditions must be considered for better success in the implementation of these processes. Unlike grounded conditions, intervening conditions affect the export development of nanotechnology products of knowledge-based companies in the construction industry and can facilitate and accelerate the implementation of mechanisms.

In the central phenomenon, the export development of nanotechnology products of knowledge-based companies in the construction industry was analyzed as the main subject of this study. The main activities that could be instrumental in implementing the export development were considered in actions and strategies. These strategies include: removing export barriers, foresight, marketing, and comprehensive support for knowledge-based companies. In order to motivate companies to enter foreign markets successfully, sustainably, and effectively, it seems necessary to understand the barriers to entering foreign markets, and the reluctance to export can be attributed to export barriers. Therefore, removing export barriers will help motivate companies to enter international markets. Finally, the expected results of the export development of nanotechnology products of knowledge-based companies in the construction industry were considered in terms of consequences. The country and companies can achieve these expected outcomes due to the implementation of export development processes, measures, and strategies. Today, the importance of developing knowledge-based exports is not only due to the greater foreign exchange earnings of this type of export, but other benefits of exporting knowledge-based products and services have become strategic to the industry sector. According to the results, these benefits include job creation, wealth creation, economic prosperity, comprehensive corporate growth and synergy, increased exports, value creation, and reduced dependence on natural resources and raw materials exports.

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ارائه چارچوب توسعه ساختمان صادرات محصولات نانوفناوری شرکت‌های دانش‌بنیان در صنعت با رویکرد نظریه داده بنیاد

چکیده

هدف از این تحقیق شناسایی عوامل مؤثر بر توسعه صادرات محصولات نانوفناوری شرکت‌های دانش‌بنیان در صنعت ساختمان، همراه با ارائه چارچوب است. روش تحقیق به صورت کیفی و با رویکرد تئوری داده‌بنیاد بوده و جمع‌آوری داده‌ها از طریق بررسی اسناد و مصاحبه انجام گرفته است. نمونه‌گیری به صورت هدفمند و گلوله‌برفی تا حد اشباع نظری ادامه یافت. نتایج بررسی داده‌ها در سه گام کدگذاری باز، محوری و انتخابی حاصل شد. به صورتی که طی فرآیند کدگذاری باز مقوله‌هایی مانند: عوامل علی، زمینه‌ای، مداخله‌گر، راهبردها و اقدامات، و پیامدهای ناشی از توسعه صادرات محصولات نانوفناوری استخراج گردید؛ در ادامه، در مرحله کدگذاری محوری، میان این مقوله‌ها پیوندی در چهارچوب پارادایم کدگذاری مشخص شد و در مرحله کدگذاری گزینشی، تمام اجزای پارادایم کدگذاری توضیح و نظریه ارائه شد.

. با انجام ۱۵ مصاحبه به صورت عمیق و نیمه‌ساختاریافته با متخصصان و کارشناسان شرکت‌های دانش‌بنیان حوزه نانو فناوری در حوزه ساختمان، مقوله‌های اصلی بعد از انجام فرآیند کدگذاری استخراج شد. دیگر مزایای صادرات محصولات و خدمات دانش‌بنیان این موضوع را برای صنعت کشور به امری راهبردی تبدیل کرده است. که بر اساس نتایج این پژوهش صادرات محصولات و خدمات دانش‌بنیان مزایایی همچون اشتغال‌زایی، ثروت‌آفرینی و رونق اقتصادی، پیشرفت همه‌جانبه شرکت‌ها و هم‌افزایی افزایش صادرات، ارزش‌آفرینی، کاهش وابستگی به صادرات منابع طبیعی و محصولات خام را دارد.

واژگان کلیدی: شرکت‌های دانش‌بنیان، محصولات دانش‌بنیان، فناوری نانو، صادرات محصولات دانش‌بنیان، صنعت ساختمان.