Designing a Paradigmatic Model of Intellectual Capital in the Iranian Cement Industry

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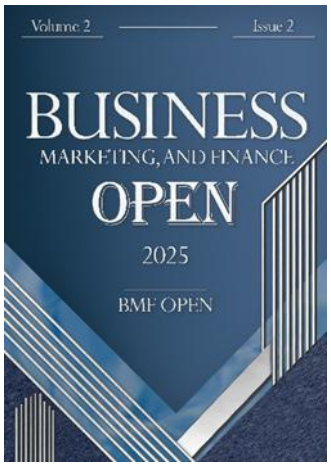

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Abstract: This study was conducted with the aim of designing a paradigmatic model of intellectual capital in the Iranian cement industry. The data collection tool was a semi-structured interview with experts. To achieve this, using a purposive sampling approach (snowball method), interviews were conducted with 20 academic experts or senior managers of companies operating in the cement industry listed on the Tehran Stock Exchange. The research data were analyzed using the coding method based on Strauss and Corbin's approach, leading to the extraction of main categories and concepts. The findings indicate that, according to the paradigmatic model of the study, causal conditions include nine main categories: capital structure, investment, production costs, quality of goods and services, corporate governance, green production, competitive capability, innovation and creativity, and knowledge and experience exchange. Contextual conditions comprise three main categories: modern technology, buyer purchasing behavior, and the competitive environment. Intervening conditions consist of three main categories: market efficiency, general government policies, and the level of construction activities. Finally, the strategies include corporate management policies, risk management, and supply chain management, while the outcomes of intellectual capital encompass production capability, sales capability, export capability, and profitability.

Keywords: Paradigm of intellectual capital, intellectual capital, cement industry.

1. Introduction

In the era of the industrial economy before today's knowledge-based economy, the factors of wealth production consisted of a set of tangible and physical assets such as land, labor, and machinery, where the combination of these economic factors led to wealth creation. In the industrial economy, knowledge was not considered a significant factor in production. However, in the knowledge-based economy, the importance of intangible capital in the wealth creation process far exceeds that of tangible and physical capital. In other words, in a knowledge-based economy, intangible capital is regarded as one of the most critical organizational assets, and its significance in the potential success of organizations is far greater than that of tangible capital [1, 2]. In summary, intellectual capital forms the foundation of individual, organizational, and national competition [3, 4]. Intellectual capital is a key factor in value creation within companies, and organizations are increasingly shifting towards value creation

through their existing intellectual capital. In fact, managers' past perspectives on organizational value creation through physical assets have evolved [5, 6].

Today, intellectual capital is regarded as the most essential resource for economic enterprises. However, many firms face challenges in understanding what constitutes intellectual capital. Emphasizing intellectual capital highlights a fundamental difference between business operations in the old economy and the new economy. In the old economy, value originated from physical assets, whereas, in the new economy, value is created through the application of knowledge and intellectual capital. One of the critical issues in traditional accounting systems is their inadequacy and inability to measure and report information related to intangible assets, including knowledge and hidden corporate values [4-9]. This phenomenon has led to a significant gap between companies' book value and market value. Lev (2002) argues that accounting, as it is currently practiced, has lost much of its informative capacity because businesses have become increasingly knowledge-driven. Intangible assets now account for approximately 60% to 75% of a company's total value. While companies in the industrial era used balance sheets to demonstrate their value to investors, in a knowledge-based economy, balance sheets alone cannot provide sufficient assurance to investors regarding the security of their investments [1]. Effective management of intellectual capital, along with organizational techniques, professional skills, customer relationships, and expertise, can create competitive advantages in the market and enhance financial performance. However, the lack of proper measurement and understanding of intellectual capital components can lead to inefficient investment decisions in the decision-making process [10].

Pablos (2003) and Fornell (2000) discuss the intangible nature of intellectual capital, stating that intellectual capital consists of intangible assets that are not reported in organizations' financial statements, yet approximately 80% of a company's market value depends on its intellectual capital [11]. Saint-Onge (1996) defines intellectual capital as the effective application of both explicit and tacit knowledge. Bontis (1998) classifies intellectual capital into three categories: human capital, structural capital, and relational capital. Human capital refers to employees' knowledge, skills, and experiences. Structural capital focuses on organizational efficiency, while relational capital relates to external collaborations. If a company understands how to manage its intellectual capital, it can create value and maintain a competitive advantage [12].

According to Pulic (1998), increasing intellectual capital value-added is evidence of improved efficiency in corporate resources and, specifically, employee knowledge. The intellectual capital value-added model has several significant strengths [13]. First, it allows a focus on the efficiency of resources used for value creation. Second, its calculation is simple as it relies on financial data from accounting reports, making all necessary information publicly available. Third, it is based on objective data—since value-added derives from market-based values, financial figures can be extracted from audited financial statements. Fourth, managers can calculate intellectual capital value-added for the entire company, for each business unit, and even for specific processes and activities. Fifth, intellectual capital value-added helps managers assess corporate performance without relying on industry standards [14, 15].

The literature on intellectual capital and its impact on organizational performance, competitive advantage, and value creation has been extensively explored from various perspectives. Marzo and Bonini (2023) investigated the nonlinear relationship between intellectual capital value-added, market value, and financial performance, highlighting the hidden nonlinearity in the VAIC formula, which necessitates a reevaluation of methods used to examine the relationship between intellectual capital and firm performance [15]. They provided new insights into the role of human capital and its interactions with other forms of capital in regression models. Özgen et al. (2022)

examined the mediating role of innovative activities and intellectual capital in the relationship between social capital and firm performance, using public hospitals in Turkey as a case study. Their findings suggested that social capital fosters trust and cooperation, which, in turn, enhance intellectual capital and organizational performance [16]. Shafaat Takoldan et al. (2024) developed a model of intellectual capital and competitive advantage in startups, identifying causal factors such as process capital, bargaining power in knowledge acquisition, and company strategy. They highlighted the strategic drivers of human capital, innovation capital, customer capital, and infrastructure capital, along with the role of competitive and collaborative strategies in enhancing intellectual capital within startups [17]. Eshghi and Eshghi (2020) analyzed the effect of intellectual capital components—human, structural, and relational capital—on financial performance, revealing a significant positive relationship at a 95% confidence level [18]. Dehghani and Azar (2020) explored the impact of location on competitive advantage through the mediating role of intellectual capital in small apparel businesses, finding significant positive effects of intellectual capital dimensions on competitive advantage, supported by structural equation modelling [19].

This study was conducted with the aim of designing a paradigmatic model of intellectual capital in the Iranian cement industry The cement industry, as one of the key and foundational industries in economic and infrastructural development, plays a crucial role in economic growth and value creation. However, this industry faces multiple challenges, such as dwindling natural resources, rising production costs, intense competition, and the need for innovation and performance improvement. In such a context, intellectual capital emerges as a vital factor for generating competitive advantages and enhancing productivity in the cement industry. Designing a paradigmatic model of intellectual capital can aid in identifying, managing, and optimizing knowledge-based resources within the cement industry. Due to its energy-intensive and raw material-dependent nature, the cement industry continually grapples with issues like rising production costs and resource limitations. Leveraging intellectual capital—including technical knowledge, process innovations, and knowledge management—can help reduce costs and enhance productivity.

2. Methodology

The present study, aimed at designing a paradigmatic model of intellectual capital in the Iranian cement industry, employs the grounded theory method. This approach is particularly suitable for studies seeking to explore new and complex phenomena, as it focuses on extracting patterns and theories from raw and observable data. In this research, data are collected through in-depth interviews with experts in the cement industry, direct observation of organizational processes, and the review of relevant documents and records. This approach enables the researcher to develop a dynamic and flexible model that accurately responds to the needs of the cement industry.

In the first phase, data collection is conducted through semi-structured interviews with senior managers, information technology specialists, and intellectual capital experts in cement companies. These interviews are purposefully designed to examine various dimensions of intellectual capital, including human capital, structural capital, and relational capital in the cement industry. Additionally, internal corporate documents, performance reports, and relevant secondary data are utilized as data sources. This approach ensures that data are gathered from diverse and credible sources.

In the next phase, data analysis is carried out based on the grounded theory methodology. This process consists of three main stages: open coding, axial coding, and selective coding. In the open coding stage, raw data are broken down into smaller components, and initial codes are extracted. In the axial coding stage, these codes are categorized into related groups to identify the core dimensions of intellectual capital. Finally, in the selective coding stage, a

paradigmatic model illustrating the relationships between these dimensions is developed. This model enhances the understanding of the role of intellectual capital in improving the performance of the cement industry.

One of the key features of this study is the reliability and validity of the data. To ensure data validity, techniques such as cross-validation are employed. This technique involves using multiple data sources (interviews, observations, and documents), various data collection methods, and different analytical approaches. Furthermore, to enhance reliability, the data are reviewed and verified by multiple independent researchers. This approach ensures that the research findings are reliable and generalizable to other companies in the cement industry.

Ultimately, the interpretation of the results and the presentation of the paradigmatic model of intellectual capital constitute the final output of this study. This model not only aids in identifying the key factors influencing intellectual capital in the cement industry but also provides practical solutions for improving the management of these resources. The model can serve as a framework for strategic decision-making in cement companies, helping them leverage intellectual capital to enhance productivity and competitiveness. Therefore, by adopting the grounded theory approach, this study presents an innovative and practical model for the cement industry that can contribute to its transformation.

Due to the vastness of the statistical population, it is not feasible to identify and interact with all individuals within the population. Consequently, selecting a sample as a representative of the target population is inevitable. Given that in grounded theory, the data collection model differs and the process of data collection and analysis occurs simultaneously, the data in this study were gathered through semi-structured interviews using an exploratory approach. Sampling continues until theoretical saturation is reached. The common assumption is that theoretical saturation occurs when no new categories emerge from the data; however, in essence, theoretical saturation extends beyond this point. In other words, the objective of this type of inquiry is not merely to reach a set of categories but to develop classifications based on their characteristics and dimensions, including their variations and possible relationships with other concepts.

In this study, individuals with relevant expertise, education, and sufficient experience in the subject matter were initially selected using the snowball sampling method. At the end of each interview, participants were asked to introduce other knowledgeable and experienced individuals related to the research topic. In cases where additional perspectives were required to complete the model and develop the theory, or when insights from individuals with specific expertise were needed in a particular area, interviewees were asked to recommend experts with relevant experience. Based on these considerations, efforts were made to interview individuals who had personally experienced the research subject and possessed extensive knowledge and expertise in this field.

According to the grounded theory approach proposed by Strauss and Corbin (1990), the appropriate sample size ranges from 10 to 25 participants, with the exact number depending on reaching theoretical saturation. This means that data collection continues until no new information or insights emerge from the interviewees. In the present study, the sample consists of 20 academic experts and senior managers from cement companies listed on the Tehran Stock Exchange.

3. Findings and Results

Based on the conducted interviews with specialists and experts in this study, the interviews were analyzed through content analysis, examining phrases, sentences, and overall concepts. Subsequently, conceptualization, categorization, and the identification of similarities and commonalities among open codes, concepts, and categories

were performed. In this section, codes and concepts were classified and identified, leading to the extraction of primary and secondary categories and concepts.

Causal conditions refer to events, occurrences, and incidents that lead to the emergence or development of a phenomenon. The phenomenon represents an idea, event, or primary incident, around which a set of reactions or actions is directed to manage it, or a series of actions are associated with it. In this study, the set of causal conditions is categorized and presented in Table 1.

Table 1. Open Codes and Concepts of Causal Conditions

Core Code (Category)	Concept (Open Codes)
Capital Structure	Interest rate on received loans, expected return rate of investors, access to foreign financial resources, amount of cash dividend distribution, financing from retained earnings, diversification of financial instruments, transparency of capital structure, balance between debt and equity, alignment of capital structure with market conditions, cost of capital for companies, debt-to-asset ratio, accurate financial needs forecasting, risk of corporate bankruptcy.
Investment	Building investor confidence in financial markets, ability to attract foreign investment, reducing volatility in money and capital markets, incentivizing long-term investment over short-term speculation, minimizing cognitive and computational biases among investors, increasing corporate investment returns in line with expected investor returns, shortening capital return periods, ensuring transparency in corporate valuation, reducing raw material and energy costs, lowering transportation expenses, granting factory construction permits based on market demand to prevent overcapacity, increasing profitability by eliminating negative competition, eliminating intermediaries and price regulation policies, reducing production costs, ensuring timely supply of electricity and gas, lowering import costs for equipment and raw materials.
Production Costs	Energy, electricity, and fuel costs, cost of raw materials such as limestone, silica, alumina, and minerals, labor wages and salaries, expenses for maintenance and repairs of buildings, equipment, and machinery, costs related to production downtime, packaging costs for the final product, transportation costs for raw materials and finished goods, procurement costs of equipment and spare parts, frequency of equipment failures, quality and lifespan of parts given sanctions, extralegal payments to governmental and regulatory institutions, fuel transportation costs, excessive bureaucratic costs for imports and exports, excessive taxation and non-standard fines, depreciation and aging costs of factories, procurement and installation costs of kilns, mills, and crushers, production resource management, waste management costs.
Quality of Goods and Services	Use of high-quality raw materials, impact of cement quality on structural strength and durability, precise control of production processes such as temperature and curing time, regular maintenance of equipment and machinery, adequate training and supply of skilled workforce, effective quality control systems, compliance with required standards, utilization of advanced technologies, incorporation of suitable additives, proper storage of raw materials and final products, routine laboratory testing, customer needs assessment.
Corporate Governance	Sufficient transparency in financial and operational information, gaining investor trust, presence of professional and efficient management, increasing efficiency and productivity while reducing costs, adequate supervision by regulatory bodies, enforcement of corporate governance laws and regulations, preventing financial corruption and misuse, eliminating conflicts of interest between managers and shareholders, making informed decisions to enhance profitability, corporate social responsibility considerations, addressing social issues to build public trust, appropriate tenure for executives, managerial focus on long-term planning, prioritization of factory renovation and modernization, profitability as a management priority, existence of a non-competitive market environment, eliminating excessive bureaucracy, managerial emphasis on innovation and creativity, strengthening the board of directors by selecting experienced and independent members, clearly defining roles and responsibilities for managers and employees.
Green Production	Implementation of green technologies and environmentally friendly raw materials, awareness of green production technologies and methods, adoption of advanced and efficient technologies to reduce pollution and energy consumption, governmental and institutional support for green production, removing investment barriers for green production, use of clean production systems to reduce carbon emissions, greenhouse gases, airborne particulates, nitrogen oxides, and smog formation, development of eco-friendly concrete (green concrete), adoption of alternative fuels such as solar and wind energy, use of industrial by-products like fly ash and silica fume to replace fossil fuels, conservation of natural resources, reduction of sulfur dioxide emissions, acid rain pollutants, water and soil contamination, noise pollution, and waste management.
Competitive Capability	Eliminating negative competition by issuing production licenses based on market demand to prevent overcapacity, setting rational prices and preventing black markets, negotiating with export destination countries such as Iraq and Afghanistan to reduce tariffs and restrictions, optimizing the use of energy subsidies while avoiding negative competition among producers and exporters, eliminating intermediaries in domestic and export sales by refraining from government-imposed price controls, designing market-adaptive strategies, enhancing innovation and research activities, utilizing resources efficiently, capitalizing on new opportunities, responding to customer needs, upgrading

	and modernizing production equipment and facilities, integrating advanced technologies, securing skilled and specialized workforce, adapting to environmental changes.
Innovation and Creativity	Encouraging acceptance of innovation within traditional corporate structures, investing in research and development and innovation, fostering creative production solutions to address environmental challenges and reduce energy consumption and greenhouse gas emissions, recruiting specialized and skilled personnel in technology, innovation, and creativity, expanding investment in employee training and development, aligning with new technologies, modernizing equipment, prioritizing sustainable and cutting-edge technologies, utilizing creativity techniques, enhancing collaboration with research institutions and universities, fostering a culture of creativity and innovation, implementing advanced processing technologies to improve production efficiency, reducing energy consumption, increasing productivity, conducting market analysis, employing artificial intelligence and data mining technologies to enhance process monitoring and control, reducing errors, advancing nanotechnology applications in cement production to improve physical and chemical properties of products.
Knowledge and Experience Exchange	Leveraging expertise from industry professionals and consultants to optimize infrastructure, fostering an open organizational culture and participatory management to enhance knowledge and experience exchange, implementing effective knowledge management systems, utilizing specialized social networks and online forums for knowledge-sharing, adopting a flat and decentralized organizational structure to facilitate knowledge and experience exchange, organizing specialized workshops and training programs, expanding e-learning initiatives, hosting specialized conferences and symposiums, establishing collaboration networks, publishing scientific and technical articles in industry journals, documenting and disseminating best practices, integrating advanced technologies, partnering with universities and research institutions, ensuring corporate data privacy and security, fostering a common culture and language, and developing shared standards.

Based on Table 1, the causal conditions encompass nine main categories: capital structure, investment, production costs, quality of goods and services, corporate governance, green production, competitive capability, innovation and creativity, and knowledge and experience exchange.

Contextual conditions represent a set of specific characteristics related to the phenomenon. In other words, they define the setting in which events or incidents associated with the phenomenon occur along a particular dimension, where interactions take place to control, manage, and respond to the phenomenon. The details of these conditions are presented in Table 2.

Table 2. Open Codes and Categories of Contextual Conditions

Core Code (Category)	Concept (Open Codes)
Competitive Environment	Decline in global market competitiveness, negative competition due to overcapacity and decreased demand following the recession in the construction industry, reduced competitiveness, changes in complementary and substitute industries, decline in competitive power, reduced market acceptance, preference for cheaper substitutes by customers, unhealthy competitive environment, lack of prioritization for innovative activities and research, unpredictability of the industry environment, structural changes in the industry, dependency of cement factories on the government, high profitability of opportunistic firms in the industry, reduced demand in foreign markets, presence of monopolistic competition structure, existence of relative advantages in domestic and international markets, need for improvement in the supply chain of active companies in the industry, necessity of adopting resilience and green strategies, decreased demand due to the construction industry recession, reduction in infrastructure projects due to industry stagnation, declining prices, sales, revenue, and profits of cement companies due to the slowdown in the construction sector.
Buyer Purchasing Behavior	Purchasing behavior influenced by practice, purchasing behavior based on personal experience, purchasing behavior driven by maximizing product profitability, purchasing behavior affected by declining buyer income, purchasing behavior impacted by substitute goods, purchasing behavior due to price increases, purchasing behavior influenced by regulations on profit margin reductions, buyer inclination toward cheaper products, lack of brand loyalty due to rising prices, buyer preference for special discounts, preference for exclusive offers, purchasing behavior resulting from changing needs, purchasing behavior influenced by shifting preferences, impact of environmental awareness on increased demand for eco-friendly products with low energy consumption and recycled materials, preference for high-performance and advanced technology products, increasing importance of design and aesthetics in purchasing behavior, purchasing behavior influenced by social networks, cultural messaging, marketing advertisements, peer experiences, need recognition process, and information search, increased price sensitivity in purchasing behavior.
Modern Technology	Upgrading equipment and adopting new technologies, thermal spraying and cladding technologies, surface strengthening technologies for resistance against heat, abrasion, and corrosion, green concrete production technology, automation and process control to enhance efficiency and reduce energy consumption, carbon emission reduction technologies, utilization of alternative materials to decrease greenhouse gas emissions, use of additives and nanomaterials to improve cement's physical properties and durability, recycling and waste management technologies to cut costs and conserve natural resources, data analytics and artificial intelligence technologies for improved efficiency and fault reduction.

Based on Table 2, the contextual conditions encompass three main categories: competitive environment, buyer purchasing behavior, and modern technology.

Intervening conditions refer to general factors that influence the nature of processes and strategies. These conditions either intensify or weaken phenomena. The details of these conditions are presented in Table 3.

Table 3. Open Codes and Categories of Intervening Conditions

Core Code (Category)	Concept (Open Codes)
General Government Policies	Selection of inappropriate corporate governance mechanisms, lack of proper policy insights and frameworks, failure to develop effective implementation guidelines, lack of facilitation in policy execution, weakness in designing functional and capacity-building tools, bureaucratic inefficiencies in the government, instability and sudden changes in macroeconomic policies, insufficient support for the private sector and startups, inappropriate foreign exchange and trade policies, legal and environmental restrictions, lack of adequate government support policies in taxation, entrepreneurship, development, and innovation, delays in equipment imports and customs clearance bottlenecks, regulated production quotas based on command economy principles, bureaucratic requirements lacking added value, uncertainty regarding government economic policies, inconsistent regulations, inappropriate financial policies and resource allocation, inadequate government loan disbursement policies, reduced international agreements and interactions, unpredictable future government policies, and industry weakening due to state monopolization.
Level of Construction Activities	Targeted and strategic capital injection, energy consumption optimization, energy resource supply, financing for development projects, economic stabilization, ensuring clarity in laws and regulations, adoption of modern technologies, risk assessment and mitigation strategies, use of structural models for improved management and execution, collaboration among government, universities, and construction firms, supply of building materials, adequate provision of construction equipment and machinery, securing skilled labor and specialized workforce, utilization of project management software, implementation of advanced technologies such as green buildings and smart cities.
Market Efficiency	Absence of sudden fluctuations in stock prices, customer and shareholder confidence in market trends, transparency in financial information, clarity in corporate performance assessments, absence of confidential information in market transactions, low probability of market failures in pricing trends, existence of information symmetry, increased corporate oversight and reduced corruption, accessibility of sufficient information for market participants, elimination of transaction costs, absence of speculative news manipulation, clear investor expectations, accurate valuation of intangible assets, correlation between stock price fluctuations and intrinsic value, elimination of hidden values and speculative trading, absence of financial market price bubbles, lack of herd behavior in investment decisions, efficiency in modern financial markets and increased public trust, prevention of market power concentration by large firms, protection of producers' and consumers' rights, stringent price and fraud monitoring, avoidance of oligopolistic market structures, and promotion of healthy competition with regulated oversight by dominant companies.

Based on Table 3, the intervening conditions include three main categories: market efficiency, general government policies, and the level of construction activities.

A core category refers to the principal event or phenomenon around which a series of interactions take place to control or manage it. The core category of this study is the presentation of intellectual capital, with its characteristics detailed in Table 4.

Table 4. Open Codes and Core Category of the Study

Core Code (Category)	Concept (Open Codes)
Intellectual Capital	Enhancement of human, structural, and customer capital, improvement of employees' knowledge, skills, and experience, increase in employee job competence and morale, strengthening employee capabilities, implementation of an effective compensation system, greater workforce flexibility, increased employee satisfaction and loyalty, enhancement of learning and creativity among employees, improvement of formal and informal relationships, development of social networks, refinement of managerial philosophy, optimization of processes and organizational habits, protection of intellectual property and brand equity, safeguarding company data, information, and codified knowledge, registration of patents and trade secrets, enhancement of corporate reputation, development of customer loyalty, negotiation of beneficial contracts, establishment of effective stakeholder relationships, accurate measurement and valuation of intellectual capital, increased investment in research and development, creation of an effective knowledge management system, and management and reporting of intellectual capital.

Based on Table 4, the core category of this study is intellectual capital, which serves as the primary focus of this research.

Strategies refer to the solutions proposed for addressing a phenomenon, with the ultimate goal of managing, confronting, and responding to it. Outcomes encompass both tangible and intangible influential results. Table 5 presents the strategies and outcomes identified in this study.

Table 5. Open Codes and Categories of Strategies and Outcomes

Dimension	Core Code (Category)	Concept (Open Codes)
Strategies	Corporate Management Policies	Adoption of appropriate policies for attracting and retaining human resources, implementation of strategies to enhance employee motivation and job satisfaction, development of effective human resource productivity policies, ensuring psychological and physical well-being, job security, a suitable work environment, and work-life balance, implementation of employment growth policies and reduction of workforce layoffs, salary increases and an effective compensation system, sound decision-making in product development, strategic management decisions considering the complexity of cement production processes, informed decision-making for production and distribution amid price fluctuations, effective management of resource supply under extensive constraints, managerial decisions aimed at reducing negative environmental impacts of production, appropriate management strategies considering frequent market demand fluctuations, strategic decision-making in response to rapid regulatory and policy changes.
	Risk Management	Management of credit risk, market risk, liquidity risk, and operational risk, mitigation of uncertainty due to economic policies and public distrust in government, risk management for sudden regulatory and policy changes, bankruptcy risk management resulting from market fluctuations, risk management for insolvency due to rapid demand shifts, bankruptcy risk mitigation due to abrupt supply changes, risk management against industry-wide negative competition, bankruptcy risk management due to high production costs, management of increased risks associated with the capital-intensive nature of the industry.
	Supply Chain Management	Strategic planning for raw material procurement, inventory optimization for raw materials, parts, and products, effective logistics management, precise demand forecasting and planning, reduction of storage costs, use of historical data, market analysis for demand prediction, supplier relationship management, selection of suitable suppliers, supplier performance evaluation, contract optimization with suppliers, production process optimization, adoption of advanced technologies (robotics), efficient distribution management, timely delivery of products to customers, strategic transportation planning, effective warehouse management, distribution route optimization, provision of after-sales support and maintenance services, utilization of effective supply chain management systems, implementation of information technology solutions.
Outcomes	Production Capability	High production capacity, utilization of advanced technology, implementation of modern production methods, increased production growth rate, production stability, reduction of production process disruptions, integrated planning among producers, enhancement of resource replacement rates, flexibility in production standards, efficient resource allocation and forecasting of distribution changes, adequate access to essential raw materials, production process improvement, reduction of machinery failures and downtime, renovation and modernization of kilns, material handling systems, mills, and crushers, enhancement of machinery and equipment efficiency, reduction of production costs, improvement of raw material quality, enhancement of employee capabilities through a skilled and specialized workforce, investment in research and development to improve quality and reduce production costs.
	Sales Capability	Improvement of distribution channels and development of an efficient and extensive distribution network, effective marketing and advertising strategies, pricing advantage, product differentiation advantage, construction industry growth, increased government infrastructure spending, elimination of intermediaries and market speculators, competitive and strategic pricing, introduction of new products, enhancement of production processes, transportation facilitation, market share expansion, attraction of new customers while maintaining existing ones, revenue and profitability growth, penetration into new markets, high customer satisfaction levels, investment in research, development, and innovation.
	Export Capability	Access to new export markets, expansion of existing export markets, increase in the number and volume of exported products, development of suitable export infrastructure, elimination of monopolistic competition in global markets, removal of excessive bureaucratic barriers in exports, competitive pricing of cement and clinker in the global market, establishment of favorable international interactions and trade agreements, high foreign exchange earnings from exports, elimination of price dumping among producers and exporters, removal of restrictions on Iranian cement exports in target countries (Iraq and Afghanistan), profitability of export pricing compared to regulated domestic prices, enhancement of product quality and global recognition, development and adoption of advanced and up-to-date technologies in cement production, reduction of transportation and logistics costs.

Profitability	Maintenance of a suitable profit margin, profitability growth in line with inflation rates, profitability growth aligned with investor expectations, industry profitability matching its global position, profitability aligned with the country's currency exchange system, competitive production costs, price stabilization at an appropriate level, balance between sales prices and production inputs, avoidance of underpricing in foreign markets, optimal utilization of production capacity based on market demand, elimination of negative competition, removal of market speculators and rent-seekers, low export taxation, reduced customs tariffs for exported products, prevention of financial resource diversion from core activities, optimal use of energy subsidies, reduction of production costs, and increased demand in both domestic and international markets.

Based on Table 5, the strategies and outcomes in this study include corporate management policies, risk management, supply chain management, production capability, sales capability, export capability, and profitability. In this research, a structured approach is used to link primary and subcategories, connecting the data to establish a coherent framework. Axial coding is applied to shape the categories using a paradigm model, demonstrating the relationships between the identified elements. Figure 1 presents the conceptual model derived from the axial coding process.

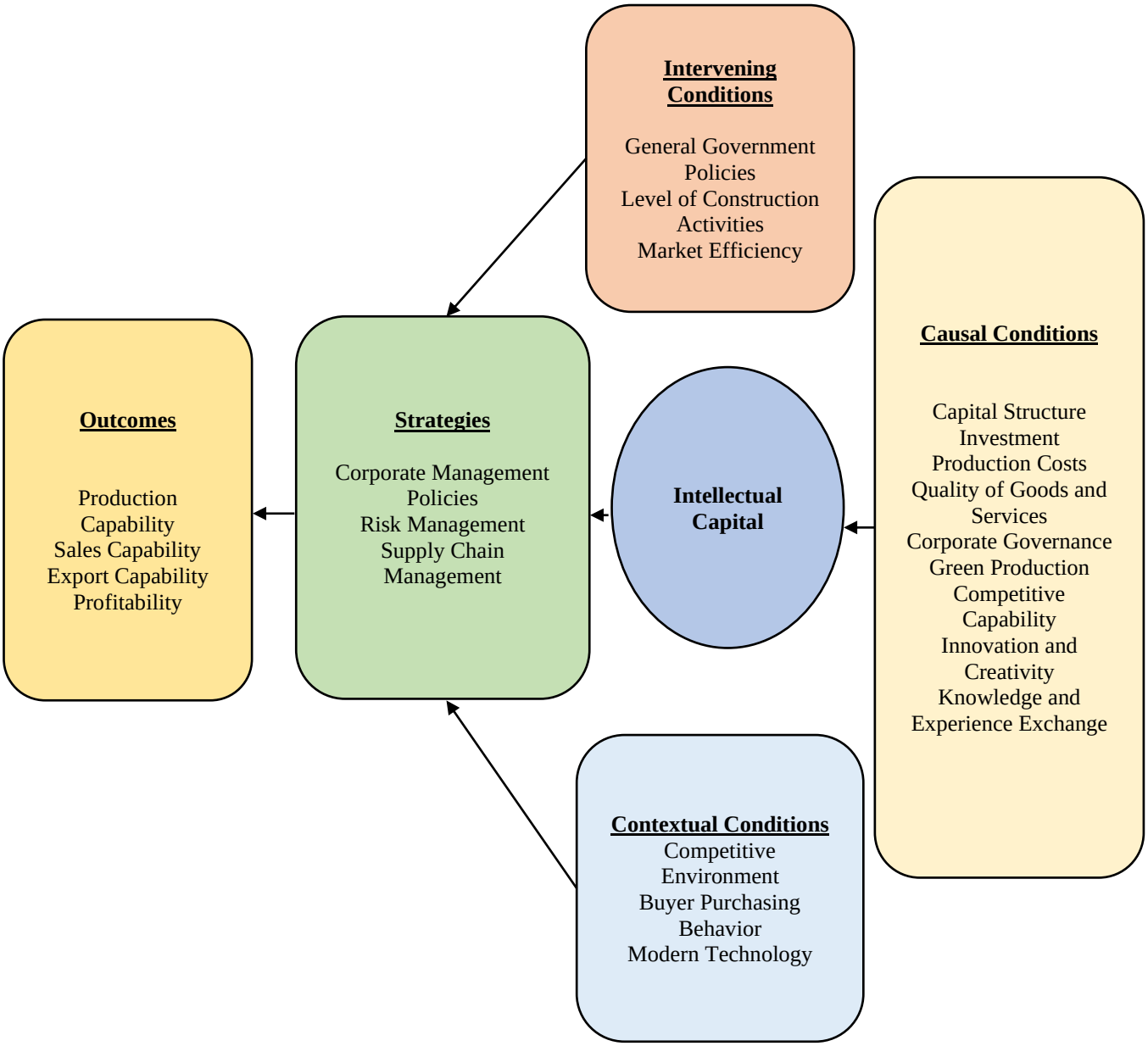

Figure 1: **The Paradigmatic Model of the Study**

4. Discussion and Conclusion

The findings of this study contribute to the understanding of intellectual capital in the Iranian cement industry by identifying the causal, contextual, and intervening conditions that shape its development, as well as the strategies and outcomes associated with its implementation. The results indicate that the primary drivers of intellectual capital in this sector include factors such as capital structure, investment, production costs, quality of goods and services, corporate governance, green production, competitive capability, innovation and creativity, and knowledge and experience exchange. These findings align with previous studies that emphasize the critical role of financial stability, innovation, and corporate governance in enhancing intellectual capital and its contribution to organizational performance [14, 15, 19].

The study also found that contextual conditions such as a competitive environment, buyer purchasing behavior, and technological advancements significantly influence the development and utilization of intellectual capital in the cement industry. Competitive pressures and changing consumer preferences require companies to continually enhance their intellectual capital to maintain market positioning and financial stability. These findings are consistent with the results of Dehghani and Azar (2020), who demonstrated that environmental factors, such as location and competitive dynamics, mediate the relationship between intellectual capital and competitive advantage. In particular, their study found that firms in dynamic and competitive markets must strategically invest in intellectual capital to sustain growth and profitability, a conclusion that resonates with the observations in the present study [19].

Additionally, the study highlighted the importance of government policies, construction activity levels, and market efficiency as intervening conditions that impact the effectiveness of intellectual capital utilization. Government policies, particularly those related to corporate governance, financial support, and regulatory stability, play a crucial role in shaping the extent to which companies can leverage their intellectual capital for competitive advantage. Previous studies [17, 20, 21] emphasize the importance of policy frameworks in enabling organizations to effectively develop and utilize their intellectual capital. Their research on the Ministry of Petroleum suggests that intellectual capital in government-affiliated industries requires structured policy support, a finding that parallels the results of this study regarding the cement industry.

One of the most critical findings of this study is the identification of key strategies for managing intellectual capital, including corporate management policies, risk management, supply chain management, production capability, sales capability, and export capability. These strategies contribute to enhanced organizational performance, increased profitability, and sustainable competitive advantage. The results align with the work of Shafaat Takoldan et al. (2024), who identified similar strategic factors in the context of startups. Their study demonstrated that process capital, strategic management, and investment in human capital are essential drivers of intellectual capital development, which ultimately lead to business sustainability and competitive advantage [17]. The cement industry, while distinct from the startup sector, shares similar dependencies on knowledge, human resources, and innovation to sustain long-term growth.

Furthermore, the study highlights the importance of innovation and creativity in fostering intellectual capital, a finding that is consistent with Özgen et al. (2022), who demonstrated that innovative activities significantly enhance the depth of intellectual capital and contribute to improved organizational performance. Their study found that innovation not only strengthens internal knowledge and skills but also facilitates the creation of relational capital through enhanced social and business networks [16]. This aligns with the results of the present study, which

emphasize the role of knowledge exchange and experience-sharing as critical components of intellectual capital in the cement industry.

Another significant aspect of this study is its emphasis on intellectual capital as a key factor in enhancing sales and export capabilities. The findings indicate that access to international markets, elimination of trade barriers, and improved production efficiency are essential for maximizing the financial benefits of intellectual capital investment. This finding is in agreement with the research conducted by Eshghi and Eshghi (2020), who demonstrated a strong positive relationship between intellectual capital components and financial performance [18]. Their study found that firms with well-developed human, structural, and relational capital exhibit higher profitability and better financial outcomes, a conclusion that is directly supported by the results of this research.

In addition, the study underscores the importance of corporate governance in shaping intellectual capital outcomes. Effective governance policies contribute to financial transparency, investor confidence, and improved managerial decision-making, all of which enhance the ability of firms to leverage their intellectual capital effectively. These findings resonate with the conclusions of Marzo and Bonnini (2023), who argued that governance structures and financial reporting mechanisms play a pivotal role in determining how intellectual capital contributes to firm value [15]. Their study emphasized that corporate governance mechanisms need to be aligned with intellectual capital strategies to optimize market valuation and financial performance.

The results also confirm that the cement industry requires significant investment in knowledge management systems to enhance intellectual capital. Firms that invest in robust knowledge management practices experience improved decision-making, better strategic planning, and enhanced organizational learning. The findings also reveal that financial stability and access to investment resources play a crucial role in shaping intellectual capital outcomes. Companies with strong capital structures and diversified financial resources are better positioned to invest in intellectual capital development, leading to greater innovation, efficiency, and market expansion. This conclusion is supported by Shafaat Takoldan et al. (2024), who found that financial strength and strategic investment in human capital are essential for sustaining competitive advantage in startups [17]. Their study emphasizes that financial constraints can limit the ability of firms to effectively develop and utilize intellectual capital, a finding that is applicable to the cement industry as well.

Overall, this study reinforces the importance of intellectual capital as a critical driver of competitive advantage, financial performance, and industry sustainability. The findings are consistent with previous research, which has established intellectual capital as a key determinant of organizational success across various industries [1, 2, 11, 12, 14-17, 21]. By providing a comprehensive framework for understanding the factors influencing intellectual capital development and utilization in the cement industry, this study contributes to the broader body of knowledge on the role of intangible assets in corporate strategy and performance.

Despite its contributions, this study has several limitations. First, the research focuses exclusively on the Iranian cement industry, which may limit the generalizability of the findings to other industries or geographical contexts. Second, the study relies on qualitative data collected through interviews, which, while providing in-depth insights, may be subject to biases or variations in interpretation. Third, the study does not quantify the exact financial impact of intellectual capital on firm performance, as it focuses primarily on identifying key factors and strategies. Future research incorporating quantitative analysis would help validate the findings and provide more precise measurements of intellectual capital's impact.

Future research should explore intellectual capital development in other industrial sectors to assess whether similar patterns and dynamics exist across different industries. Additionally, longitudinal studies tracking the

evolution of intellectual capital over time would provide deeper insights into its long-term effects on organizational performance. Researchers could also examine the role of emerging technologies, such as artificial intelligence and blockchain, in enhancing intellectual capital management. Furthermore, comparative studies between different countries or regions could shed light on the influence of regulatory environments and economic conditions on intellectual capital utilization.

Managers in the cement industry should prioritize investment in intellectual capital as a strategic asset, focusing on continuous innovation, employee development, and knowledge management. Firms should implement structured corporate governance policies to enhance transparency, investor confidence, and financial sustainability. Additionally, organizations should adopt advanced supply chain management practices to optimize resource utilization and reduce costs. Expanding international market access and fostering global partnerships would enhance export capabilities and drive profitability. Lastly, companies should integrate knowledge-sharing mechanisms and collaborative networks to maximize the benefits of intellectual capital investment.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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