

FRAMEWORK FOR STRATEGIC TECHNOLOGICAL DECISION-MAKING IN AN EMERGING ECONOMY

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Abstract

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The concepts of technology and innovation represent a paradox in today's highly turbulent business environment and are characterized by increasingly short lifespans. In this situation, it is of great importance to study how senior leaders make strategic technological choices (STC) to guide their firm's success. STC creates products and services critical to firms' future revenue and market share (Chiesa, 2001). This study aims to identify the factors and processes that are critical to strategic technological decision-making in an emerging economy such as India. In-depth interviews were conducted using a semi-structured interview protocol to understand how firms prepare for strategic technological decisions (STD). We used a qualitative research approach to analyze the transcribed interviews of Indian chief technology officers (CTOs) (Miles & Huberman, 1994). The study found factors grouped into business environment, organizational, strategic, and expected outcomes. Based on these findings, an integrated framework is provided that could help in the development of decision-making systems for practitioners. While rooted in the Indian context, the study offers a foundation for comparative research in other emerging markets. This proposed framework contributes to both theory and practice by enhancing the understanding of how firms can navigate technological complexity in resource-constrained settings.

Keywords: Strategic Technological Choices, Emerging Economy, Strategic Technological Decision-Making, Qualitative Research

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1. INTRODUCTION

The idea of technology and innovation is paradoxical in today's turbulent business environment, with rapidly reducing technology and innovation lifespans. To succeed in this environment, firms

rely extensively on senior leaders' decisions about seemingly conflicting business requirements, such as short-versus long-term objectives, market pull versus technology push, and their commitment to implementing these decisions. Furthermore, the growing importance of technology decisions is

also evident in the fact that an increasing number of organizations are introducing a new position called chief technology officer (CTO), primarily responsible for the firm's strategic technological choices (STC). STC encompasses the selection of one technological solution over another in uncertain conditions. This requires an assessment of the impact at multiple levels in a firm (Petrick & Provance, 2005). To decide on a technology choice, a firm carefully assesses technical and market factors to identify an array of targets for technological development (Burgelman et al., 1988).

Various authors have presented key taxonomies of strategic technology decisions (STD). Chiesa (2001) argued that the selection, timing, and acquisition mode of technology are key STDs for a firm's competitive advantages. Lingens et al. (2016) discussed four types of technological decisions based on the degree of perceived uncertainty and perceived impact: daily business, decision or die, long quest, and strategic. They suggested that senior leaders, primarily responsible for strategic decisions, should be quick to make decisions under high uncertainty to have a high impact on the firm's success. They provided a rubric for technological decision-making by firms for each technology, where a technological decision-making process is not fully formalized or a wide range of technologies are to be managed. Different generations of research and development (R&D) management require technology leaders to build advanced firm capabilities. The most recent 6th generation of R&D management calls for enriched and enhanced capabilities through multi-technology research networks (Nobelius, 2004). To develop and manage technological capabilities, senior leaders typically choose strategies for accepting, accommodating, and differentiating/integrating competing technological resources (Smith, 2014), further leading to a firm's technology strategy (Burgelman et al., 1988).

However, the connection between strategy, criteria, and methods is not well-established for increasing amounts and sources of information. This implies that traditional methods of strategic decision-making, such as risk analysis, return on investment (ROI), scenario analysis, competency analysis, and the S-curve, need further exploration under the recent explosion of big datasets at the global level (Lingens et al., 2016). This issue has not been well-explored in emerging economies, which have traditionally depended on developed economies for technological capabilities. Firms in developing economies have observed large market opportunities due to the rapid growth of their gross domestic product (GDP) and have been trying to bridge technology gaps. Institutional voids in emerging economies thus require different strategies from firms (Khanna et al., 2005). However, there is a paucity of research on STDs in emerging economies. This study aimed to fill this research gap.

This study aims to identify the factors and processes that are critical to strategic technological decision-making in emerging economies. It further aims to understand how firms prepare themselves for such an STD with the aim of developing a framework for strategic technological decision-making. This study identifies and structures the primary strategic and operational elements of a framework that aids technology leaders in evaluating and selecting STD.

The structure of this paper is as follows. Section 2 reviews the relevant literature. Section 3

analyses the methodology that has been used to address the research gaps. Section 4 illustrates the findings. Section 5 presents results and discussions around the study. Section 6 lists the conclusions, implications for theory and practice, limitations of the study, and future research directions.

2. LITERATURE REVIEW

The existing literature on strategic decision making is broadly categorized into content and process research (Elbanna & Child, 2007). However, another theme of context research is also significant in strategy research. To address the research objectives mentioned in the previous section, we explored the existing literature and presented its analysis in accordance with the process, content, and context of the strategy research in the following subsections. Furthermore, we also listed the possible reasons why prior findings cannot be generalized to an emerging economy in the subsequent sub-section.

2.1. Technology strategy and strategic decision-making process

The strategic planning involves developing a plan to implement this strategy. However, this is not about strategic planning. Today, strategic planning has become a part of the routine of any business and is accompanied by a set of beliefs and protocols that underpin day-to-day practices (Kumar et al., 2025). Barnett and Burgelman (1996) provide an evolutionary perspective on strategy planning and suggest that a strategy should be developed and implemented based on firm capabilities.

In today's world, the focus of firms' technology strategies has evolved from making a set of technological choices to acquiring knowledge and technical resources to benefit from networks, to the selection of projects and portfolios of projects. The desired output of technology strategy planning is the definition of the firm's long-term technology policies. Technology strategy addresses three critical questions about technology choices: what, how, and when (i.e., selection of technologies, mode of acquisition, and timing of development and introduction into the market) (Chiesa, 2001). It also considers the needs of current and future customers by selecting a mix of technological initiatives and deploying people, patents, processes, and technologies. Itami and Numagami (1992) discuss three types of linkages or interactions between technology and strategy: current strategy-current technology, current strategy-future technology, and future strategy-current technology. Raghavan et al. (2013) extend this to the fourth type, i.e., future strategy-future technology.

Comparing different approaches to technology strategy, it was found that the positioning approach helps in formulating technology strategies for firms and contexts where competition is played on a product's functional performance, and cost and industry boundaries are well-defined. This is because the firm can locate its current position in the identified industry or geographic location and aim for its future position by setting up strategic steps based on positioning approaches to technological strategies. Conversely, the resource-based theory (RBT) approach to technology strategy helps firms whose survival depends on new products or markets

and whose competition is so dynamic that products have shorter life cycles and high innovation rates. In such cases, firms should focus on resources that are rare, non-imitable, and valuable to achieve a sustainable competitive advantage. Higher value from resources can be obtained by developing core competencies, which are a set of certain capabilities and resources specific to a firm. The key difference between these two can also be understood by examining the unit of analysis, technology for the positioning approach, and resources for the resource-based view.

Furthermore, two other approaches are identified based on future uncertainty and the difficulty in predicting change: rationalist and incrementalist approaches. Incrementalists consider a systematic analysis of the inner and outer context to obtain perfect knowledge of its environment and understand strengths and weaknesses, rate, and direction of change, and, according to the approach, formulate a technology strategy around it.

Eisenhardt (1989) observes that making fast decisions in a high-velocity environment requires real-time data, creation of a number of alternatives, excellent use of expert counselors, building consensus among scouts with qualifications, and decision integration. Strategic decisions include identifying alliances, developing new products, determining next product development, scouting new markets, and setting strategic directions. Chiesa (2001) identifies three approaches to technology strategy: the positioning approach, the resource-based approach, dynamic capabilities, and rationalist and incrementalist approaches.

2.2. Strategic technological decisions (STD)

In a firm, decisions are essentially management actions in response to emerging constraints.

Lingens (2016) employs an attention-based approach to study firms' technological decisions. Under this approach, management attention is viewed as an essential resource for decision-making, and corporations are considered systems of structurally distributed attention (Kumar et al., 2019). Lingens (2016) identifies four archetypes of technological decisions based on two factors: the impact of the decision on the firm and the level of uncertainty associated with it. The four decision archetypes are from daily businesses: functional/operational, decide/die, long quest, and strategic. In the case of strategic and "decide-or-die" technological decisions, top management is involved in both analysis and decision-making. However, with daily business decisions, top management relies on analysis by lower-level managers and is involved only in the decision-making step.

A strategic decision may involve the deployment of dynamic capabilities, which, in turn, can involve processes that unfold over a considerable period. Adam et al. (1998) classify strategic decision support according to a problem's structure (structured, semi-structured, and unstructured) and usage for types of management control (operational control, management control, and strategic planning), as shown in Table 1. Unstructured problems under strategic planning are related to mergers and acquisitions (M&A), new product development (NPD), and R&D planning. The tasks in Cells 1, 2, and 4 were performed by lower-level managers, whereas those in Cells 6, 8, and 9 were entrusted to top-level executives. The tasks in Cells 3, 5, and 7 were performed by middle-level managers. Semi-structured and unstructured problems cannot be addressed using conventional management information systems (MIS) or management tools (operational research-based). They require human intellect and different approaches to computational technology.

Table 1. Matrix for the type of decisions

<i>Structure of problems vs. their usage for management control</i>	<i>Operational</i>	<i>Managerial</i>	<i>Strategic planning</i>
Structured	1 Accounts receivable, order entry	2 Budget analysis, short-term forecasting	3 Warehouse location, distribution systems
Semi-structured	4 Production scheduling	5 Variance analysis of the overall budget	6 M&A
Unstructured	7 Cash management, part cost systems	8 Budget preparation, sales, production	9 NPD, R&D planning

Source: Adam et al. (1998).

Senior technology managers usually focus on M&A, NPD, R&D planning, and advisory decisions related to budget preparation, sales, and production. Van der Hoven (2010) identified eight uncertainties, termed transition types, which have a direct impact on how technology needs are managed. These include changes in ownership, leadership, governance, competitive, economic, customer/supplier, technological, and management tools.

A prior study defined STD as technological decisions where both uncertainty and impact are high, and greater resources and more extensive investigation are warranted. Table 2 presents examples of the STD. It forms the basis of STC.

For example, a firm forecasts various emerging technologies, such as technology developments of clean energy systems powered by solar, nuclear, and wind energies, and then selects which choice will bring a competitive advantage to the firm in a given business context. Hence, it is imperative that firms devise a framework for strategic technological decision-making. Another category of STC created by a firm is making or buying technology (Chiesa, 2001). The choice of technology depends on a firm's capabilities (development and absorptive capacity), technology strategy, and speed of technology development.

Table 2. List of selected STDs and methods

<i>STD</i>	<i>Author(s), year</i>	<i>Methods used</i>
Evaluation of technology landscapes	Adomavicius et al. (2008)	Qualitative: Visual mapping; Quantitative: Graph-based state diagram
Determination of the direction of technological change	Guo et al. (2016)	Subject-action-object (SAO), morphology
Technological migration/substitution	Khajeh-Hosseini et al. (2011)	Cost-benefit and risk modelling
Technology selection	Khouja (1995)	Quantitative approaches
Identification of potential application areas of technology for technology transfer	Park et al. (2013), Ikram et al. (2022)	Multicriteria decision model (MCDM)
Exploration of technological opportunities by linking technology and products	Yoon et al. (2014)	Morphological analysis and text mining

Source: Authors' elaboration.

2.3. Business environmental context

Business environmental context pertains to the dynamic environment both within and outside a firm (Chen & Yang, 2024). The concepts of volatility, uncertainty, complexity, and ambiguity (VUCA) are used to understand the uncertainty inherent in technologies that influence a firm's performance in a dynamic environment. In this study, we considered two types of uncertainty: technological and market. Uncertainty due to a lack of information affects the quality of technological decisions (Nutt, 1984). Strategic technology planning also considers market uncertainty regarding competitors as well as customers.

2.4. Organizational context

The organizational context (Egala et al., 2024) for strategic technology decision-making has been covered in prior studies on strategy and organization (Kingsley et al., 1991; Hambrick & Snow, 1977). Technological decisions are influenced by top management orientation, information processing and management, and the information sources within the firm. Li and Liu (2014) found that firm size and age also influence technological decisions as organizations and their management leverage learning over time and count the number of personnel impacted by technological decisions.

Top management orientation refers to the ability to take risks and leverage innovativeness (Brownlie, 1992). In technology-intensive firms, managers are encouraged to propose innovative directions that may be high-risk (Calantone et al., 2003). Information processing and management add value to the quality of technological decisions. Technology foresight, technology intelligence, and scouting collectively help in sensing both the external environment and internal environment of the firm (Kumar et al., 2017). These factors contribute to data-driven decisions and accelerate strategy formulation.

Information sources like top management meetings with product managers, sharing of ideas, and organizational routines for technology development, transfer, and NPD also help in STD.

2.5. Strategic context

Strategic levers are mutually exclusive options that allow firms to gain a competitive advantage. Examples include organizational structure (centralization or decentralization of R&D), leveraging technology for NPD, and collaboration with other firms. Collaboration and alliances via social platforms (e.g., industry-university collaboration) (Perkmann & Walsh, 2007) and cooperation with other firms help

top management commit resources and attention to enhance a firm's social capital. Strategic levers provide a firm with added capabilities, including the capability to reconfigure organizational resources (both tangible and intangible). Important resources include technical and financial means, investment, and intellectual property rights (IPRs).

2.6. Institutional voids in emerging economies

Institutional voids in emerging economies require different strategies from firms. They are related to political and social systems, openness, product, labor, and capital markets. Strategic decision-makers can identify institutional voids in any emerging economy by seeking answers to these questions (Khanna et al., 2005) and adapting their business models to the institutional context of the emerging economy. Usually, business strategies and their implementation in emerging economies differ from those in developed economies.

Our literature review on STD highlights the lack of an emerging economic perspective on this matter. We aim to fill this gap by finding theoretical and empirical support for the factors in strategic technological decision-making in emerging economies and their linkages. For this, we interviewed technology leaders to propose a framework for strategic technological decision-making. Based on the interviews, we sought empirical support for these factors and their links. Thereafter, we attempted to use the dynamic capabilities framework to map it.

3. RESEARCH METHODOLOGY

We employed a qualitative approach to address our research objectives. Research methods using qualitative approaches in the management field have developed into increasingly recognized and appreciated architects of research inquiry for studying lived experiences, which require the application of rigorous and procedural methods. There should be reliable qualitative research that can help establish that the analysis of qualitative data has been steered in a specific, consistent, and comprehensive way by recording, systematizing, and disclosing the methods of analysis with sufficient details to allow readers to know whether the method is dependable (Nowell et al., 2017).

To validate our takeaways from the literature about the three schools of thought, we conducted in-depth interviews with senior technology managers from 12 different firms, with the help of a semi-structured interview guide. The interview contained open-ended questions regarding technology strategy formulation and the technological decision-making process. It also included prompts to guide the interview process in case of deviations. We

selected firms that had senior technology managers and that spent heavily on technology-related activities. Moreover, the conceptual decision-making framework is extracted from the data analysis (Hickey & Davies, 2024).

3.1. Selection of respondents and subject matter experts

We selected respondents through purposeful sampling to obtain information-rich cases and

critically examined the theories related to firms' STD. For this study, key informants were selected so that deliberate examination could be performed to obtain information-rich cases critical for the theories in focus. The sampled key informants were part of the top management team and were involved in technological decisions and improvement initiatives on a regular basis. Each interview of the industry respondents took between 50–70 minutes, and the interview responses were transcribed and shared with the respondents.

Table 3. Description of key respondents

Industry type	Product offering	Key informants
Manufacturing	Tyre manufacturing	CTO
Manufacturing	Engineering, procurement, and construction	CTO
Manufacturing	Infrastructure	CTO
Manufacturing	Electric mobility	CTO
Service	Banking and financial solutions industry	CTO
Service	Telecom software product	CTO
Service	Telecom infrastructure product	CTO
Service	Software product for banking applications (technology innovations)	CTO
Service	Intellectual property management software and technology	CTO
Service	Technology consulting projects	CTO
Service	Digital marketing technology services	CTO
Service	Information technology (IT) software for banking	CTO (technology start-up)

Source: Authors' elaboration.

We reached saturation in codes and constructs as we progressed through our interviews (Yin, 1993). We attempted to obtain an equal number of personnel from the manufacturing and service sectors. However, only 12 respondents agreed to participate in the data collection process, of which four respondents were from the manufacturing sector, and eight respondents were from the service sector. This asymmetry is considerable, as we observed skewness in the number of CTOs in the service and manufacturing sectors, whereas we profiled CTOs from the LinkedIn professional network for our potential targets.

3.2. Data analysis approach

Data were analyzed four-step approach of coding, data reduction, display, and conclusion drawing (Miles & Huberman, 1994). We used ATLAS.ti software for content analysis of the transcribed data, as it supports analytical-level coding and the network/visualization function. We used the coding scheme developed by Van der Hoven (2010) for this study. To arrive at the final code, the scheme was first discussed among the authors and then refined through multiple rounds of feedback. Figure 1 shows a sample of open coding using ATLAS.ti.

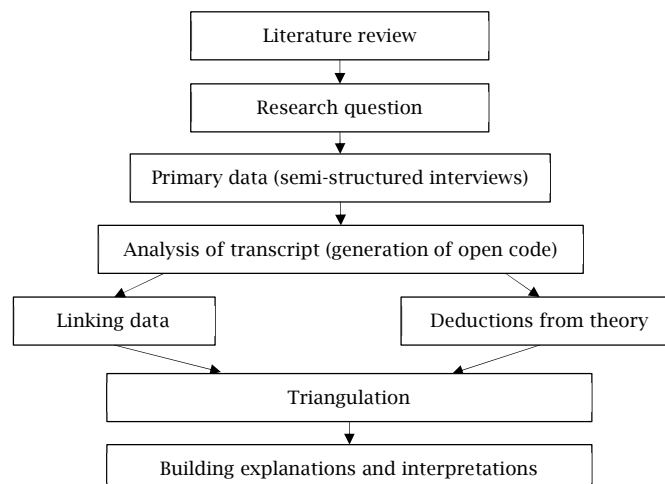
Figure 1. Sample of open coding using the ATLAS.ti software tool

in. so, right now the way I am going about it more tactical, it's driven by projects that transformation is required and for that transformation we need to evaluate what technologies are required. Rather than saying okay this is my 5 years technology roadmap. Another thing is that as a consultant I always use to consult companies on the digital is "don't have 5 years roadmap". Digital is changing too fast to have a 5 year roadmap. Have a business 5 year roadmap and digital

Source: Authors' elaboration.



Figure 2. Steps in the research and analysis process



Source: Authors' elaboration.

Figure 2 illustrates the steps of the research and analysis process. We used a deductive qualitative research approach for the analysis (Bitektine, 2008; Yin, 1993). An alternative approach to analyze the transcribed data is using an inductive approach and Grounded theory method (Glaser & Strauss, 1967). Another commonly used approach is to use interviews to get success factors rated for further analysis (Aman & Tahir, 2011).

4. RESEARCH RESULTS

The data from interviews provided new insights into the strategic management of technology and innovation as well as strategic technological decision-making within Indian firms. Apart from identifying the variables of strategic technological decision-making, the data examined technology managers' experiences and perspectives to understand the influence of the business environment, organization, and strategic levers on STD.

4.1. Business environment

Figures A.1 and A.2 (see Appendix) validate the significance of the factors associated with the business environment, which comprise technological uncertainty (Tushman & Anderson, 1986), market uncertainty, and external sense capability. The business environment characterizes a firm's dynamic environment. Respondents noted that technology gaps and emerging technologies within and across industries could be beneficially leveraged. Furthermore, they also confirmed that market uncertainty pertains to market conditions and innovative products launched by competitors, and agreed that STDs are influenced by external sense capabilities that are used to sense opportunities outside the firm (Ridder, 2013).

4.2. Organizational context

In a firm, technological decisions are influenced by top management orientation, organizational processes, and information processing and management within the firm. Internal sense capability is the ability to promote the internal development of technological competence. Top management orientation refers to far-sightedness, risk-taking behavior, and the involvement of different functional heads. It helps overcome internal hurdles, such as employee resistance to technological changes. Organizational processes mostly rely on internal sense capability to determine everything from scanning and monitoring routines to assessing technological fit and readiness

for deployment. Information processing and management refers to a firm's technological intelligence capability. Figures A.3, A.4, and A.5 show the concepts (information processing and management, top management orientation, and organizational processes) supporting the organizational context.

4.3. Strategic context

Strategic decisions are made by top management and senior technology managers, and to do so, they are empowered with a certain freedom to introduce changes to the organizational structure, human capital, social capital, leveraging of alliances, appropriation of technology, technology transfer, and integration. This freedom to introduce change is usually based on a credible analysis of the business environment and organizational context. Figures A.6, A.7, and A.8 show the concepts (collaboration and alliances, organizational structure, and leveraging of technological capabilities) supporting the strategic context.

5. DISCUSSION OF THE FINDINGS

A conceptual framework is developed by using suggested linkages among them. The variables discussed in the previous section influenced the STD. Lingens et al. (2016) categorized top management technological decisions based on their impact and uncertainty. They assessed the outcomes of STD in terms of ROI and cost savings, which, in turn, improved firm performance.

In this research, respondents from the manufacturing industry indicated that many of the technological decisions in their firms belonged to the decide-or-die category (Lingens et al., 2016), as digital technology has become a disruptive agent in service industries such as banking, IT, telecom, and transportation. The CTOs responded that they wanted to leverage the power of digital technology in their respective firms. Accordingly, they were looking for acquisitions that could reduce operational costs, enhance product features, and eventually earn a higher market share.

Table 4 summarizes the findings of the content analysis. The identified factors influencing STD are categorized based on the dynamic capabilities framework. The sensing process involves decisions related to technological and market uncertainty. The seizing process includes technological decisions related to the organizational structure, information processing and management, collaboration, and alliances. The refiguring process includes technological decisions related to top management orientation, leveraging technological capabilities, and organizational processes.

Table 4. Mapping of concepts to constructs

<i>Concept</i>	<i>Factors</i>	<i>Construct</i>
Emerging technology, high product innovation, technology gap, technology-driven competition	Technology uncertainty	Sense
Risky market, dynamic market, customers, nature of the industry	Market uncertainty	
Top management buy-in, responsiveness to risk, the chief executive officer's (CEO's) perspective on technological decisions, and the relationship between CTO and top management	Top management commitment, support	Seize
Technology intelligence, technology roadmap, company foresight, data-driven decisions	Technology information processing and management	
Operations management, human capital, strategy planning, and assessing technology readiness	Organizational processes	
New strategic business unit (SBU), organizational model, strategic team, co-founder	Organization structure	Reconfiguration
University-industry alliance, collaboration with technology vendors, joint R&D, acquisition of startups	Collaboration and alliances	
Leveraging technology, meeting sub-goals, a differentiated product, and technology projects	Leveraging technological capability	

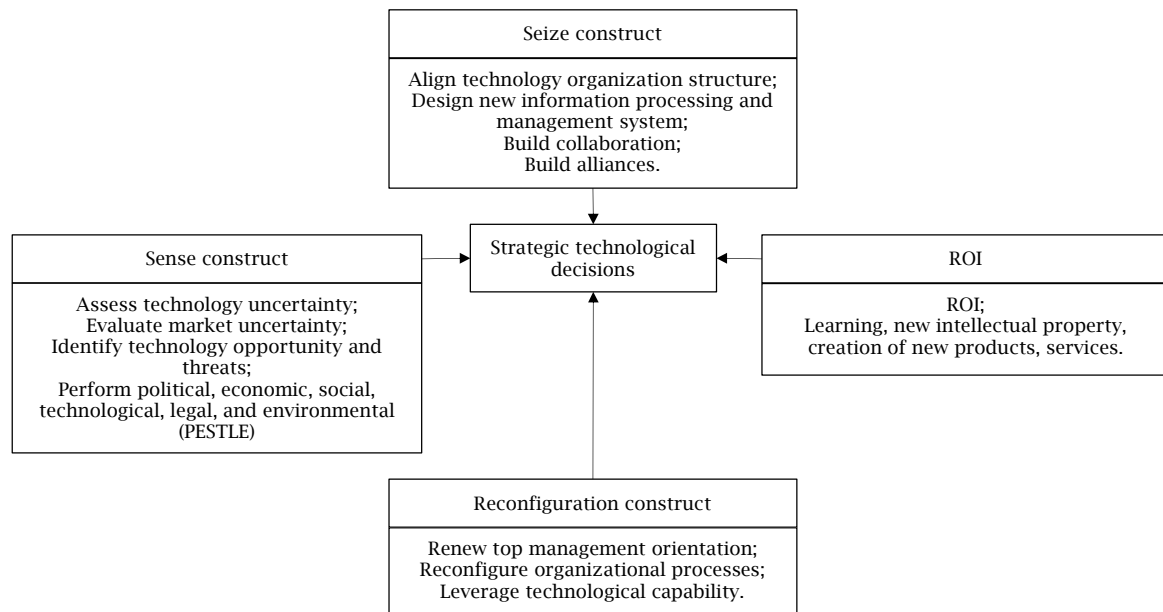
Source: Authors' elaboration.

The sensing process involves scanning and monitoring technological and market changes in the business environment. The objective of the sensing process is to identify new ideas for the development of future products and/or services and create new businesses. The seizing process links innovativeness to products and markets by delineating new business models and various customer offerings, creating new ventures, and identifying partners and distribution channels. The refiguring process aligns a firm's resources and capabilities by redeploying its existing and complementary assets. It helps in the co-specialization of assets, reengineering processes, promoting commitment, and new ways of allocating resources, such as incentive systems, knowledge management, and learning (Teece, 2007; Jantunen et al., 2012; Kumar et al., 2016). Based on these constructs, we propose a framework for strategic technological decision-making, as shown in Figure 3.

The impact of STD on a firm is assessed in terms of ROI and learning. The proposed framework

is a synthesis of that proposed by Teece (2007) and Chiesa (2001), and empirical evidence based on practitioners' views of technology leaders in an emerging economy. It exhibits the influencing factors, their relationships, and the process of strategic technological decision-making. This framework differs from previous STD frameworks (Lingens, 2016; Lingens et al., 2016; Chiesa, 2001; Burgelman et al., 1988; Sherif & Khalil, 2008). The proposed framework is an advancement of theories on technological strategies and related decision-making processes (Teece, 2007). This model's advantages are that it is simple to understand and serves as a stepping stone to building an analytical model for the formulation of a firm's technology strategy. The proposed model differs from those reported in the literature and supports a shift in strategic technological decision-making from traditional (Lingens, 2016; Lingens et al., 2016; Teece, 2007) to a new approach.

Figure 3. Proposed framework of the strategic technological decision-making process



Source: Authors' elaboration.

With more than ten telecom service providers in India before 2016, when Reliance Jio launched its services with tremendous success, Reliance Jio could sense a business opportunity by launching the emerging telecom technology of 4G mobile network technologies, i.e., long-term evolution (LTE) and voice over LTE (VoLTE). There had been a degree of uncertainty with respect to the adoption of LTE, as it required the upgrade of mobile phones. However, Reliance Jio built a new organizational structure, aligned technology teams, and built collaborations with existing partners to seize the business opportunity. The result was more than 5 million subscribers within the first 83 days of launch (IIDE, 2025). Overwhelmed with initial success, Reliance Jio kept on renewing and reconfiguring its organizational structure and process in order to adapt to the emerging market scenarios and also leverage technological capabilities. All these processes of sense, seize, and reconfigure as part of STD have resulted in great ROI, learning, creation of new intellectual property, and also the launch of new

products and services (JioTV, JioCinema, JioMoney, etc.). The case of Reliance Jio could be easily explained by the framework shown in Figure 3. Reliance Jio has also invested hugely in artificial intelligence (AI) and Big Data Technologies so that it can continue its dominance in the Indian Telecom Industry (Lohchab, 2024).

Likewise, the framework in Figure 3 can help in explaining STD in CEAT tyres. CEAT has done many innovations¹. Especially STD, such as developing smart sensors in tyres, was a result of sensing business opportunity, seizing with the launch of smart sensors in tyres and continuously reconfiguring processes to support such innovative products with complementary services and digital apps to stay ahead of the competition. It's a great amalgamation of physical products with digital technologies (Big Data, AI, information processing technologies, etc.).

¹ <https://www.ceat.com/corporate/innovation.html>

6. CONCLUSION

Technological decisions define many strategic actions of firms today. The proposed framework summarizes the factors that influence such decisions. It's an integration of dynamic capabilities for competitive advantage theory and relevant theories on STDs. A firm is likely to face one of the technological decision categories proposed by Ridder (2013). At such times, the strategies that senior technology managers make provide a strategic direction to the firm and prioritize its attention toward achieving the desired outcomes in the long run. By identifying these three sets of factors, this study offers practitioners a support system that aids in strategic technological decision-making. This may help reduce errors and effort in proposing suitable management actions for today's complex and unpredictable business environment.

This study may be of interest to technology managers employed in fast-paced, technology-intensive firms who need assistance with crafting management actions in response to triggers in complex and unpredictable business environments. The aspirants of techno-entrepreneurship can also benefit from such studies (Naik et al., 2018). The framework can also be further refined using K-means and agglomerative clustering approaches (Suha & Sanam, 2023). The limitation of unbalanced

respondents in terms of manufacturing and services can also be overcome by adding more respondents in the manufacturing sector. The research can be further refined using a grounded theory approach. The success factor rating method could also help in understanding the relative priority among them.

The variables that influence STD may be further categorized as direct or intervening types for further building structured equation models. Decide-or-die situations call for not only quick decision-making and action but also comprehensive analysis. Decision support systems based on this framework, which offer quick and reliable outputs for senior techno-managers, are an interesting avenue for future research. Further research can also consider an integrative approach to add the role of digital interventions (Sharma et al., 2023). Another approach to update the framework could be the technology-organization-environment (TOE) framework (Amin et al., 2024). A simulation model can also be developed using this suggested framework in Figure 3. This can help capture the business dynamism more effectively (Serman, 2000). Another approach to take this research further is to use AI and machine learning algorithms on a large set of strategic technological data (Özemre & Kabadurmus, 2020) for better insights. It may also be extended to study the impact of the size of the organizations on the theme.

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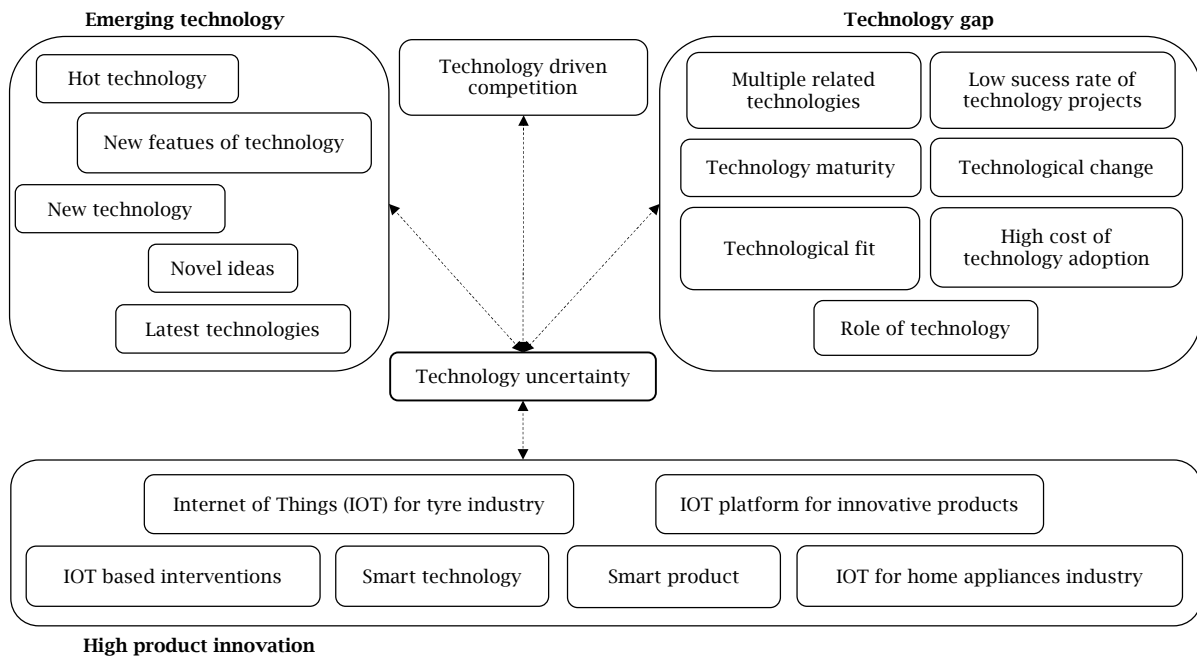
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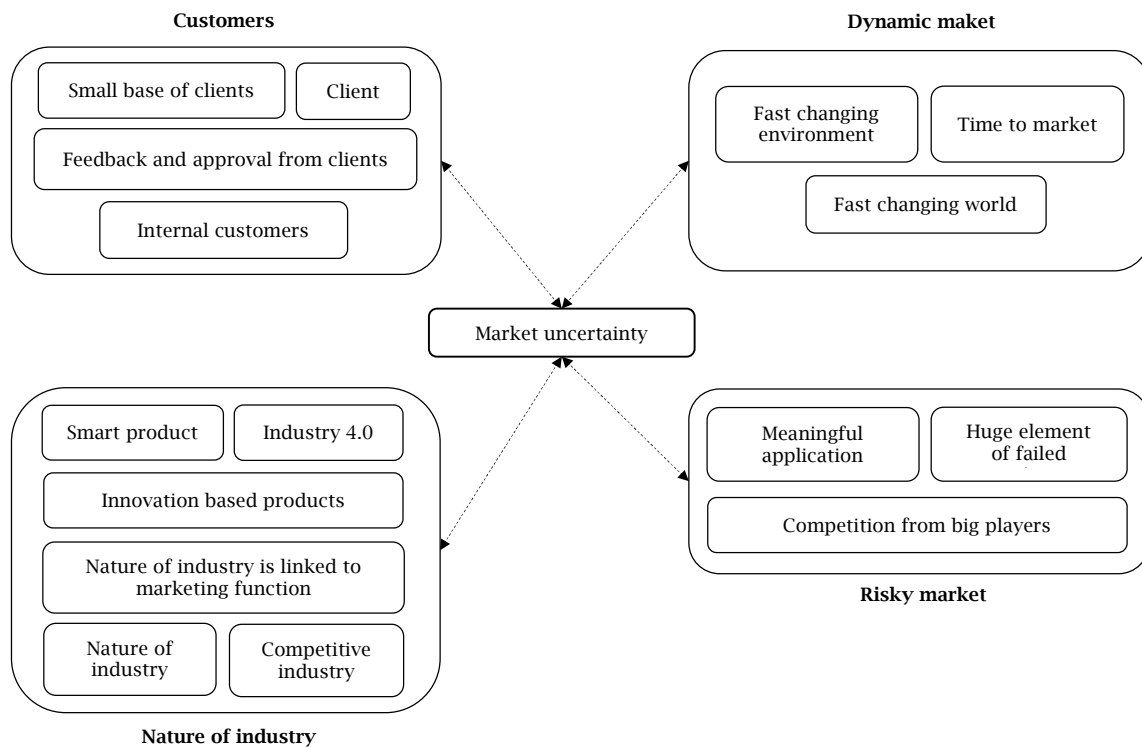
APPENDIX

Figure A.1. Concepts linked to the technology uncertainty construct

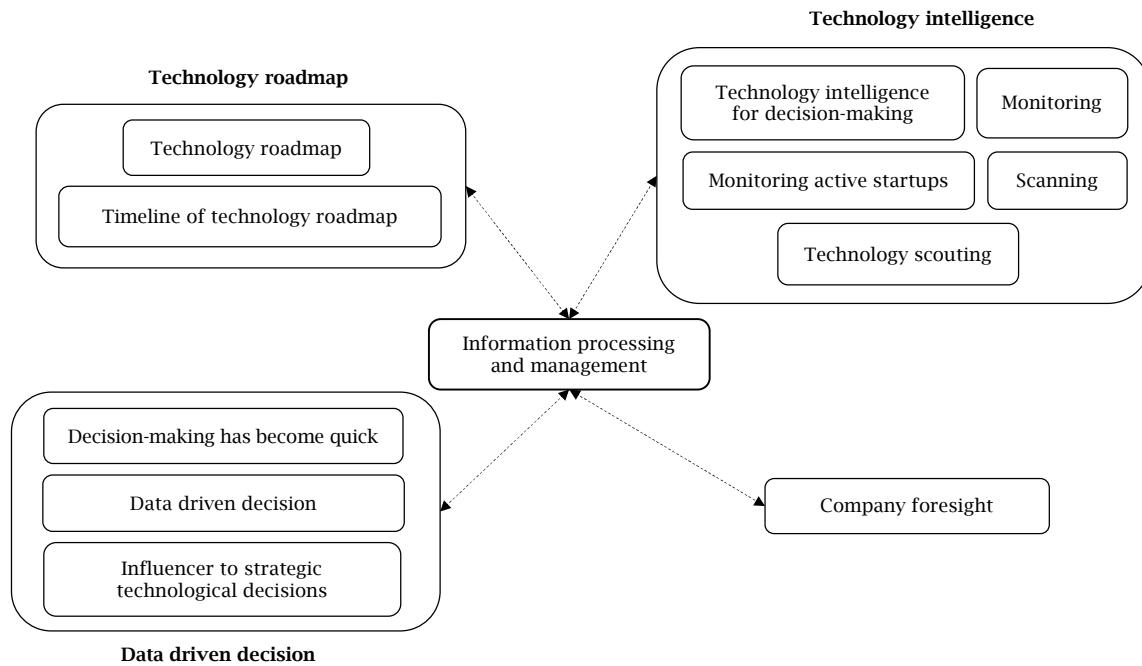


Source: Authors' elaboration.

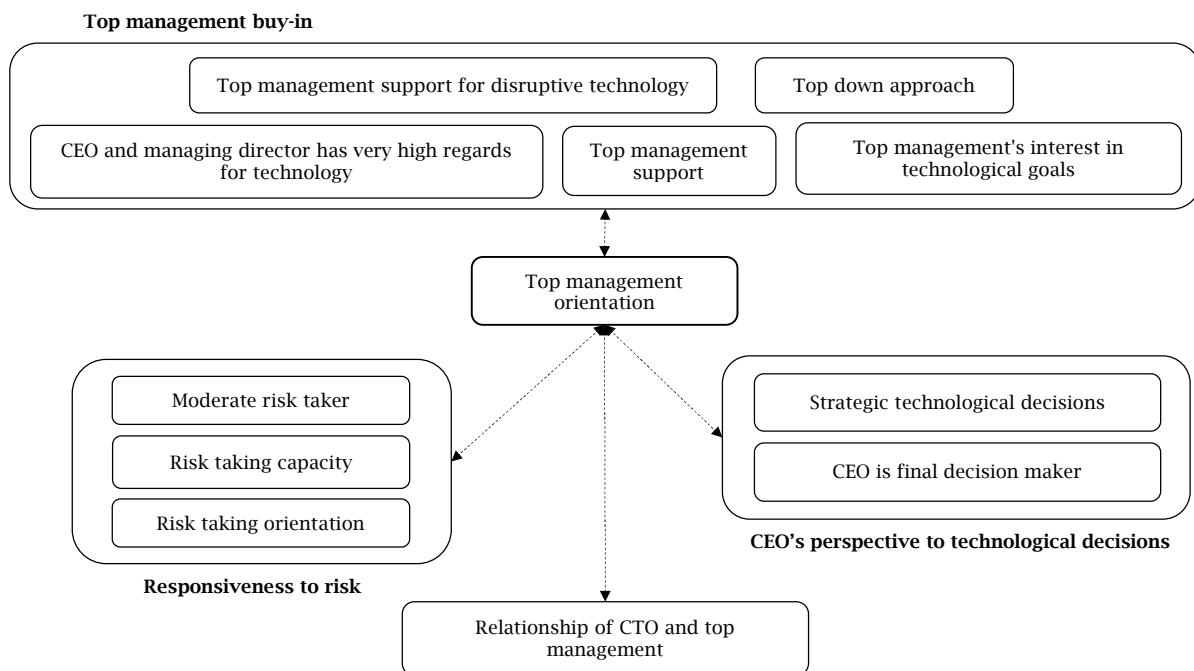
Figure A.2. Concepts linked to the technology uncertainty construct



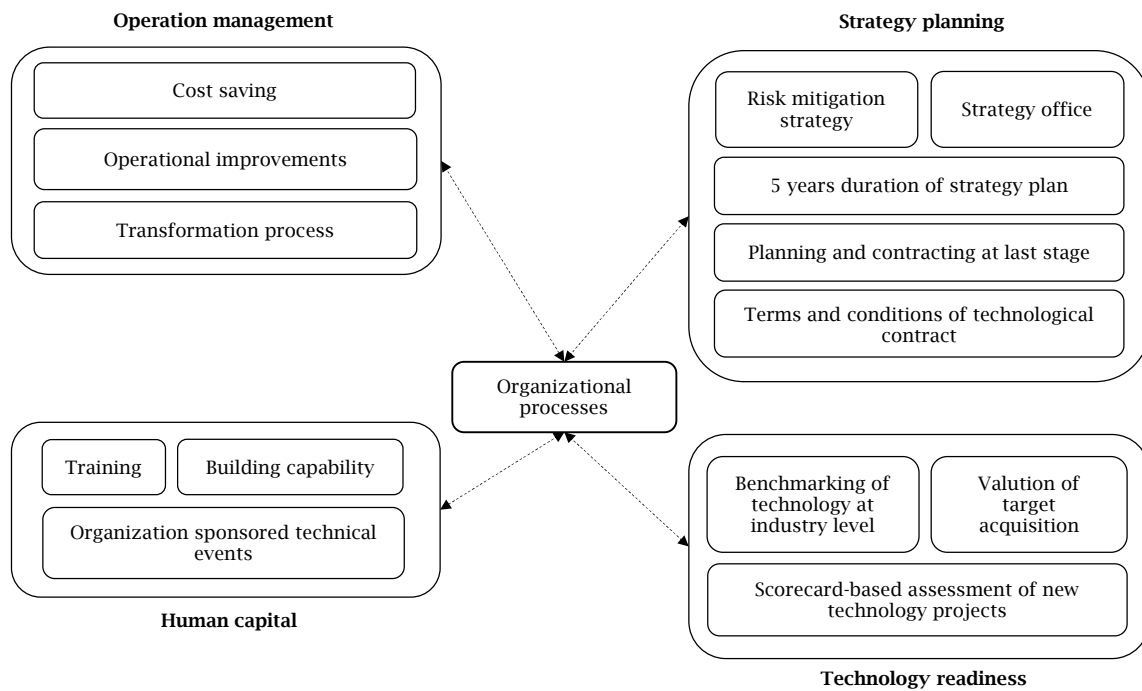
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Figure A.3. Concepts linked to the information processing and management construct

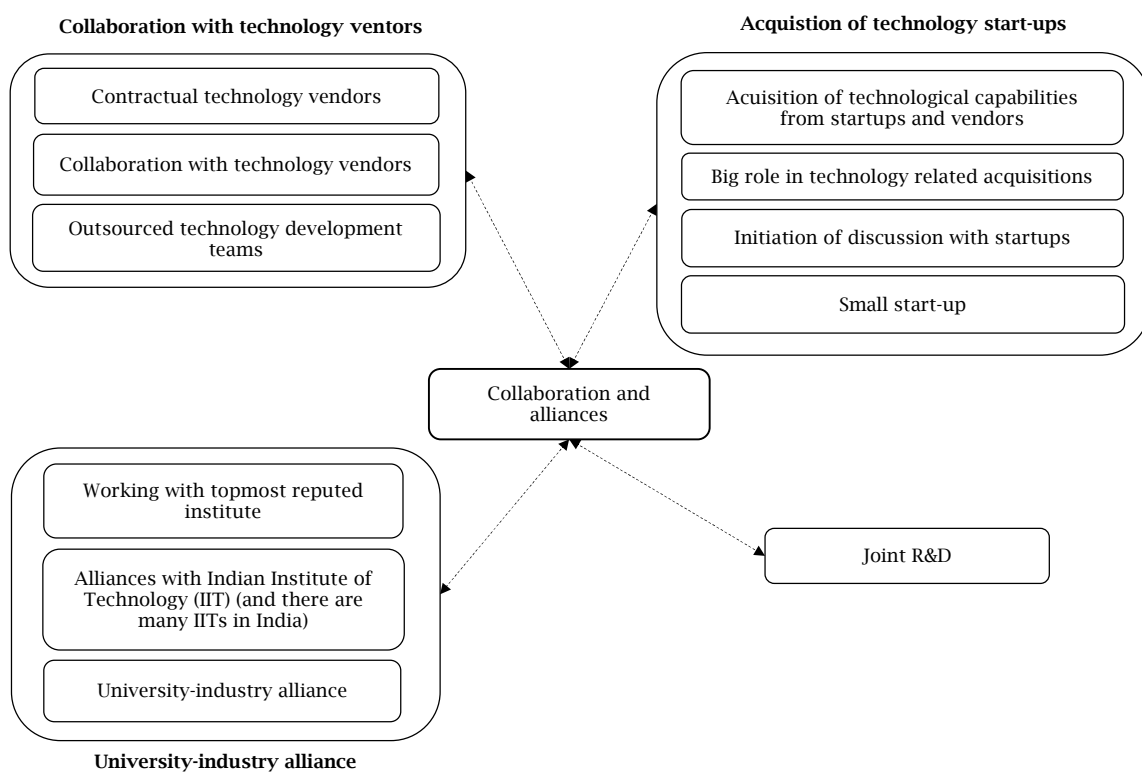
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Figure A.4. Concepts linked to the top management orientation construct

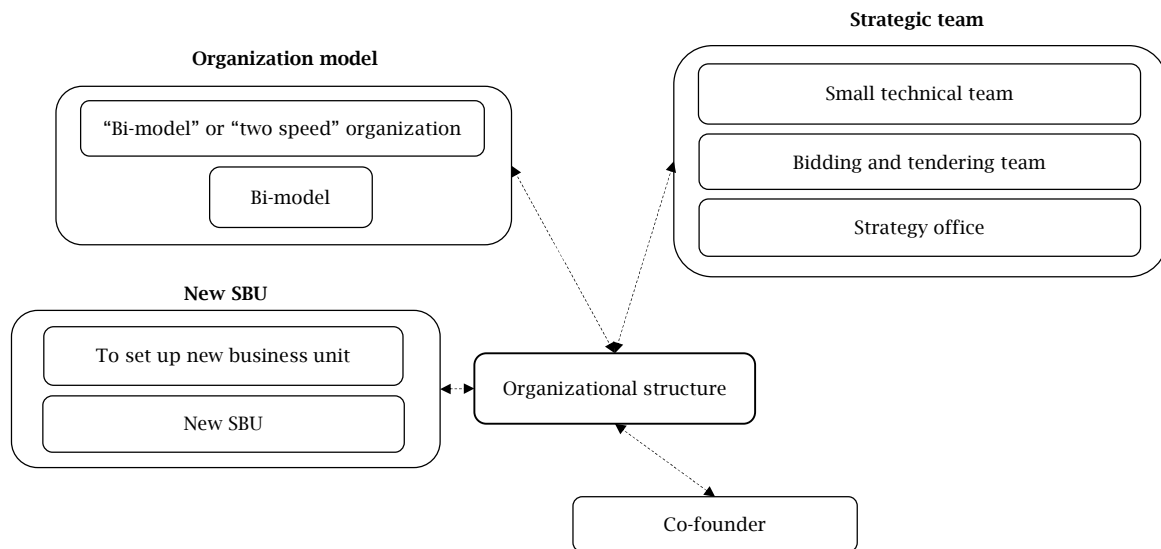
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Figure A.5. Concepts linked to the organizational processes construct

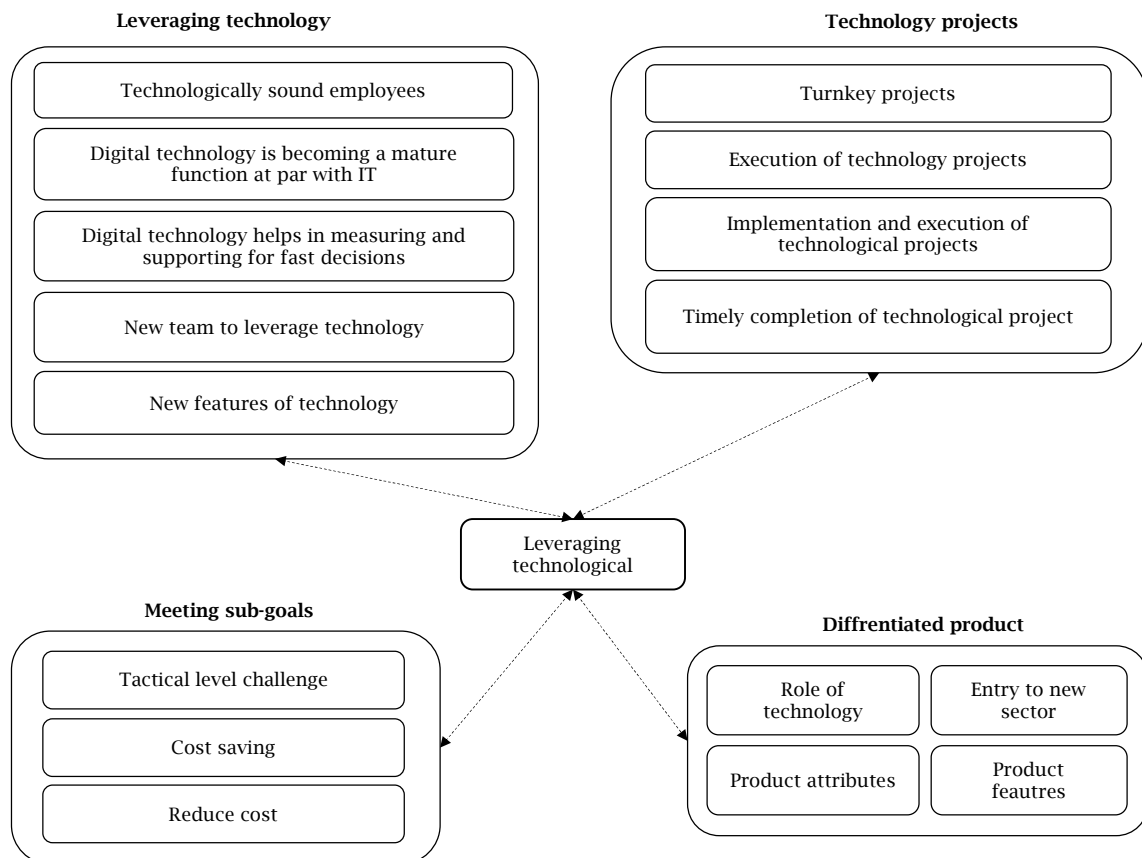
Source: Authors' elaboration.

Figure A.6. Concepts linked to the collaboration and alliances construct

Source: Authors' elaboration.

Figure A.7. Concepts linked to the organizational structure construct

Source: Authors' elaboration.

Figure A.8. Concepts linked to leveraging technological capability

Source: Authors' elaboration.