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Opening the Dynamic Capability Black Box: An Approach to Business Model Innovation Management in the Digital Era

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ABSTRACT The digital era is reshaping the competitive landscape, creating a more turbulent environment where digital technologies play a significant role in enabling innovative business models. Companies need to promote business model innovations, readapting their business models, and create new digital business models to thrive in this scenario. The literature emphasizes that dynamic capabilities are the main antecedent to business model innovation. However, the dynamic capabilities construct is poorly operationalized, lacking proper measurements that effectively translate them to practice, remaining a black box. This paper aims to further understand, operationalize and measure the distinctive dimensions of dynamic capabilities for business model innovation. To this end, we follow the design science research methodology, building a tool for dynamic capabilities evaluation through a systematic literature review. We then evaluate the tool based on a three-year, in-depth case study of a software company. Our findings show that the current business model has a central role in shaping dynamic capabilities for business model innovation. The proposed measures encompass activities and practices and business model structure, highlighting the relevance of the co-evolution between business model and dynamic capabilities. Thus, we propose creating what we call a ''business model innovation engine'' as a function that reshapes the business model to incorporate dynamic capabilities as part of the value creation architecture. We contribute to theory by better translating dynamic capabilities for business model innovation to observable (and measurable) organizational phenomena, linking it to the extant strategic management literature, and elucidating how to measure and guide the build-up of such capabilities. We also add to practice by developing a practical tool for management to use as a means to evaluate their current dynamic capabilities state, therefore guiding for informed strategic action.

INDEX TERMS Business model innovation, design science research, digital economy, dynamic capabilities, innovation management.

I. INTRODUCTION

This paper aims to further understand, operationalize and measure the distinctive dimensions of Dynamic Capabilities (DC) for Business Model Innovation (BMI). The focus is on assisting management in evaluating their company's DC for BMI, following the logic of responsiveness in management. It is necessary to better understand and measure the problem in order to be able to solve it. Thus, understanding the connection between DC, BM, and BMI is key to finding ways to manage DC's creation for BMI. Hence, this study seeks to answer the following research question: What are the main DC dimensions and how to measure DC for BMI management, leading to the build-up of such capabilities?

Research on BMI advanced fast in the past years, improving our understanding of designing and implementing novel

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BM. Recent literature reviews and studies aiming at framing the big picture of BMI have proposed similar ideas. Teece [1] argues that Dynamic Capabilities (DC) are necessary for BMI, accounting for the search, design, and implementation of novel BMs exploring technological opportunities. Foss and Saebi [2], [3] suggest that the theory is still fragmented because publications follow specific aspects of specific industries' particular cases, leading to an apparent conceptual divergence. However, the authors suggest that they may be closer than it seems and that the Open Innovation (OI) paradigm and DC are the core BMI antecedents. Wirtz and Daiser [4] suggest that knowledge management improves DC for BMI.

Despite the convergence in the literature towards emphasizing DC as the main road to BMI, the remaining issue is that reaching out to this conclusion is not enough. DC remains poorly operationalized because, in attempting to measure DC, extant research has not gone much beyond the quite abstract concepts of sensing, seizing and transforming [1], which are hardly translated to observable (and measurable) organizational phenomena. For instance, Yuan *et al.* [5] have asked the question ''The resource reconfiguration capability of our firm is strong'' in a questionnaire aimed at measuring DC [5]. Yet, it is arguable whether managers answering such questions share the same understanding of reconfiguration capability. Moreno *et al.* [6] adopt Pavlou and El Sawy's [7] proposal for operationalization of DC, which is based on Teece's early formulation of DC theory [8] and comprises the following categories to be measured in scale: environment understanding, learning ability, integration ability, and coordination ability. Again, such categories are at a very high level of abstraction, which is not easily identifiable with measurable organizational indicators. In this regard, how to translate sensing, seizing and transforming capabilities into measurable routines, practices and assets, which could consistently inform managerial action, remains a significant gap.

To answer this study's research question, we choose to conduct the study under the Design Science Research (DSR) approach. First, we conducted a systematic literature review to extract and group the major organizational practices, resources and tools associated with the building up each of the three major DC for BMI: sensing, seizing and transforming. Then we created a measurement, an indicator for each group to construct a tool for evaluating DC for BMI. Finally, we conducted a longitudinal in-depth case study with a Brazilian medium-sized software company to evaluate the tool for three years.

Our findings indicate that the current BM plays a central role in shaping DC for BMI. Our evaluation tool and our case study show that the build-up of DC depends on specific activities and practices. Moreover, reshaping the current BM also helps in promoting DC in a company; that is, BM structure and its evolution path are significant for building DC. Hence, each company will likely need to deploy different strategies, activities, and practices for developing DC considering their BM characteristics. This finding highlights the tool's effectiveness once its indicators scores helped the company build-up DC for BMI by creating what we call a BMI engine function. Thus, our contributions to the literature are on advancing DC's theoretical construct, positioning it as a co-evolution with BMI and advancing the notion of BMI management. Finally, we also contribute to practice by providing management with a potential tool to map its BM current state in terms of DC and guide its development to create a BMI engine while also sustaining the BM performance.

The paper's structure is as follows. Section 2 presents the theoretical background, guiding the reader to our proposition's logic, and showing the main concepts. Section 3 presents the research methodology. Section 4 contains the tool design and presentation, and section 5 depicts its evaluation through a deep dive case study. We discuss the findings and put forth the final considerations in Section 6.

II. THEORETICAL BACKGROUND

A. DYNAMIC CAPABILITIES, INNOVATION, AND STRATEGY

The achievement of sustainable competitive advantages is the primary goal in the strategy literature. To sustain competitive advantages, firms need to differentiate themselves, both by strategic positioning in the market and by leveraging complex, rare, difficult to imitate resources. However, the competitive positioning fades out in the presence of innovation [8], [9], which leads to the need for the company to build DC for sustaining its innovation performance and competitiveness [10]. A good example is Kodak's creation (and failure to exploit) of digital photography, creating new dynamics in the industry that led Kodak to bankruptcy, destroying their value and competitiveness sources [11].

DC is defined as a firm's capability to sense new opportunities, mobilize resources to seize such opportunities, and transform/reconfigure key organizational aspects to implement the necessary changes [8]. Therefore, DC is strongly associated with innovation and represents the exploration of both technological and market-oriented opportunities to profit from innovation [12]. It means the company's capability to innovate at the strategic level.

To survive in today's ''Digital Economy,'' companies need to build strong DC to sustain (and create) competitive advantages [13]. The increasing technological progress pace, the organizations' digital transformation, the changes in the social and cultural spheres, and the rising environmental and social-related regulatory pressures are all ingredients to a more turbulent and uncertain environment. Uncertainty and risk are essential variables to understand the relevance of DC at the BM level. The former are ''unknown unknowns,'' a terrain where there is simply no way of predicting the future. In turn, risks are ''known unknowns,'' as they are predictable, measurable, and often manageable [14]. In an uncertain digital world, there are increasing threats to a BM's health while opening the possibilities for new BM, emphasizing the relevance of developing strong DC for BMI.

The persisting challenge is that developing a strong DC is not trivial, and the distinction between Ordinary Capabilities (OC) and DC is essential to understand this issue. The former comprises the current routines, the cumulative learning by doing, and ''best practices'' underpinning the current BM [15]. The latter searches for opportunities beyond the current BM designs new BM to seize those opportunities and implement a new BM by transforming and escalating [1]. Christensen's [16] innovator's Dilemma and Levinthal's [17] competence trap provide us with illustrations of how hard it is balancing between strengthening OC and developing DC. The odds that companies will focus on enhancing OC are much higher [18].

The challenge is that improving the current BM performance is more straightforward and often more comfortable than developing DC. It may look even more challenging considering the difficulties to operationalize DC's, creating further barriers. To search for a potential solution to these limitations, we will further explore BM and BMI theories. Every company needs an adequate BM to be successful, strengthening it to improve performance. This leads to a side effect: the more effective the BM grows; generally, the more rigid it gets [3]. Additionally, to explore novel opportunities, especially those not aligned with the current BM, companies will have to design and implement new BM.

B. BUSINESS MODELS AND BUSINESS MODEL INNOVATION

According to Teece [19, p. 172], a BM ''describes the design or architecture of the value creation, delivery, and capture mechanisms it employs.'' It represents the underlying logic of the business and how the different strategic components relate to each other. The literature suggests different BM dimensions and components [20], [21]. DaSilva and Trkman [22] define BM as a combination of the resource-based view with the Transaction Cost Economics and the market positioning literature. However, the point is that if it is only a combination of well-defined strategy theories, how does the BM literature add value to the strategic management literature? According to Foss and Saebi [3], BM and BMI's core contribution is systemic, placing complementarities as the main BM component. Strategic management focuses on setting goals and objectives and defining key BM components, such as resources, capabilities, and market positioning [22]. The BM literature, in turn, focuses on how such components should be interconnected, amplifying the value chain by creating virtuous value cycles, translating the strategic plans into a logical and coherent architecture [23].

Understanding BM as a system has significant conceptual consequences, such as that internal consistency alone is not sufficient since the relationship with the external environment is also relevant. Different countries and regions have different cultures, institutional rules of the game (i.e., regulatory scenario, Intellectual Property Rights laws, and human resources characteristics), and specific problems to solve. The fit between the value proposition to the customer will vary, and the value creation and delivery architecture will need to adapt. Analysis of Uber's BM transfer to South Africa shows us how environmental features, such as the high unemployment rates, lead to different value creation dynamics. Dreyer *et al.* [24] show that the value to Uber's drivers is lower in South Africa because there are many more drivers available than in the USA, leading to problems with assigning runs and harming the BM's long-term health.

Considering complementarities as the key BM component has implications on the definition of BMI itself. We follow Foss and Saebi [2, p. 216] definition of BMI as ''designed, novel, and nontrivial changes to the key elements of a firm's BM and/or the architecture linking these elements,'' understanding BMI in terms of novelty and scope. Scope follows from modular to architectural. Modular indicates low complementarities level, meaning that it is possible to change a few components keeping the others intact. Architectural means that changing one component calls for a total BM reconfiguration. Novelty ranges from new to the company to new to the world.

Thus, both components and their interactions matter for BMI, leading to different degrees of change. For companies to survive, they need to understand those challenges to innovate their BM and answer to the changes resultant from both technological and non-technological innovations. However, the challenge is that this notion also has a side effect: the company's BM evolution shapes the company's capability to innovate the current BM [25]. It leads to a seeming paradoxical nature that the company needs DC to innovate the BM, which could, in turn, reduce its DC in the long run. Therefore, it seems that while literature emphasizes DC as the primary BMI antecedent, the relationship does not seem to be unidirectional, simply because a BMI could lead to a reduction in the company's future capability for BMI. Christensen's [16] Innovator's Dilemma provides us several examples of this feature, with new entrants disrupting old markets by introducing novel BMs but failing to answer the next wave of disruption.

C. THE CHALLENGE AHEAD

Considering the bidirectional relationship between DC and BMI, the challenge is how both literature strands can be combined to understand these dynamics better and tackle this issue. Recent literature suggests that similar to product innovation, BMI should also rely on understanding the BM lifecycle, with the possibility to manage more than one BM simultaneously [26]. Others suggest the organizational ambidexterity as a solution [27], which is in fact considered an important dynamic capability [28]. Some specificities make sense in theory, but it is hard to translate to the practice. As we argue, this is due to the systemic character of BMs, which means that each company deploys different BM in different contexts, demanding different strategies. Therefore, one size does not fit all. A technology-intensive firm with low entrepreneurial orientation is more likely to have a hard time sensing opportunities. In turn, a market-oriented one

may struggle to provide technological solutions to external opportunities. We argue that each company's BM reflects specific DC characteristics, having strengths in some DC facets while weaknesses in others. As such, strategic action for developing DC in the first example will be significantly different than to the second. While the first may focus on deploying open innovation to find market partners to sense opportunities, the second may focus on finding technical partners to develop solutions or leveraging a startup network to seize sensed opportunities. Thus, assessing DC's reality by understanding the BM is a means to understand strengths and weaknesses and map the necessary capabilities to build and create adequate strategic action plans.

III. METHOD

A. RESEARCH METHODOLOGY

We chose to conduct this study under the Design Science Research (DSR) approach. We justify this decision by the mixed theoretical and practical goals of this research. While contributing to BMI and DC literature, we address the need to create innovative ''artifacts'' (i.e., methods, tools, roadmaps, etc.) to tackle a problem-oriented issue [29]. Given such objectives, DSR is considered an appropriate approach [30]. We adapted Hevner *et al.*'s [31] four-step methodological procedure, using Cole *et al.* [32] for managerial applications and Van Aken and Romme's [33] for using systematic literature review to build the artifact as a tool for the evaluation of DC for BMI.

The resulting four-step methodology is as follows: (1) define the class of problems based on problem-oriented issues. In this study, the class of problem is that of the measurement of DC for BMI as observable organizational phenomena; (2) conduct a systematic literature review to build an ''artifact'' to solve the defined problem. Following the DSR literature, ''artifact'' represents any human-made artificial solution [30], [34]. We used the systematic literature review to clarify different facets of the DC for BMI, organizing the literature into clusters and transforming such clusters into a set of indicators to measure DC for BMI. The set of indicators is the basis for designing a tool (artifact) to measure DC for BMI; (3) evaluate the artifact either in practice, through a case study, for example, or artificially through simulation. We chose to conduct an in-depth case study since our tool targets understanding DC as observable organizational phenomena; (4) draw conclusions, fine-tune the ''artifact,'' and derive theoretical and practical implications. To fine-tune the tool, we conducted the literature review before and after the evaluation, as the practical application provides important inputs for the tool. To draw conclusions and implications, we considered the DC and BMI literature and the capacity to solve the practical problem of measuring DC.

B. DC FOR BMI EVALUATION TOOL DESIGN METHODOLOGY

We conducted a systematic literature review to design the tool [33]. For the publications' search, we used Scopus and Web of Science databases. For the keywords' selection, we began by selecting influential articles and searching for representative keywords aligned with the guiding question of how to manage DC for BMI. Then, we conducted a pre-analysis to evaluate the search term's quality and fit the guiding question. The investigation was initially conducted in June 2017 and repeated in November-2020 to update and fine-tune previous results. Fig. 1 summarizes the process.

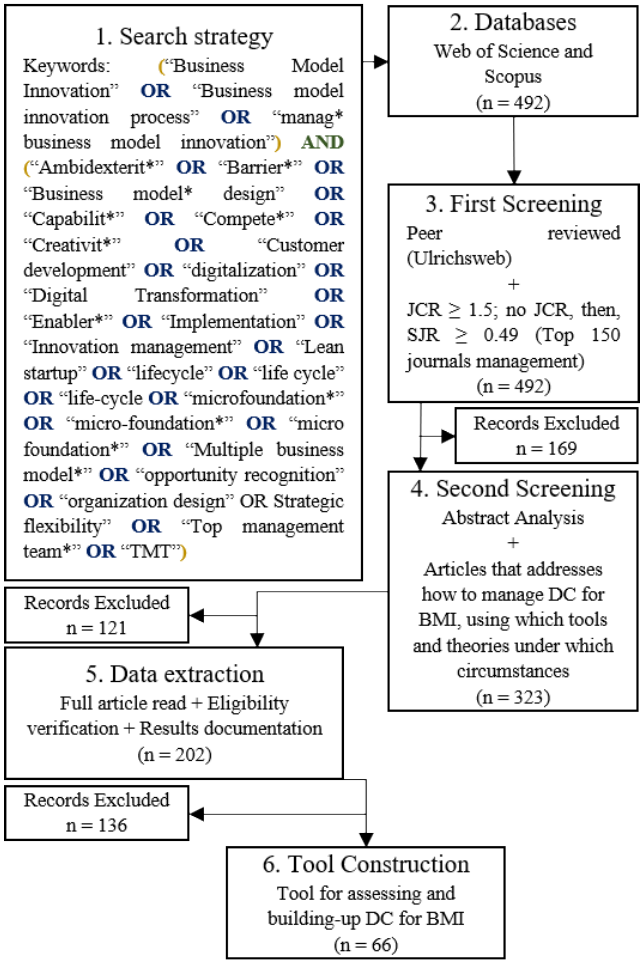

FIGURE 1. The systematic literature review process.

1) TOOL CONSTRUCTION

Operationalization is the act of translating an abstract construct to observable organizational phenomena, creating measurable indicators [35]. The main idea is to attempt to cover every facet of a given construct [36], [37]. Bearing this in mind, we organized the literature review into clusters that translate each DC of sensing seizing and transforming into a broad set of tractable and measurable indicators. We extracted six significant indicators for each capability (a total of 18 indicators) from the 66 literature review publications. To access each indicator, we created a worst and a best-case scenario as a method (Figs. 5 – 7). Attached to each indicator is a 6-point scale to attribute a score for each indicator, allowing for diagnosis and action. Also, it serves as

a base to create an index that can be used for data visualization and future studies using the indicators for measuring DC for BMI in quantitative studies.

Our focus is on securing solid theory-driven indicators and qualitatively accessing their practical value through an in-depth case study to check their adequacy to reality. This is relevant considering that systematic literature reviews and practical evaluation are essential phases of building indicators for constructs [38], [39].

Thus, to test the indicators, we apply the case study methodology. Thus, based on interviews and documentation, we assign scores to each indicator. To gather data, we designed a data collection strategy specific for each indicator. Then, we triangulate relevant data to access the necessary information and attribute an adequate score for the company's evaluation.

C. TOOL EVALUATION METHODOLOGY

The case selection is essential for the evaluation phase of the DSR method [29], once it should involve the main targeted company population and critically assess the ones facing the defined class of problem.

We chose a critical, longitudinal, and revealing case study with exploratory goals [40]. It is a critical case because it represents a company with weak DC for BMI, displaying rigidity to change given a successful BM with complementarities. To this end, we evaluated the company's history of not creating significant different BMs nor substantially changing its current BM. It is a revealing case because the authors had total access to relevant information, bringing forward knowledge that is otherwise hardly accessible. Finally, the longitudinal nature, showing a ''before'' and ''after'' situation, allows us to explore in-depth and detailed information regarding the case.

The selected company, which we will call ''Alpha,'' is a medium-sized software company with approximately 300 employees and a revenue of about US$ 8 million per year (in 2020 values). The company's core competencies are related to digital technologies. The company provides services for large multinationals that outsource part of their R&D and software development. Since its founding, the company had not substantially changed its BM and has not created any significant new BM, evidencing weak DC.

1) DATA COLLECTION AND ANALYSIS

The data collection and analysis followed three years, from 2017 – 2020. We used the tool to diagnose the initial state and then as a means to re-evaluate after each of the company's interventions and compare it with the company's DC for BMI. We used different data sources to secure triangulation, such as semi-structured interviews, non-participant observations, company documents and artifacts, and other file registers.

The interviews were all semi-structured, allowing most of the conversation to be open for the interviewee to express freely. It is semi-structured since we used the DC indicators from the tool as an interview guide but did not limit the worst and best-case scenarios. Keeping the dialogue is relevant to capture significant facets of each measurement, which, combined with other data sources, allowed us to reduce biases and better depict each indicator. The interviews were not recorded to reduce informant biases [41], [42], allowing the interviewee to express his/her opinion freely. We interviewed different company members to reduce biases since our key informants are all from the company's Top Management Team (TMT) [40], [43]. Thus, we interviewed middle managers and operations employees to confront the TMT's interviews and assess potential inconsistencies in their arguments. On average, interviews with key informants took from 60 to 90 minutes, considering that they are from the TMT and had a maximum of 90 minutes available for each interview without disrupting their agenda. The interviews with other company members had a maximum of 15 minutes. We took less time with other members to interview more people, gather different opinions, and improve the research's reliability [35]. During two weeks in the first year, one of the authors went to the company daily to gather local data and conduct additional interviews with different company members and specific observations for data triangulation. We repeatedly interviewed the key informants over the three years (on average, one interview every two months) and revisited company internal and public documents to understand DC's evolution. Table 1 summarizes each data source, the goal, and specific aspects for each evaluation lens.

We tabulated the documents to analyze the data, organized the interviews in a timeline, and analyzed each indicator. We revisited the data multiple times, conducting the ''before'' and ''after'' evaluation, trying to connect the DC evaluation to the practical results. We qualitatively analyzed every data and discussed between the authors, confronting the company in interviews when seemingly confusing or inconclusive data. We organized into cycles of DC evaluation, designing strategic action and implementation. We considered that a cycle was over when the designed strategic action plans led to significant (nontrivial) changes in its BM. Then, we re-evaluated the DC through the tool. We used the empirical results data as a control variable to the tool's indicators to validate its applicability.

IV. BUILDING THE TOOL FOR DC EVALUATION

A. OPENING THE DC BLACK BOX: THE TOOL FOR EVALUATION OF DC FOR BMI

We synthetized the BMI literature into the DC framework, considering the current BM as the central analysis unit, contemplating the different facets of each DC. Hence, we understand that the indicators should represent structural aspects and strategic and decision-making aspects. Current BM creates barriers and enablers for BMI, derived from path-dependency [22]. Strategy and decision-making aspects play an essential role in relevant DC facets. Some examples are: defining how to protect a new BM, secure sound implementation of BMI projects, execute experiments, and deploy adequate tools necessary to create and implement new BM. Thus,

TABLE 1. Data collection sources and strategy.

Data source	DC evaluation	BMI outputs
Interviews	Key informants: CEO, Innovation director. Additional: HR manager, project managers, and employees. Total of 19 people.	Key informants: CEO, Innovation director. Additional: HR manager, project managers, and employees.
Interview strategy	Semi-structured: the tool as an interview guide.	Semi-structured: focus on the current BM changes, its performance, and new digital BM developed
Observations	Routine activities, project dynamics and informal conversation dynamics.	-
Documents	Company's vision, mission, and values; Balanced scorecard, job satisfaction, leadership style, and strategy communication documents	Strategy communication presentations: balanced scorecard, changes in the company's current BM, performance data and new BM data.
Files	Public data: company website, and magazine and TV news.	Public data: magazine and TV news

structure and strategy walk hand in hand when translating sensing, seizing, and transforming capabilities into observable organizational phenomena.

To build the DC evaluation tool, we organized the literature into ''clusters'' that translate parts of each dynamic capability of sensing, seizing, and transforming. We then created an indicator from each cluster and synthesized the central idea into a worst-best case scenario to guide DC for BMI evaluation.

The next sections present the indicators for each core DC – sensing, seizing, and transforming. We summarize each capability and deliver the tool in three separate parts, one for each DC. The organization of the literature into each DC dimension is in the Appendix.

1) SENSING CAPABILITY FOR BMI

Sensing for BMI means the capability to search for new business opportunities, both internally and externally [44]. Monitoring the changing environmental conditions, such as new technological regimes, societal and regulatory pressures, and potential current and new competitor threats, also fit inside this capability [1]. We organized the publications considering similar sensing opportunities and found supporting evidence to create six sensing capability indicators:

Managerial complexity represents the extent to which the organization's structure consumes managerial attention [45] and is built to support the search for new opportunities with activities, resources, and processes [46]. Overly complex structures fill up management time, limiting search strategies [46], [47].

Knowledge configuration represents the existing combination levels of technological and marketing knowledge [48], [49]. High technological knowledge and low marketing knowledge, for example, is not optimal since for better opportunity recognition, a balance between both is desirable [25], [48]. The company's path-dependent learning and its members' experience and mental models are relevant. They are part of the ''dominant logic'' [50]. In the BMI case, the excessive experience could be harmful [51].

Network relationships represent the extent to which the company's partners and stakeholders (i.e., suppliers, clients, other organizations in the same industry, or other industries) improve knowledge deepness and broadness. Strong ties mean knowledge redundancy and deepness, whereas diverse ties mean knowledge broadness [52]. Usually, this is a side-effect of the current BM evolution and is path-dependant [53]. Having a diverse network is relevant to improving knowledge configuration, creativity, and broadness opportunities [54].

Top management team measures the board's knowledge characteristics through diversity (tenure and functional) [55] and their strategic orientation [56]. It is particularly relevant because the TMT drives the strategic orientation, search activities and guides management's attention [46], [56]. The functional diversity influences their view of the world (i.e., a board full of engineers is more prone to a ''technocracy'' than a board of marketers) [55]. This also applies to their experience in different industries, their tenure diversity. A long experience in the same industry may prevent the TMT from recognizing opportunities beyond dominant logic [51], [57]. The TMT's strategic orientation largely shapes the BM configuration and directs managerial attention and effort [58]. Focus on large projects and only improving current BM performance creates unbalance in the portfolio [59], [60], both because resources are directed to these projects and because managerial attention will also be focused on fulfilling this goal [61].

Teams' learning capability evaluates the teams' diversity, creativity, methodological approach, and efficacy. Hence, it captures the ability to conduct experiments, learn and pivot opportunities [62], [63]. Experimentation capability is essential to extract valuable knowledge from BMI tools and practices [64]–[66]. Fitting the methodological approach for coping with uncertainty surrounding BMI efforts is relevant to secure better alignment between resources mobilized and achieved results [67]. Some authors [68] suggest screening and selecting a continuum between causation [69] for less uncertain environments and effectuation for high uncertain environments [50], [70]. Hence the BMI context influences the tools' selection and application. It shapes the

application success and secures the quality of sensed opportunities [53], [71].

Tools for sensing capture the existing tools applied for sensing new opportunities. The main tools are Lean Startup [65], [71]–[73], Customer Development [71], [73], Validation board [34], [74], stakeholders value mapping [62], BMI processes tools [75], BM visual tool Canvas [71], and agile methods crafted for testing hypothesis and refining it (''pivoting'' is the word for changing the basic assumptions of the hypothesis) [73], [76]. Fig. 5 depicts the method guide for measuring the sensing indicators in practice.

2) SEIZING CAPABILITY FOR BMI

Seizing is the capability to mobilize the necessary resources to design new BM for sensed opportunities [1], including designing a new BM to substitute a declining existing BM [26]. Additionally, there is a need to strategize how to protect new BM to secure a competitive advantage over potential imitators [77]. Naturally, startups and new ventures do not face the issue of substituting a prior BM, but they will need to protect the BM from retaliation [78]. When considering an existing BM, and not only startups and new ventures, it is crucial to have a balanced BM innovation portfolio [79], not only for the evolution of the current BM, re-aligning to the contextual reality, but also to create new and parallel BM [80]. We organized the publications considering similarities between the publications into six seizing capability indicators:

Technological capabilities evaluate a company's ability to design and implement technological solutions to problems [81]. It is key for coupling value proposition to customer segments and for improving the offering [82]. This dimension also regards the correlation between a company's innovation strategy and its technological base and industry [48].

Resource mobilization indicates the quantity and quality of resources devoted to designing and experimenting with new BMs [1], [67]. Every new BM demands resources, being it human [83], [84], financial [67], organizational [85], or relational [54], [66], [86]. Securing these resources allows teams to build the BM, test and validate, and introduce it to the market [73]. The size of the company, existing slack resources, organizational structure, complexity, and BMI portfolio management all play a role in shaping the extent to which resources will be mobilized to different BMI projects [87].

BMI portfolio management evaluates the structure deployed to select BMI projects and the balance between improving the current BM and creating new BM [80]. Hence, it relates to how the company allocates time and effort for BMI [79] and how it is structured to pursue BMI [55].

Creativity evaluates the teams' knowledge diversity, intrinsic motivation, and openness to ideas [63]. It depends on skills for designing new BMs and on the leadership style and culture [64], [65]. Engaging different stakeholders and supporting diverse teams are also relevant [62].

BM protection strategies assess the existence of strategic actions to protect newly developed BM and evaluate these strategies' quality and suitability. Designing a potentially suitable BM is insufficient for its success in the market [88], [89]. It is essential to protect it from retaliation [77], safeguarding against inconsistent regulatory pressures [90], and imitability [91]. Possible paths are creating imitation barriers [85], intellectual property rights management [92], building complementary assets (and complexity) [78], and choosing the right time to introduce the BM to the market [77].

Tools for designing new BM evaluates the company's usage of tools, which are: Design thinking and design tools [93], [94], BM visual tool Canvas and its variations [71], [95], tools to support experimentation [66], [74], [96], [97], agile methods, such as Lean Startup and customer development [71]–[73], [98], business modeling processes [75], customer experience journey modeling [99]. Fig. 6 depicts the guiding worst and best-case scenarios for evaluating seizing capability.

3) TRANSFORMING CAPABILITY FOR BMI

The transforming capability relates to managing implementation and scaling new BMs' growth, moving forward in the BMI process. It is mainly associated with constructing the value creation architecture, fine-tuning every BM element to build complementarities [100]. The literature supported evidence for creating six transforming capability indicators:

Organizational culture evaluates the existence of a learning culture, such as openness to ideas and communication, management by commitment, shared vision, and trust, which is critical for considering a changing environment [46], [101]. It is part of the company's BM, and leadership plays a significant role in enabling or hindering change management and learning [63], [82]. Even though this seems more applicable to existing companies, startups also display a culture from their founders, which largely shapes their capability to change the main idea as new learnings come [74], [76].

Resources and capability building are the extent to which the company is capable of creating new resources and capabilities. In practice, this can be done by developing internally, creating new business functions, and training people [102] or externally by leveraging strategic partners [103]. It is a necessary dimension to scale a BM growth. It enables value creation and value delivery architectures [83].

Strategic human resources management refers to evaluating the company's practices for hiring, deploying, and training people [102]. It means bringing new people in, moving people for acting on different BMs, correctly assigning people based on skills, cultural background, and interests [79], [101], [104].

Change management assesses the existence of good practices of building a shared vision to create commitment and be transparent while implementing practices [82], [102], [105]. It is influenced by the leadership style and organizational culture as structural constraints [50], [106].

Organizational design indicates the quality of practices for creating the value creation and delivery architecture for newly developed BM. Some practices are developing strategic capabilities internally or externally [103], creating structures to protect from imitation, such as creating complex distribution channels [107], creating complementarities with other BMs to build complexity [104] and imperfect imitability [78], and creating a constellation of startups as partners to execute new BMs [87]. Thus, it relates to decisions surrounding new BMs' structure [108], [109].

Organizational Ambidexterity assesses the application of adequate strategies to manage multiple BMs. Exploring complementarities with other BMs while separating potential conflicts are key ambidexterity practices [110]. It is directly related to the business model innovation portfolio [79], [111], but designing new BM is different from managing and scaling them [107]. The tools for sensing and seizing focus on BM design, but these tools usually do not cover when reaching out the point of scaling or defining how to explore synergies between an existing BM and a new BM while avoiding pitfalls that destroy value [80]. Fig. 7 depicts the guide for measuring transforming capability indicators.

V. TOOL EVALUATION: RESULTS OF THE CASE STUDY

A. FIRST EVALUATION-DESIGN-IMPLEMENTATION CYCLE

1) PRESENTING THE BM CONTEXT AND INITIAL STATE EVALUATION

Alpha was a project-based organization whose value proposition was to provide software solutions for different Multinational ICT players. Alpha optimized its value creation through total quality management and focused on operations management to be attractive in a competitive environment. The idea was to keep costs low while securing high quality and on-time delivery to leverage customer satisfaction. The higher the satisfaction was, the better the company reputation and the greater demand for projects. Being knowledge-intensive, Alpha relies mainly on human resources as the foundation of value creation. Therefore, keeping up a high project demand also means increasing its HR retention and reducing turnover.

A critical problem with Alpha's BM was its context. The external environment, more precisely the broader economic cycles, plays a major role in shaping customers' budgets, affecting demand for projects. Sales downturns or performance losses by its main clients caused a reduction in their R&D budget, leading to a drop in project demand, directly impacting its BM, since the decline in project demand entailed severe drawbacks. First, Alpha assigned specific personnel for specific projects. Hence, when there was a reduction in project demand, it also implied laying off unassigned personnel. Second, since experience and knowledge accumulation were relevant for securing project quality and delivery time, layoffs meant a loss of technological capabilities and performance. Fig. 2 contains Alpha initial state DC evaluation.

In aggregate, it is possible to notice that Alpha had an overall low score in the initial state DC evaluation. The strongest points were especially those related to the current BM path dependency, such as technological knowledge and strategic human resources management. We also noticed a good overall organizational culture and propensity to change, considering its leadership style. This aspect would facilitate the implementation of necessary changes in the current BM to develop DC. Fig. 3 shows the initial state scores in blue.

2) STRATEGIC ACTION PLANS DESIGN

Alpha designed an innovation program focusing on sensing and seizing capabilities. Such a program was pointed to leverage synergies between the innovation program and the current BM, building complementarities and improving performance. In the long-term, the company expected to begin performing BMI through these new value creation activities. Besides, such activities were associated with the innovation program, leading to a diversification of business activities. Initially, the key selected dimensions for change were Managerial Complexity, Knowledge Configuration and Absorptive Capacity, management Team's tenure diversity, Network Relationship, Business model innovation protection strategy, Resources Mobilization, Tools for sensing opportunities, and Business model design tools. Table 2 depicts the key strategic action plans, the description, the affected DC dimensions, and how it changes Alpha's BM.

For better clarifying strategic action plans, we provide a brief description of its objectives in sequence.

TABLE 2. Summary of the first cycle strategic action plans, the affected DC dimensions and the impacted BM dimensions.

Strategic Action Plans	Affected DC dimensions	Impacted BM dimensions
Change in the company's structure.	Sensing: TMT. Seizing: BMI portfolio management.	Value creation: structure
Design and implement OI funnel.	Sensing: Managerial complexity; Knowledge configuration; Network relations. Seizing: BM design tools;	Value creation: key resources and partners
New technological learning groups	Sensing: Managerial complexity and Knowledge configuration Seizing: Technological capabilities	Value creation: key activities and resources
Explore external non-refundable financing	Seizing: Resources Mobilization	Value creation: key resources.

MC = Managerial Complexity; KC = Knowledge Configuration and Absorptive Capacity; NR = Network Relationship; TMT = Top Management Team; TS = BMI tools for sensing; TLC = Teams learning capacity; PM = Business model innovation portfolio management; CR = Creativity; PS = Business model protection strategies; TC = Technological capability; RM = Resources mobilization; DT = BM design and validation tools; OA = Organizational ambidexterity; CM = Change management; OC = Organizational culture; OD = Organizational design; RB = Resources and capability building; HR = Strategic human resources management.

FIGURE 2. **Alpha initial state DC evaluation, the description of the company state, the evidence, and the scores.**

Change in the company's structure: (1) Decouple the innovation program from the quality branch to directly reporting to the CEO as a new "innovation function," and (2) Hire an innovation director with different backgrounds and experiences.

Design and implement OI funnel: (1) Focus on outside-in open innovation to leverage marketing knowledge by searching for marketing-oriented external partners. At that moment, it was not designed as an inside-out OI strategy, considering that no technology was idle to license, and it had not created any significant new venture to spin-off. (2) Target partners: universities, companies, startups, public organizations, research institutes, and social organizations. Also, different people with experience in key selected market

areas, such as health, finance, and agribusiness, are needed; (3) Create internal technological platforms: Data science, Internet of Things (IoT), Computational Vision, Cognitive computing, and Artificial Intelligence (AI).

New technological learning groups: Solidify its technological capabilities by creating new activities (learning groups) for the personnel engaged with specific technologies.

Explore external non-refundable financing: (1) Explore the regional public policy regarding non-refundable financing for innovation projects; (2) Design of a training process to develop the necessary skills to formulate projects in order to be successful in obtaining funding;

Implement BMI tools for sensing and seizing: (1) Design of the ''futures lab,'' an event-based program where the company's members and the external OI partners ideate potential problem-solution fit to begin the BM design process; (2) Coupling marketing and technology knowledge; (3) Apply BM design tools: Design Thinking, Lean Startup, and BM Canvas.; (4) Create Minimum Viable Products (MVPs) and Proof of Concepts (PoCs) (for more details on MVPs and PoCs definitions, please refer to [111] and [112]).

3) IMPLEMENT AND MONITOR

The first important thing in implementation was Alpha's recognition of the need to proceed through the BM change process, leveraging its existing transforming capability. In practice, it followed the change management practices [114], [115] of building a shared vision, sending strategic signals from the TMT, including the new activities into its strategic map and the employee's functions, and using its established strategic human resources management capability. The procedure designed by Alpha has the following four steps: Build shared vision, Build informal leadership, Create technological platforms, and Experiment with ''Futures lab.''

Build shared vision: TMT's engagement and active communication with employees to transmit the future state and the innovation program's vision. The TMT also participated in the search for OI partners.

Build informal leadership: engage influential volunteers to spread the innovation program's vision and gather volunteers to learn writing innovation projects for non-refundable financing.

Create technological platforms: solidify the new technological learning activity and increase motivation.

Experiment with "Futures lab": demonstrate that OI is not easy and that not all good ideas are inside the company. Find weak spots and induce learn-by-doing.

We notice that the tool's evaluation of its transforming capability was in line with its practical results. The average high scores on change management, organizational culture, and strategic human resources management reflect real-world evidence. Alpha successfully implemented these first changes in the BM, overcoming barriers such as inertia and the dominant logic by inducing change and securing their employees' support. The high rates of volunteers, the goodwill of employees to spend overtime in the initial phases of technological research groups, the engagement and motivation during the ''futures lab,'' and their engagement in the search for external partners are all evidence supporting the success of the implementation. Alpha experimented with the designed innovation program for a year before assessing whether the evolved BM would have improved its DC. Fig. 3 depicts Alpha DC scores evolution after implementation in orange.

B. SECOND CYCLE

1) STRATEGIC ACTION PLANS DESIGN

The second cycle action plan's target was the transforming capability, emphasizing organizational ambidexterity and organizational design, seeking to move a step forward on new BM development. The already implemented changes targeting sensing and seizing would be further improved, especially searching to improve BM knowledge (for enhancing BMI tools and practices). Alpha could reach the MVP and PoC point of BM design but still struggled with the revenue model and value creation architecture for the new potential BMs. According to the evaluation, there was an improvement. Still, there remained a learning curve, and low BM knowledge hindered the quality of the opportunities and the capability to design novel BM effectively.

Another problem was that merely looking outside for partners was not enough to engage with the right partners. However, Alpha's image was evolving as innovative, successfully attracting higher-quality partners willing to share the venturing risk. Table 3 summarizes the strategic action plans, the affected DC dimensions, and the consequent BM changes.

To better clarify each strategic action, we provide below a brief description of each action.

Deepen learning by doing with BMI tools: (1) Employees were trained on lean startup, customer development, and business model canvas; (2) Participation of employees in events, such as lean startup machine and hackathons.

Improve the brand's image as an innovator to attract more reliable external partners: (1) Build synergies between the innovation program and the current BM; (2) Use MVPs and PoCs as assets to leverage the brand's image; (3) Demonstrate the capability to solve problems and resilience.

Build complementarities between technological learning groups and current BM: (1) Technological learning groups began to research potential customers' problems and develop solutions; (2) Instead of being found by clients, proactively propose projects to clients.

Stimulate intrapreneurship and build new venture teams to launch new BM to market: (1) Increase motivational levels and stimulate employees to transform MVPs into potential BM design; (2) Create a bridge between new BM and Alpha's BM through the employees.

Take the first steps towards organizational ambidexterity: (1) Improve complementarities and conflicts analysis to build new BM launching to market strategies; (2) Learn about the key issues surrounding designing and implementing

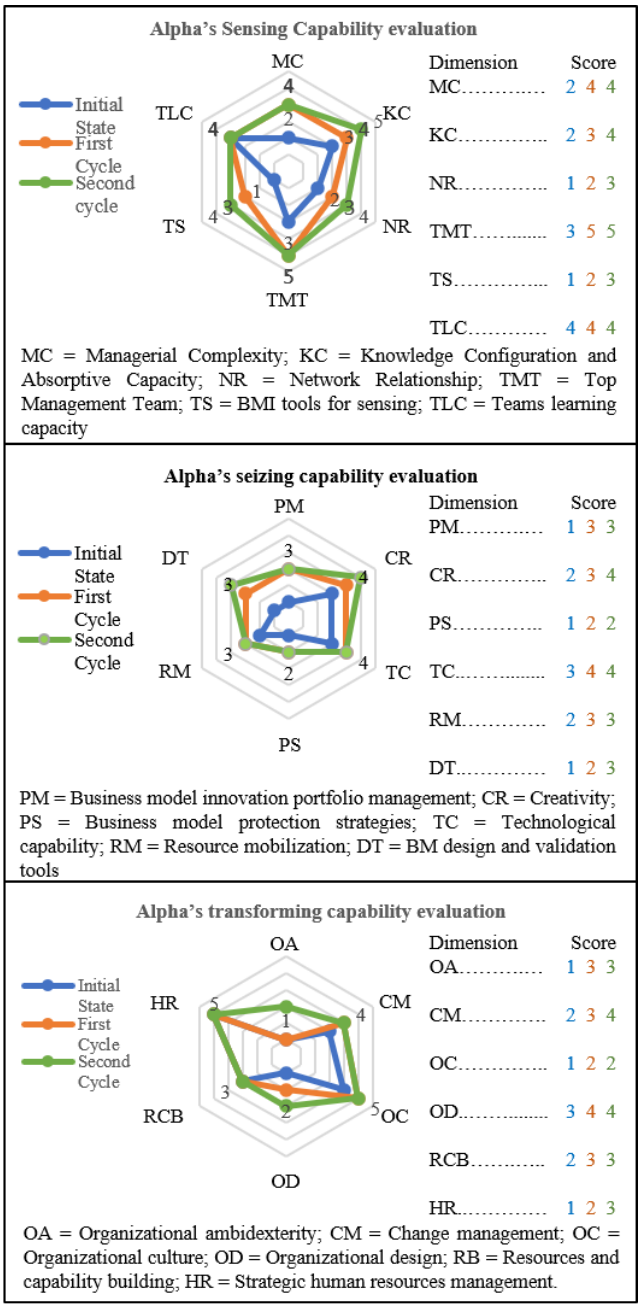

FIGURE 3. Alpha's DC indicators evolution from the initial state to the second cycle.

novel BMs into the market; (3) Explore potential partners to participate in the new BM design, create adequate teams, and secure Alpha's support.

2) IMPLEMENTATION AND DC RE-EVALUATION

Alpha's approach to design and test the actions to improve exploratory transforming capability was to experiment. The idea was to deploy organizational ambidexterity through conflicts and complementarities analysis, seeking to understand how to take new BMs to market, if completely separated or partially united or completely united. Finally, to increase the BM escalation, the idea was to leverage organizational

TABLE 3. Summary of the second cycle's strategic action plans, the effects on the DC dimensions, and the BM changes.

Strategic Action Plans	Affected DC dimensions	Impacted BM dimensions
Deepen learning by doing with BMI tools	Sensing: Knowledge configuration, Network relations, and Tools for sensing Seizing: BM design tools	No changes.
Improve the brand's image as an innovator to attract more reliable external partners	Sensing: Knowledge configuration and network relations. Seizing: Creativity, Resource mobilization, and BM design tools;	Value creation: key activities Value delivery: channels
Build complementarities between technological learning groups and current BM	Sensing: Knowledge configuration. Seizing: Technological capabilities, Resource mobilization.	Value creation: key activities and resources Value capture: customer segmentation
Stimulate intrapreneurship and build new venture teams to launch new BM to market	Sensing: Network relations Transforming: Organizational ambidexterity, Organizational design, and Resources and capability building	Value capture: Revenue stream
Take the first steps towards organizational ambidexterity	Transforming: Organizational design and Organizational ambidexterity	Value creation: cost structure Value capture: revenue stream

design by finding adequate partners to develop the new BMs' resources and capabilities. Leadership and strategic human resources management were vital in this process, identifying key personnel with an entrepreneurial orientation to create functional teams by coupling with external partners to design new BM and experiment in practice. The goal was to make diversified and complementary teams capable of building new BMs to escalate and spinning-off the most successful ones. This action walked hand in hand with the efforts to continue improving sensing and seizing because improving the sensed opportunities and the BM design process quality increased the new BM's success chances. Fig. 3 depicts Alpha's DC evolution after the second cycle implementation in green.

C. EVALUATING THE TOOL: ALPHA BMI OUTCOMES

1) ALPHA'S CURRENT BM CHANGES

Alpha's BM suffered nontrivial changes. As shown in Tables 2 and 3, there were changes related to value creation, delivery, and capture. Before the first cycle, Alpha had a passive tailored software development BM. This means that the source for new projects was through referrals from other

satisfied customers. Clients were responsible for contacting Alpha and requesting specific software solutions. After the first and second cycles, Alpha solidified the execution of a technological research activity, which served as the base for a BM's change to an active tailored software development BM. Through the technological learning teams, Alpha searches key ICT players' core technological developments. Instead of waiting for customer's demands (passive), Alpha actively suggests software developments that would assist these players, focusing on solutions through its competence. This change significantly impacted the company's performance after implementing the innovation management program. As reported by Alpha's CEO and by its Innovation Director, the innovation program accounted for around 54% of 2020 revenue (around US$ 8 million). Alpha's financial performance before the innovation program shows a pattern of resistance of around US$ 9 million in sales revenue (in 2020 values). However, it evolves to a consistent growth pattern after 2017, surpassing the previous barrier (Fig. 4). Furthermore, the technological research activity became an R&D department, which led Alpha to leverage technological innovation performance in its new BM configuration.

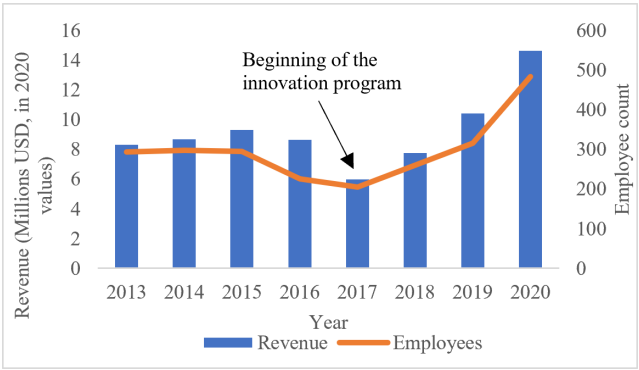

FIGURE 4. Alpha annual sales revenue in 2020 values and employee count (2013/2020).

Inside this new BM paradigm, the developed MVPs and PoC's role is twofold. First, it works as a showcase allowing the ICT players to observe Alpha's capability to carry out innovative software projects. Second, it creates complementarities by promoting Alpha's image as innovative, enhancing its reputation, attracting new customers and strengthening the relationship network.

Thus, Alpha's open innovation funnel engages relevant stakeholders, supporting and building a strong brand image. The open innovation funnel and the ''futures lab'' events support the technological research activity. Through that, it was possible to raise funding for projects to create MVPs and PoCs, reducing the cost structure and legitimizing this new key activity.

2) ALPHA'S SPIN-OFFS

Alpha's innovation program had an ultimate goal creating new digital BMs, developing, through the open innovation funnel and the technological research activity, new companies as spin-offs. After the second cycle, Alpha began to create its first new BM through the open innovation funnel and the technological research activity, executed through the ''futures lab.'' In the first stage, Alpha used the MVPs and PoC as showcases to improve its current BM. However, after consolidation, Alpha started to explore them to create new digital BMs and start introducing them into the market. Alpha had to design an inside-out open innovation activity.

TABLE 4. A summary of Alpha's developed startups, its descriptions, base technology, and market area.

Startup	Market area	Technological base
Beta	Finance	Artificial intelligence, Cognitive computing
Gama	Finance	Blockchain, Artificial intelligence
Delta	Finance	Social media, Blockchain, e-commerce, and Artificial Intelligence
Epsilon	Finance	Data Science

This was made by coupling a co-acceleration process for the new Digital BM, building complementary assets with partners, engaging with startups, and exploiting its technological capability.

Alpha also performed a prospecting process looking for entrepreneurs inside the company to embrace MVPs and PoCs as the starting point to create new BMs. The first experimentation with this new strategic action plan led Alpha to create the first four startups, Beta, Gama, Delta and Epsilon (Table 4).

Beta BM focuses on debt paying, connecting debtors and creditors, using Artificial Intelligence. It contacts both sides through an avatar with voice and video (deep fake techniques) to create an AI with empathy, improving customer experience through a more humane machine, promoting negotiation. To protect this BM, Alpha explored one large partner to be Beta's core first customer. Beta had its first monetization in January 2021.

Gama deploys a platform-based BM. It is an app to facilitate money transfer in markets, considering people without access to the banking systems and pays cash only. It creates a safe environment through blockchain technology that converts change into digital money, creating a digital wallet for customers. The app keeps track of its customers' expenses, helping them to manage their money better. Currently, the startup is validating its BM inside a medium-sized supermarket chain in Ceara, Brazil.

Delta is a platform BM specialized in creating e-commerce for digital influencers. It has two primary value propositions. First, it creates safe micro e-commerces to sell their products using blockchain. Second, it applies Artificial Intelligence to profile the influencers' followers for effective digital marketing strategies. Delta's app is available on both Google Play and Apple store. It has more than five thousand downloads.

Epsilon BM's focus is on facilitating opening new companies in Brazil. The Brazilian regulatory issues and associated costs of opening new companies are very high, leading to a problem that hinders the entrepreneurs' impetus to open new companies. Epsilon's app simplifies this process and creates new companies in 10 minutes. It also has a consultancy program in which it helps startups to grow. Epsilon has been launched into the market and has a number of clients in its portfolio.

VI. DISCUSSION AND CONCLUSION

This study aims to understand, operationalize and measure the distinctive dimensions of DC for BMI. Our findings of the systematic literature review show that extant BM plays a major role in shaping DC for BMI. This notion allowed us to build the tool by combining BMI and DC theories and organizing them inside the BM concept, making the build-up of DC for BMI measurable and manageable. Our findings from the longitudinal in-depth case study show that the tool seems to reach satisfactory results, contributing to the company developing DC for BMI over three years. The practical results show evidence supporting the idea that DC and BMI co-evolve and have mutual influences. To develop DC coherently, Alpha needed to deploy specific activities and practices supporting DC, reshaping its BM to foster DC inside its value creation architecture logic, moving from a passive to an active tailored software development BM. This finding highlights the proposed tool's relevance in capturing the structural dimensions, coupled with human and tools dimensions.

Therefore, we propose that companies should create what we call a BMI engine, complementary to the dominant BM, advancing the discussion on BMI for incumbents. Alpha successfully designed an innovation program by decoupling the innovation direction from other divisions. This new division had the utmost goal of creating new BM, developing new solutions to existing problems, which called for new technological developments. Nevertheless, it also had significant synergies to Alpha's current BM, effectively improving its performance while legitimizing its position to manage BMI. The BMI engine consisted of innovating Alpha's current BM, creating new activities, resources, and building complementarities between existing BM components. There were attractive architectural gains, such as technological research contributing to the commercial, proactively proposing solutions to customers, and improving operations by improving technological capabilities. Furthermore, it created a new key resource, namely the brand's image in the market, consequently improving the project demand and monetization. This coherence in the BMI engine structure was responsible for the build-up of DC and successfully embedding DC into the BM logic, sustaining the engine's persistence until reaching out to the point of creating new BMs.

A. THEORETICAL CONTRIBUTIONS

The theoretical contribution of this paper is the operationalization of DC for BMI. One of the key critiques on the DC literature is that it only addresses the empirical world at a quite abstract level. Therefore, there is a substantial challenge to translate it into practice [116]. This problem is even more relevant since much advancement and recent literature point towards DC as the primary BMI antecedent [3]. Some studies show how companies successfully achieved BMI deploying different DC [117]–[119]. In our study, we open the DC black-box by deliberately connecting the DC and BMI literature, focusing on producing indicators for the distinctive DC of sensing, seizing, and transforming. We also promote a measure translating DC for BMI into observable organizational phenomena by creating an evaluation tool capable of detecting why each DC is present or not and which facets are well or badly implemented. Hence, it helps to identify how the current BM is structured to support DC. Thus, our tool assists strategic action for building-up DC for BMI. Therefore, we sustain BMI as a continuous effort and not a solution for a specific problem. Hence, to operationalize DC, we suggest creating the BMI engine as a function analogous to what R&D is for technological innovation. Alpha shows that the innovation program sought to create a continual BMI management capability that should remain after implementing the new model. Such capability may be a path to overcome the BMI side-effect of reducing DC in the long term. This finding is relevant once the literature on BMI suggests that usually, a BM's evolution accompanies an increase in its rigidity to change [3], [16], [17]. As Christensen *et al.* [18, p. 33] put it, ''Business models by their very nature are designed not to change, and they become less flexible and more resistant to change as they develop over time.'' Our findings show a potential path for reaching the opposite effect, improving the BM while increasing the capability for BMI.

The literature strand that tries to measure DC shows significant problems [116]. First, overall, DC measurement scales are somewhat diffuse, pointing towards DC for different activities (such as product development) or, more generally, to a few selected capabilities. Most of these measures do not consider higher-order DC linked to BMI, a relatively new proposition [1], [3]. As our DC indicators show, the TMT is critical when considering the BM level. The changes encompass several divisions, changes in the overall business logic, entrance into different markets, and exploration of synergies between current BM and newly created BM. Hence, DC for BMI is much more related to the TMT and often relies on the strategic level. The DC measures usually focus on practices (i.e., market search, competitiveness analysis, etc.) at the operational level, often neglecting the TMT's level.

Our findings suggest a relevant dialogue between the DC for BMI literature with the innovation management literature. This is aligned with Tidd and Bessant [120] criticism of the disconnection between BMI theory and the Innovation Management research field. Many of the measurement

dimensions do not seem to be specific to BMI and overlap with technological innovation management capabilities, such as those defined by Francis and Bessant [121]. Setting a balanced innovation management portfolio, securing the TMT's participation in all stages of the innovation process, recognizing new opportunities, designing technical solutions, and the overall sensing and seizing capabilities have a significant match. The most distinct DC for BMI is transforming capability. One interpretation may be that traditional innovation management practices usually focus on sustaining business performance and not changing the BM [18], [122]. One explanation is that DC for BMI expands traditional innovation management to embrace creating new BM and following different technological strands that do not fit the current BM. Our findings, therefore, match the notion of better grounding BMI in the consolidated innovation management field.

The discussion about the relationship between BMI and technological innovation theories is relevant, and it still needs further clarification [123]. To date, literature has mostly developed the idea of BMI as a conduit to market new technologies, especially technologies that do not fit its creator's current BM [124]. It is also the OI's central idea, which places new BM development to explore unused patents and monetize from intellectual property rights [125]. Therefore, there is a strong suggestion that technological innovation precedes BMI. In our case, Alpha revealed the opposite. BMI led to the creation of R&D and pulled the need to conduct technological innovations. Thus, we advance this discussion by taking the first steps in understanding this opposite relation between BMI and technological innovation. Is BMI a path to build technological innovation capabilities? It is a question that we did not have the ambition to answer in this paper. However, our results display potential baby steps in such a direction.

B. MANAGERIAL IMPLICATIONS

The increasing turbulence and uncertainty in the business environment brought about by the digital era are reshaping companies' strategic reality. This increases the pressure to innovate the BM as new competitors arise and distinctive industries' boundaries dissolve. One good example is that digital players, such as Google and Apple, span the traditional automotive industry's boundaries as the digital and electric paradigm gain strength [13], [126]. This change in the business landscape means that the very base of companies BM is under threat, which pushes management towards trying to find means to develop capabilities to consistently manage BMI, targeting the digital transformation of their current BM and creating new digital BM [127], [128]. Thus, there is an increasing urge to elucidate and measure the organizational phenomena behind the effective management and development of capabilities for BMI. We believe that we contribute to this issue by taking steps into better understanding the organizational phenomena behind the DC for BMI, reducing failure rates of strategies deployed, and increasing the quality of actions considering each company's BM particularities.

This study targets this issue by proposing a tool to help managers measure their current BM state regarding DC and design strategies for BMI. Therefore, management should focus mainly on understanding their current BM. How could cutting-edge BMI practices, such as open innovation, engagement with startups, Lean Startup, be better-applied, building complementarities and virtuous value creation cycles to the company's current BM. We think it would be possible to reduce failure rates during the implementation phase by following this direction. This will improve companies' innovation performance and enhance the BM performance. Thus, creating a favorable environment to move forward with innovation strategies, improve the company members' overall buy-in, and create virtuous cycles.

We also propose a potential roadmap to develop DC. First, begin with an in-depth BM analysis. Then, follow to create a new function for placing innovation at the TMT's level and design the sensing and seizing capability. Before creating new BM, one should have a good antenna for sensing opportunities and quality for designing, testing, and validating solutions. Then there is an important step of connecting this initial stage BMI engine to the current business, exploring complementarities to strengthen the main BM. Finally, target the remaining DC to create the capability to design complete BM and introduce it to the market.

C. LIMITATIONS AND FUTURE RESEARCH

It is important to highlight that the tool evaluation is based on a single case study setting, which provides limitations regarding drawing generalizations. Thus, evaluating the current BM and the associated DC in Alpha may not necessarily lead to similar results in other companies. Some idiosyncrasies will certainly vary for each case, and, consequently, the strategies to build-up DC in different conditions will probably differ. However, we focus on the tool's capability to operationalize DC in practice, showing in detail how it happened. This approach is essential for learning and allowing future research. Moreover, although our indicators show theoretical consistency and a positive practical application, they should still undergo full validation, evaluating their content validity, collinearity, and convergent validity using other reflective DC measurements [36], [37], [129].

We argue that because our tool has its roots at the BM level, it should help capture each case specificity, deploying specific strategies aligned with these variations. This is in line with the DSR methods' propositions, in which the focus is to be the most applicable as possible, considering a set of organizations that face similar problems. Thus, we believe that a multiple case study setting should further enhance the tool, fine-tuning it, and increase its applicability across different industries. Moreover, a multiple case study setting can help better understand potential macro archetypes of existing BM, providing the possibility to search for similarities that lead to similar approaches to build DC. Hence, leaving the adaptation to each company BM specificities to tactical actions.

FIGURE 5. **The tool for measuring sensing capability for BMI indicators.**

Another limitation is that our study focused on BM as the central analysis unit. In this respect, we also chose a case study based on a high degree of accessibility to information and weak overall DC while having a successful BM. However, we did not directly consider how the external dynamics variations and how the external environment

FIGURE 6. The tool for measuring seizing capability for BMI indicators.

impacts and shapes each DC dimension's relevance over time. It seems that completion, sectorial conditions, and external dynamics, such as regulatory and social pressures, may affect the extent to which a company must develop and explore each of the DC dimensions. Thus, combining our tool with elements such as level of industry opportunities, cumulativeness of knowledge, and appropriability levels [130], for instance, could be interesting to

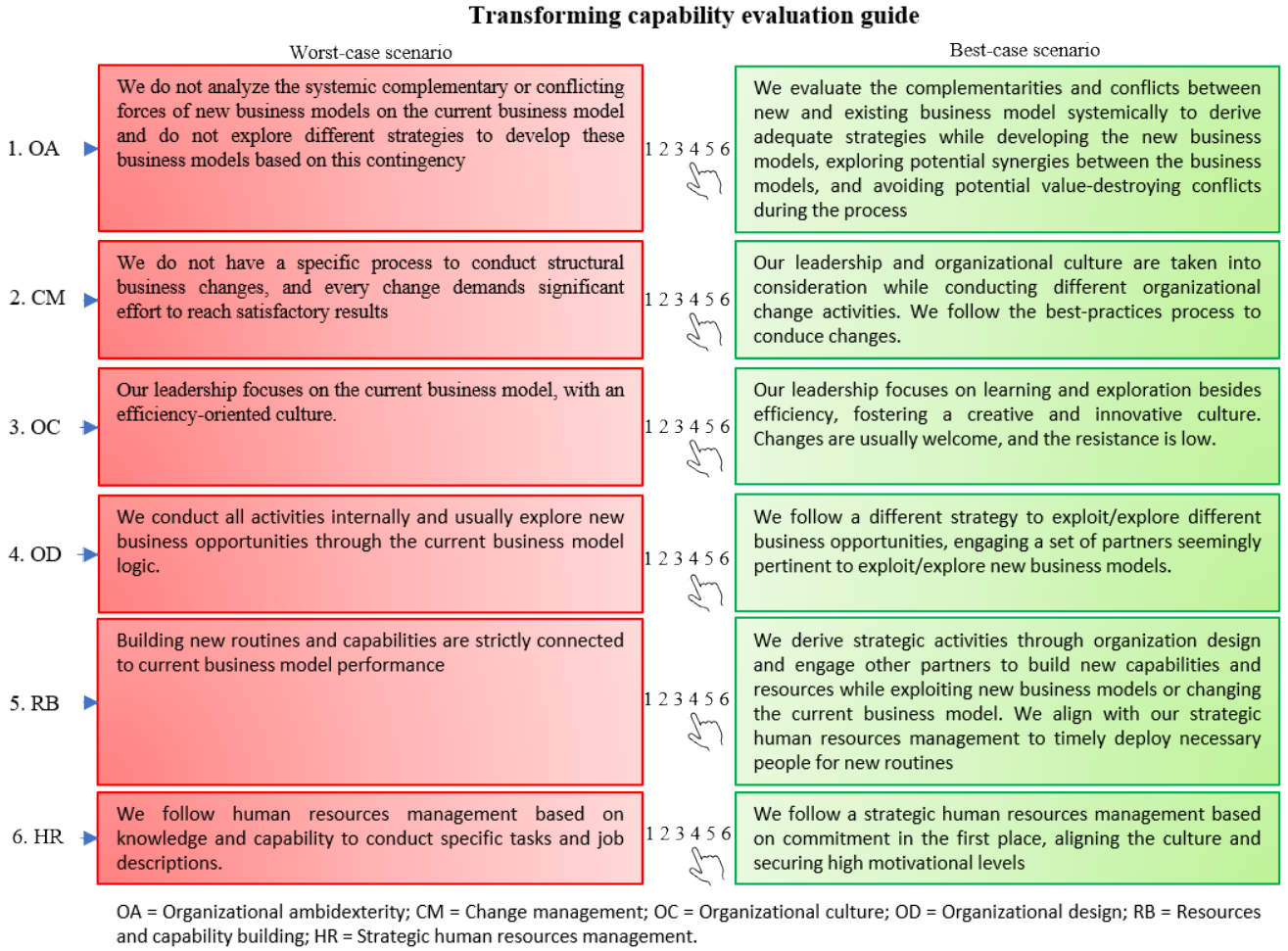

FIGURE 7. **The tool for measuring transforming capability for BMI indicators.**

further continue the research on the operationalization of DC for BMI.

APPENDIX

See (Figures 5–7).

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