Artificial Intelligence-Enabled Business Model Innovation: Competencies and Roles of Top Management

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Abstract—**Research in artificial intelligence and business model innovation is flourishing. Nevertheless, the current discussion lacks an overarching understanding of, and thus has not sufficiently addressed, the interface between artificial intelligence-enabled business model innovation and the critical role of top management. Although a paradigm shift affecting top management is already occurring, extant management literature is limited, especially in terms of primary research. Accordingly, this study explores how top management can encourage and facilitate artificial intelligence-enabled business model innovation. We utilized an inductive approach and conducted semistructured interviews with 47 practitioners to develop a grounded theory. The developed framework consists of five top management competencies and eight top management roles. Overall, our study contributes to research in business model innovation theory, revealing that top management requires a specific skill set to carry out their roles and fulfill expectations.**

Index Terms—**Artificial intelligence (AI), business model innovation (BMI), top management (TM).**

I. Managing Artificial Intelligence (AI) is a Chief Matter

IN RECENT years, the number of academic publications in the field of AI and business model innovation (BMI) has trended upwards [4], [16], [18], [25], [29], [78]. Most business model researchers focus on the effects of added value propositions and their potential for innovating firms [22], [24], [90]. Research in this field is justified not only by the interest of the academic community but also by the managerial implications [32], [69], [92].

The transformative nature of AI and its potential to bring about substantial changes within business processes is well known and will intensify in coming years [41], [45], [47], [48]. The impact of automation on various professions in numerous industries is already tangible [49], [63]. In particular, the recent development of generative AI, e.g., ChatGPT, highlights the increasing momentum of AI in driving innovation behind products, services, business models, and research practices [14], [15], [28], [74]. AI technologies are evolving and society is becoming increasingly digitized, and, in this context, new and emerging forms of data are creating novel types of values and opportunities for data-driven solutions to address various management challenges [66], [71]. It is vital to integrate these new data forms continuously and appropriately into AI-based algorithms [58]. It is also essential to adequately assess and manage the future values and risks arising from AI advances, say, to predict cyber risks through autonomous algorithms and real-time analytics [64]. In addition to automatization, companies must rethink their current value offerings to customers to stay competitive in an increasingly disrupted world [6], [11], [31], [37], [38]. In such a volatile, uncertain, complex, and ambiguous world, the role of top management (TM) is to identify and address how value can be created and sustained through innovation [7], [61]. To manage emerging organizational challenges, TM must utilize an appropriate change management and suitable leadership structures [44], [92].

Although the changes affecting TM are already happening, the current discussion has not sufficiently addressed the relationship between AI-enabled BMI and TM [50], [76]. Extant literature lacks an overarching understanding of this phenomenon, primarily due to a scarcity of primary research [17], [88].

In the current conversation of AI-enabled BMI, most researchers underline their studies with the resource-based view by Barney [8] and the dynamic capabilities view by Teece et al. [82]. The resource-based view limits itself to unique internal resources, which, in the context of AI, most companies lack [25]. Recent BMI studies base their research on the dynamic capabilities view, which focuses on sensing, seizing, and transforming [81], [89]. However, for our purpose of analyzing AI-enabled BMI in combination with TM roles and competencies, the prevailing theories cannot explain the phenomenon in all its complexity, and thus, a sufficient theoretical framework must be

developed [9], [79]. In this article, we aim to make a significant contribution to this underexplored area of research by focusing on the following research question.

"How can TM encourage and facilitate AI-enabled BMI?"

In the following sections, we provide a brief literature review of the research topic, followed by the applied research methodology. We then display our results and conclusions.

II. What We Know So Far

This section provides a brief literature review on the current state of extant research. First, we provide a basic definition of business models, and then we delve into the current state of research on AI-enabled BMI and TM.

As highlighted by many academic studies, firms either implicitly or explicitly choose a business model that meets customer needs and, at the same time, cannot be imitated by competitors [19], [75], [80]. In developing business models, firms must consider how they can offer value to their customers, how much customers are willing to pay for this value, and how this value can be converted into profit [2], [19], [53], [75], [80], [95]. In essence, business models consist of various mechanisms to effectively create, deliver, and capture customer-centric value [51], [80].

To remain competitive, firms must continuously innovate their business models in a structured way, also known as BMI [1], [30]. The concept of BMI has been studied extensively by researchers investigating different organizational types, methods, and perspectives [10], [21], [40], [56], [85], [94]. Some researchers view BMI as a fine-tuning procedure that occurs over time, whereas others take a more disruptive and radical approach to BMI [3], [72]. However, most studies underscore the importance of a change in the value proposition as a vital block in BMI [3], [13]. In line with Teece [80], we define BMI as a modification in the value offerings in at least one dimension, such as a change in value creation, value delivery, or value capture. By embracing BMI, firms can enhance profit margins, revenue, and performance [1], [93]. Therefore, it is critical to understand BMI and implement it efficiently to succeed in today's fast-paced, data-driven, and rapidly evolving business environment [57], [72].

Recent discussions illustrate that technologies with disruptive potential, such as AI, present significant opportunities for BMI within firms [12], [20], [91]. Various definitions of AI coexist within the literature, and thus, we ground our research on a broadly recognized definition of AI as "a system's ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation" [46, p. 17]. In the context of Industry 4.0, the role of AI for BMI is becoming increasingly important [67], [68]. Extant studies show that AI is no longer seen as a simple decision support system; rather, it encompasses additional areas arising from existing Industry 4.0 frameworks, such as connected devices or cognitive concepts, which are crucial for the development of new business model approaches [54], [67], [73]. Radanliev and Roure [65] have highlighted the significant

new opportunities emerging from advances in autonomous AI. The idea that algorithms can optimize and adapt on their own, such as self-innovating AI, has introduced new opportunities for the continuous and autonomous innovation of business models [42], [64].

Numerous studies (e.g., [16], [76], and [52]) have already addressed the phenomenon that AI provides essential possibilities for BMI. Burström et al. [16] focused on AI-enabled BMI and transformations within industrial ecosystems. A central finding of this study is that AI-based BMI must be aligned with the innovation of the broader ecosystem. In other words, to succeed in the long term, firms must establish an ecosystem around the AI-enabled business model that suits its purpose [16]. Likewise, Sjödin et al. [76] examined this topic to determine how specific capabilities related to AI may facilitate BMI. They found that data pipelines, algorithm development, and AI democratization are three sets of critical AI capabilities [76]. In another study, Lee et al. [52] characterized AI as a BMI catalyst and examined the factors influencing AI-based BMI. They point out that firms may conceivably disrupt a global competitive landscape by properly implementing AI-enabled business models and processes [52].

Based on extant literature, we understand AI-enabled BMI as a firm's ability to adapt AI capabilities to innovate its business model. However, our analysis of studies on AI-enabled BMI has revealed some research gaps. It must be emphasized that research related to TM and AI-enabled BMI is at a very early stage of development, with very few studies addressing this issue. Garbuio and Lin [33] have highlighted that TM team composition plays an important role in the development of new AI-based business models and the associated funding issues. Likewise, Volberda et al. [87] and Narayan et al. [59] have underlined that the composition, commitment, and cognitive diversity of TM teams have a crucial impact on their area of attention when aiming such kind of BMI. Moreover, Rodríguez-Espíndola et al. [70] emphasized that adequate support from the TM team is important when introducing new technologies, such as AI. However, at present, there is a lack of primary-data studies focusing on the TM roles and competencies required to implement AI in firms to innovate business models. Current management literature focuses on the potential of AI technologies to optimize corporate processes in the context of digital transformation or to disrupt the mechanisms of creating, delivering, and capturing value. Furthermore, initial studies have examined the influence of leadership on organizations that adopt AI technologies. Matsunaga [55] explored the concept of transformational leadership combined with uncertainty management theory to analyze how the uncertainty over introducing AI-based technologies in an organization impacts employees. In another study, Helo and Hao [39] indicated that TM combined with a transparent AI strategy plays a significant role when utilizing AI in an organization. Furthermore, Trenerry et al. [84] underlined the importance of effective leadership and TM skills with a general focus on digital transformation [23]. Nevertheless, these studies do not empirically identify the TM roles and competencies necessary for AI use in firms. Accordingly, in the present study, we address this research gap by analyzing the specific roles and competencies of TM in the context of AI-enabled BMI.

TABLE I
OVERVIEW OF SAMPLE COLLECTED THROUGH EXPERT CONSULTATION

ID	Category	Educational background	Working country	Industry	Duration
1	AI Specialist	Engineering	Ireland	Technology	30 min
2	Managing Consultant	Business	Germany	Health care	29 min
3	Lower & Middle Management	Engineering	Austria	Technology	37 min
4	AI Specialist	Engineering	Germany	Technology	36 min
5	AI Specialist	Engineering	Germany	University	54 min
6	AI Specialist	Business	Germany	Healthcare	33 min
7	Professor	Engineering	Germany	University	42 min
8	Top Management	Engineering	Denmark	Technology	43 min
9	Lower and Middle Management	Business	Germany	Technology	39 min
10	Lower and Middle Management	Engineering	Germany	Media	42 min
11	Managing Consultant	Engineering	Germany	Technology	34 min
12	Top Management	Engineering	Germany	Health care	35 min
13	Lower and Middle Management	Engineering	Germany	Manufacturing	33 min
14	Lower and Middle Management	Business	Germany	Technology	30 min
15	Lower and Middle Management	Engineering	United Kingdom	Health care	30 min
16	AI Specialist	Engineering	Germany	Logistics	47 min
17	AI Specialist	Engineering	Switzerland	Media	37 min
18	Lower and Middle Management	Engineering	Germany	Logistics	34 min
19	Lower and Middle Management	Engineering	Germany	Media	37 min
20	Top Management	Business	Germany	Manufacturing	25 min
21	Lower and Middle Management	Engineering	Denmark	Technology	31 min
22	Lower and Middle Management	Engineering	Switzerland	Media	28 min
23	Top Management	Engineering	Denmark	Health care	46 min
24	Top Management	Engineering	Germany	Media	42 min
25	Professor	Engineering	Denmark	University	60 min
26	Top Management	Engineering	Denmark	Logistics	37 min
27	Lower and Middle Management	Business	Germany	Manufacturing	25 min
28	Top Management	Business	Germany	Manufacturing	32 min
29	Top Management	Business	Germany	Manufacturing	33 min
30	Lower and Middle Management	Engineering	Germany	Manufacturing	36 min
31	Top Management	Business	Germany	Manufacturing	27 min
32	Top Management	Business	Germany	Manufacturing	37 min
33	Lower and Middle Management	Engineering	Germany	Manufacturing	57 min
34	Top Management	Engineering	Germany	Manufacturing	40 min
35	Lower and Middle Management	Engineering	Germany	Manufacturing	24 min
36	Top Management	Engineering	Germany	Manufacturing	33 min
37	Lower and Middle Management	Engineering	Germany	Manufacturing	36 min
38	Top Management	Business	Germany	Manufacturing	28 min
39	Top Management	Engineering	Germany	Manufacturing	38 min
40	Top Management	Business	Germany	Manufacturing	31 min
41	Top Management	Engineering	Germany	Manufacturing	26 min
42	Top Management	Business	Germany	Manufacturing	34 min
43	Lower and Middle Management	Business	Germany	Manufacturing	28 min
44	Top Management	Business	Germany	Media	29 min
45	Professor	Engineering	Germany	University	36 min
46	Top Management	Engineering	Denmark	Technology	39 min
47	Top Management	Engineering	Canada	Technology	30 min

III. IMPLEMENTING GROUNDED THEORY FOR CONCEPT DEVELOPMENT

To form an understanding of, and build a framework for, the roles and competencies of TM in the context of AI-based BMI, we used an inductive approach and followed Gioia et al. [34]. Researchers may develop a grounded theory by following this systematic approach, which relies on rigorous qualitative standards [34]. Various AI-related studies have relied on the Gioia method and demonstrated its suitability for the context in question [5], [36], [76], [77].

A. Collecting Knowledge From Experts

For the data collection process, we selected interviewees based on the following criteria: 1) experience (either theoretical or practical) in working with AI; 2) an understanding of managerial challenges in implementing AI; and 3) a sense of BMI potential arising from AI technologies. We approached experts with engineering or business background and a strong understanding of the managerial implications of AI. In our sample selection, we favored firms that are represented in corporate networks with a focus on engineering and manufacturing, as numerous studies have already shown that these firm types utilize AI technologies [60], [92]. In addition, a key selection criterion was that the respondents' firms have at least early to midstage AI adoption experience. Table I summarizes core information about our sample.

Overall, we conducted 47 semistructured interviews (for a total duration of approximately 28 h) over nine months from October 2021 to June 2022. This number of interviews led

to saturation, as the content of the most recently conducted interviews did not lead to further significant insights. Our sample comprises practitioners, managers, and academics from various industries or subject areas, who possess the required knowledge of AI technologies and BMI. We divided our sample into five groups:

1) TM (20 interviews with C-level executives and managing directors);
2) lower and middle management (16 interviews with the direct reports of TM and department heads);
3) AI specialists (six interviews with experts that have in-depth knowledge in utilizing AI within firms);
4) professors (three interviews with university professors focusing on strategic management and AI research);
5) managing consultants (two interviews with consultants in managerial roles and experience in transformational AI projects).

To analyze TM roles and competencies from different perspectives and to generate a fully comprehensive understanding, we also included the views of other relevant groups in our sample beyond those related to TM.

As recommended by Gioia et al. [34], the interviews were not based on extant theories or frameworks. Rather, our interviewees had the opportunity to provide their candid insights regarding AI-enabled BMI without considering any conceptual specifications. The interviews were conducted in person or remotely via video conferencing software, such as Microsoft Teams or Zoom, in English or German. We translated relevant passages from the German interviews to English, retaining the meanings and structures of the original quotations. Additionally, we anonymized the recorded interviews so that no statement could be traced to an individual or company and transcribed them shortly after completion [26], [27].

B. From Codes to Data Structure

After completing the transcription process, we coded all interviews with the software MAXQDA Analytics Pro [86]. Following the approaches of Glaser and Straus [35] and Gioia et al. [34], we identified patterns in our empirical data by iteratively comparing the interviews. We reviewed the various patterns for commonalities and differences to reduce the number of identified categories and analyze them in a more suitable way, following the approach of Gioia et al. [34] for grounded theory development. We then consolidated comparable in vivo codes into 60 first-order categories and generated appropriate phrasal descriptions. In doing so, we retained essential language used by the interviewees. In further analyses, we identified relationships among the first-order categories to combine them into 13 researcher-centric second-order themes. Based on these second-order themes, we determined two final aggregate dimensions. In that sense, we concurrently reflected on multiple levels to analyze beyond the surface level and identify unexplored concepts. Overall, the grounded theory approach underlines that the entire set of first-order categories, second-order themes, and aggregate dimensions represents the basis of the iteratively adapted data structure. Following Gioia et al. [34], we illustrated
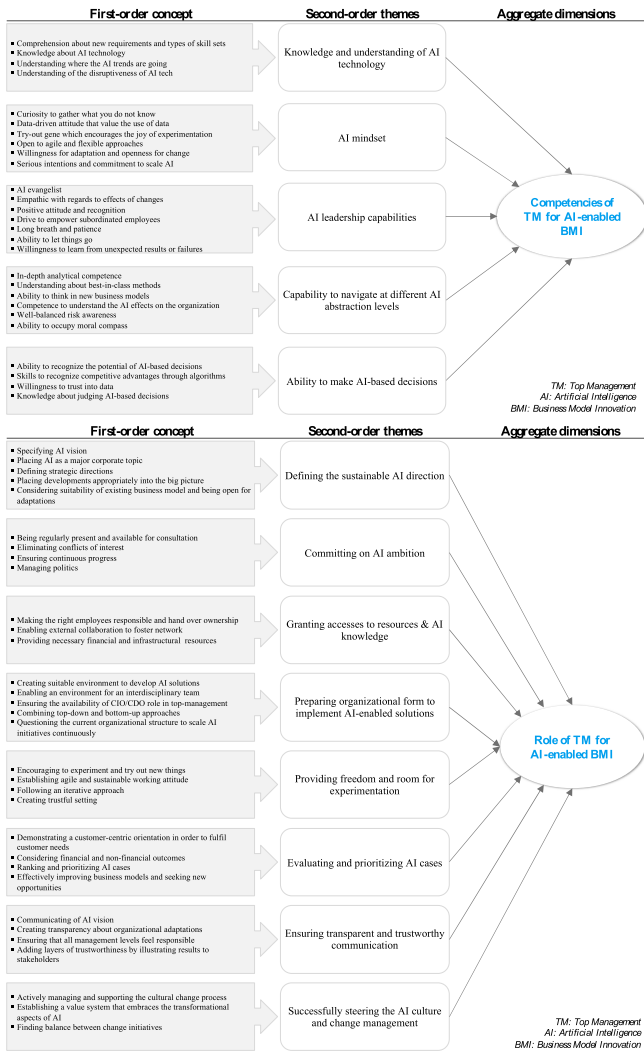
Fig. 1. First-order concepts, second-order themes, and aggregate dimensions for the competencies and roles of TM in AI-enabled BMI.

the overarching dimensions in a data structure for demonstrating rigor in qualitative research [62], [83]. Fig. 1 shows the final data structure. Further details regarding the identified first-order categories, second-order themes, and aggregate dimensions are examined in the following section.

IV. Framing the Roles and Competencies of Top Management

Based on our empirical results, we identified the roles and competencies of TM along two aggregated dimensions for AI-enabled BMI. These dimensions are introduced in the following passages, and our final framework is presented at the end of this section.

A. Competencies of Top Management in Artificial Intelligence-Enabled Business Model Innovation

The aggregate dimensions of AI competencies consist of five second-order themes, which are explained in detail in the following sections.

1) Knowledge and Understanding of Artificial-Intelligence Technology: Knowledge and understanding of AI technology represent the first second-order theme of AI competencies for TM. Our empirical observations revealed that TM must understand the new requirements and skill sets required to utilize AI within an organization successfully. Indeed, TM must show a high willingness and ability to gain profound knowledge about AI technologies. In this context, our interviewees stated that TM does not have to consist of AI experts but must have a basic understanding of AI technologies and their corresponding possibilities and limitations.

> *"Top managers don't have to understand entirely what's going on, and how the algorithms work, and how the machines learn. They don't have to understand all the details." (Interview 39)*

The aforementioned aspects represent the abilities required to understand the direction in which AI trends develop. Our observations indicated that AI is bringing about a profound shift in business, and its effective implementation depends entirely on new competencies developed by TM and all other stakeholders. TM must comprehend the disruptiveness of AI technologies to initiate suitable BMI activities and guarantee a firm's long-term competitiveness.

2) Artificial Intelligence Mindset: Another crucial TM competency highlighted by our interviewees is AI mindset. TM is required to show a high degree of curiosity to begin learning about AI-related topics and processes. In this regard, they must have a flexible mindset, a desire to experiment, and an enthusiasm for gathering data-driven insights. TM must change its mindset and be agile and flexible in its approaches. Furthermore, TM must be willing to adapt and open to change.

> *"All I can think of now is flexibility, openness to new things, and the courage to try something new." (Interview 30)*

Our empirical results showed that the competencies we studied might help TM emphasize its intentions and commitment to scale AI throughout the organization.

3) Artificial Intelligence Leadership Capabilities: Participants assigned great importance to the development of AI-specific leadership capabilities. One AI leadership quality is being an AI evangelist, i.e., an attitude typified by appreciating and sharing a holistic vision of AI. TM must act as AI pioneers and represent an all-encompassing AI mission throughout organizations.

> *"I think you have to be able to anticipate technological developments, even a little bit beyond that." (Interview 37)*

An essential quality of an AI evangelist is the ability to convince important stakeholders within the firm. This also requires a certain level of empathy concerning the effects of changes on specific areas or individuals within the firm. Similarly, TM should have a positive attitude and recognize employees' efforts when implementing AI technologies. In situations where progress is not meeting expectations, TM must adapt quickly and focus on improving its current status while minimizing disappointment among employees. TM must quickly recover

from failures or wrong approaches and continuously learn from them.

> *"I think fault tolerance is definitely an important issue because you're going in a new direction; you're building a new business model." (Interview 43)*

> *"This is totally linked with the overall company culture. If there's a company that does not accept any failures, the employees will hesitate to use new tools, especially those that are unknown to them." (Interview 36)*

> *"You also have to be willing to adapt if the direction doesn't fit." (Interview 35)*

Our results suggest that TM must empower subordinate employees by showing trust, providing responsibilities for decision-making, and handing over the ownership of specific activities. In this context, TM should understand the importance of giving employees an adequate degree of autonomy.

> *"You have to understand that you do not know everything, and you have to know that there is someone in the organization. [...] Having trust in the employees and being aware that you do not have to be the AI expert to implement AI." (Interview 39)*

Most of our interviewees mentioned that patience is another crucial TM competency. Based on the experiences of the AI experts we interviewed, the implementation of AI technologies and considering them for BMI is a long-term process. Therefore, TM must accept that the deployment of AI projects may require more time than conventional projects.

4) Ability to Navigate Artificial Intelligence Abstraction: The ability to navigate different levels of AI abstraction is another vital TM competency. TM must grasp the essentials of AI technologies and their potential in BMI by focusing on the future. The potential of AI technologies must be understood to be in its initial stages. Without concrete expectations concerning financial returns in the near future, TM should expect to focus first on nonfinancial outcomes.

> *"I believe that there is huge potential to recognize things with AI that you might not even focus on in the beginning." (Interview 43)*

> *"At some point, of course, the question of ROI will come up. [...] And top management may lack patience. [...] But I believe that the expectation of ROI in these projects must be different than normal when it comes to artificial intelligence." (Interview 42)*

This process also requires a new type of in-depth analytical competency. Our interviewees stated that analytical skills are essential to overcome the challenge of classifying and prioritizing AI-related issues and decisions appropriately. Furthermore, TM should be familiar with the AI-related activities that best-in-class firms are performing or planning to implement in the future. Some interviewees emphasized that they continuously monitor the AI activities of various firms in Silicon Valley and use these organizations to establish their own benchmarks for success. Our empirical results demonstrate that creating these benchmarks inspires TM and promotes the development of critical TM competencies, such as thinking in new business models, which allows innovation and opens unexplored avenues for novel approaches.

> *"The ideal setup is you need to see what the best-in-class do—the best-in-class are typically the Silicon Valley companies." (Interview 8)*

Another AI abstraction level that TM must be capable of navigating is understanding the effects of AI on organizational structure. The interview results clearly show that, regardless of the areas where AI is utilized for BMI, a new organizational structure with suitable processes is required. Even the roles of employees must be reconsidered, and TM must predefine new methods of collaboration between humans and AI technologies.

> *"In order to make this a real success on a broad scale, it is also necessary to achieve acceptance among employees. [...] In other words, is artificial intelligence my new little helper, and does it make my life easier? Or will it take my job away? And that is the area of tension that actually has to be covered." (Interview 42)*

TM must have well-balanced risk awareness to manage potential pitfalls associated with AI implementation. For instance, AI application could result in employees fearing losing their jobs, or it could damage the manufacturing process. These types of risks must be appropriately assessed by TM, and suitable strategies for overcoming them must be prepared. In this regard, inverted thinking methods might support TM in analyzing risk scenarios in a structured way by reconsidering them backward. Ultimately, TM must be able to represent a moral compass for the organization, ensuring that crucial ethical standards are followed in the context of AI-enabled BMI.

5) Ability to Make Artificial Intelligence-Based Decisions: The final TM competency we identified in our observations is the ability of managers to make AI-based decisions. According to our interviewees, AI-informed decisions are perceived as faster, more well founded, and more reliable than intuitive decisions. Furthermore, complex algorithms can extract invaluable insights from substantial amounts of data that TM would not usually be able to uncover using conventional methods. Recognizing the potential for competitive advantages by relying on such data-based insights is thus a critical skill. This also requires the willingness of TM to trust the underlying data. Our interviewees stated that using AI is always related to making decisions in some way. Hence, if TM does not trust AI-based decisions, then AI-enabled BMI cannot be facilitated.

> *"Management struggles to understand the key mechanisms. It is an abstract technology. [...] It's about understanding the predictive modeling idea, with a training and a test set, [..] that you can take that information and, by using a machine learning model, turn it into new information that is relevant to you." (Interview 25)*

Finally, TM must appropriately judge outcomes resulting from AI algorithms before considering them in ultimate decisions. Our observations indicate that AI is particularly adept at recognizing helpful patterns from data, but prudent decisions should still be based on a final human judgment.

6) Summarizing the Competencies of Top Management in Artificial Intelligence-Enabled Business Model Innovation: In this section, we summarize the main quotes from the interviews concerning TM competencies for AI-enabled BMI, which are listed in Table II.

TABLE II
SUMMARY OF TM COMPETENCIES IN AI-ENABLED BMI

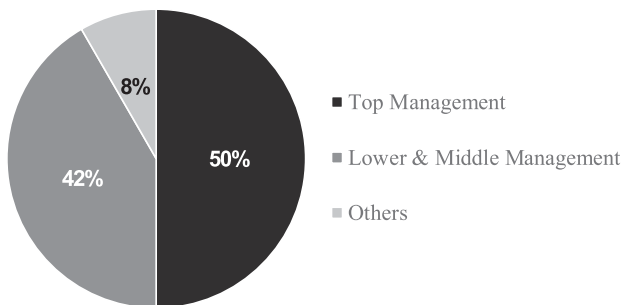| Competencies	Key interviewee quotes	Interview ID
Knowledge and understanding of artificial intelligence technology	*Top managers don't have to understand entirely what's going on, and how the algorithms work, and how the machines learn. They don't have to understand all the details.*	Interview 39
Artificial intelligence mindset	*All I can think of now is flexibility, openness to new things, and the courage to try something new.*	Interview 30
Artificial intelligence leadership capabilities	*I think you have to be able to anticipate technological developments, even a little bit beyond that.*	Interview 37
	I think fault tolerance is definitely an important issue because you're going in a new direction; you're building a new business model.	Interview 43
	This is totally linked with the overall company culture. If there's a company that does not accept any failures, the employees will hesitate to use new tools, especially those that are unknown to them.	Interview 36
	You also have to be willing to adapt if the direction doesn't fit.	Interview 35
	You have to understand that you do not know everything, and you have to know that there is someone in the organization. [...] Having trust in the employees and being aware that you do not have to be the AI expert to implement AI.	Interview 39
Ability to navigate artificial-intelligence abstraction	*I believe that there is huge potential to recognize things with AI that you might not even focus on in the beginning.*	Interview 43
	At some point, of course, the question of ROI will come up. [...] And top management may lack patience. [...] But I believe that the expectation of ROI in these projects must be different than normal when it comes to artificial intelligence	Interview 42
	The ideal setup is you need to see what the best-in-class do—the best-in-class are typically the Silicon Valley companies.	Interview 8
	In order to make this a real success on a broad scale, it is also necessary to achieve acceptance among employees. [...] In other words, is artificial intelligence my new little helper, and does it make my life easier? Or will it take my job away? And that is the area of tension that actually has to be covered.	Interview 42
Ability to make artificial intelligence-based decisions	*Management struggles to understand the key mechanisms. It is an abstract technology. [...] It's about understanding the predictive modeling idea, with a training and a test set, [..] that you can take that information and, by using a machine learning model, turn it into new information that is relevant to you.*	Interview 25

Fig. 2. Breakdown of key quotes by interview categories for TM competencies.

Fig. 2 visualizes the key quotes by interviewee category for TM competencies in AI-enabled BMI. The graph shows that the TM category is the most represented at 50%, followed by the "Lower and Middle Management" category at 42%, and the remaining categories at 8%. In conclusion, the most representative results regarding the competencies of TM in AI-enabled BMI are essentially derived from the different management levels of our sample companies. The other interviewee categories only account for a small proportion of the findings.

B. Roles of Top Management in Artificial Intelligence-Enabled Business Model Innovation

We have identified eight overarching roles of TM to initiate AI-enabled BMI, which are described in the following sections.

1) Defining a Sustainable Artificial Intelligence Direction: Indeed, the initial role of TM is to define an organization's sustainable long-term AI directives. This highly strategic task requires all competencies described in our study. The role involves specifying an AI vision that ensures the long-term success of a company. Furthermore, AI will be effectively applied in an organization only if TM deems it an essential corporate effort. Defining an organization's strategic directions, including the initiation of projects with overall targets and subtargets, will guide the organization toward implementing AI technologies for BMI successfully. TM should foster mutual trust within the organization and inspire continuous progress. As new developments arise, they must be appropriately contextualized to ensure they are consistent with a company's strategic initiatives.

> *"People need to be led, inspired, and passionate about getting somewhere. […] So my role is […] to point the way and make myself available to help people who do not know how to progress towards our shared goals." (Interview 46)*

To achieve this objective, AI-enabled BMI requires TM to rethink the suitability of existing business models. Quite often, the existing channels, customer relationships, and building blocks of a business model do not allow for AI-enabled solutions to be implemented suitably, nor do they allow TM to challenge these structures.

> *"Making sure we have the right people, asking the right questions, framing the problem statements, and then applying the technology that we build, making sure there are feedback loops on communication. And then we have been growing as an organization […] It is now about how to go to market and commercialization—how to capture that value." (Interview 47)*

2) Committing to Artificial Intelligence Ambitions: Another TM role in promoting AI-enabled BMI is a continuous commitment to AI-related ambitions. Our empirical observations show that TM must be regularly present for consultation purposes to foster effective collaboration. The disruptive potential of AI will raise many conflicts of interest in an organization due to shifts in power structures, workflows, and responsibilities. TM must eliminate these conflicts by negotiating appropriately, setting firm boundaries, eliminating obstacles, building alliances (especially between managers), and assigning recognition and reward to all participants to promote the organization's shared vision.

> *"You need top management that stands behind you and says, we need this, and I want to afford this." (Interview 20)*

Moreover, TM is responsible for ensuring the continuous progress of AI initiatives by motivating employees and coordinating and monitoring their intermediate goals.

3) Granting Access to Resources and Artificial Intelligence Knowledge: AI-enabled BMI can only occur when TM provides access to resources and AI knowledge. In concrete terms, this means making the right employees responsible and handing

over ownership. Many interviewees stated that it is crucial to create diverse and interdisciplinary teams to effectively counter algorithmic biases. However, this is a highly complex task, as it requires a thorough understanding of new requirements to hire, retain, and develop high-potential employees with the right skill sets.

"It is about providing the company with the appropriate expertise. That means I need developers. I need data scientists. I need people to apply and develop it." (Interview 24)

Furthermore, TM must release employees from other activities to balance their workloads. This effort can ensure that the company remains attractive to employees. Knowledge of AI is a precious asset. Therefore, TM must enable external collaboration to enlarge a company's network. It is vital to connect with the right people at the right time. In addition, quick access to knowledge can also be gained from AI advisors, partners, and other institutions such as universities. For TM, it is essential to interact with experts in AI implementation, learn from them, and recombine patterns.

"Ensure that they team up with someone who has really learned how to do it or seek advice from someone who is really an expert in implementing AI solutions." (Interview 21)

An essential complementary task of TM is to provide the organization with the necessary financial and infrastructural resources. It is worth noting that the funding aspect of AI initiatives may be quite different from that of traditional software implementation. For AI initiatives, there is a much higher degree of underlying uncertainty, especially concerning evaluating data availability and the required processing structure.

4) Preparing Organizations to Implement Artificial Intelligence-Enabled Solutions: Another critical task of TM is to prepare the organization to implement AI-enabled solutions, e.g., by creating an AI lab. A company will develop and scale solutions only if a suitable environment allows these attempts. Most organizations have inappropriate decision-making hierarchies and excessively complex structures to launch AI-based solutions. Therefore, interdisciplinary teams will be successful only if they can operate independently of the needs and pressures of the core organization.

"When you see a significant discovery or invention, you need to think about how to scale it to the entire organization. When it comes to AI and machine learning, you need to have your strategy, and it could be to have a lighthouse strategy, digital twins, incubation, or a moon-shot laboratory—and it depends, and there are different purposes for that." (Interview 23)

Continuously questioning organizational structure to scale AI initiatives is another vital function of TM. To steer and continue these attempts, the availability of both a chief information officer and a chief digital officer will be required. There are two strategies to staff these positions. First, the roles may be filled by trusted individuals within the organization, whose opinions are valued and who hold strong commitments. Second, the roles may be filled by external specialists who join the organization equipped with innovative ideas related to the planned AI initiatives.

"It depends on the company; some of them are more needs-driven […] and others are more strategy driven […] and, in order to achieve that, we need a department or teams that do that—the approach depends on whether it is top-down or bottom-up." (Interview 17)

5) Providing Freedom and Room for Experimentation: AI-enabled BMI requires freedom for experimentation, and TM must ensure flexibility in this regard. Allowing an iterative and agile approach and a tolerance for inevitable failures ensures a sustainable development process and a trusting environment.

"It is important not to misjudge that the direction is clear, and that it is a paradigm shift, and the goal is clear—just get there via experimentation. Also, to bring my organization along at all." (Interview 14)

"Do I need to connect different systems to align the data? That requires you to do more frequent changes to your systems or to your business process to make AI successful." (Interview 15)

6) Evaluating and Prioritizing Artificial Intelligence Cases: Evaluating and prioritizing AI use cases is another TM function for AI-enabled BMI. This role requires a distinctly customer-centric orientation to fulfill customers' needs. Many interviewees expressed that implementing AI solutions is not a self-fulfilling purpose. The main objective is to reveal the AI's value to the customers and the business model by finding and prioritizing appropriate corner cases. Only then will current or future customers be eager to pay for the offered value proposition.

"Especially in the areas of top-management and innovation, it is important that these people know their users and know what their needs are and then think about how solutions could look." (Interview 10)

Furthermore, this role requires fully understanding both financial and nonfinical outcomes, such as ethical, moral, and legal concerns, as well as effects on trust and strategic fit. TM must understand these outcomes and aspects at various levels to be well equipped to rank and prioritize AI cases accordingly. These cases must be preassessed by experts according to their complexity. The role of TM is to prioritize effectively, approving and rejecting initiatives with a balance of innovation and risk aversion.

"AI is a buzzword that unfortunately is not deeply understood, and the new challenge for top managers is to better classify, better assess, and thereby better prioritize." (Interview 14)

Finally, the effects of AI on the business model must be assessed. TM must question existing procedures and approaches and dare to challenge the existing building blocks of the business model.

7) Ensuring Transparent and Trustworthy Communication: The nature of AI itself is enigmatic. Thus, ensuring transparent communication from leadership is essential. This begins with clear and open communication of the AI vision. Furthermore, organizational adaptations implied by the disruptive changes in processes and workflows must be communicated with transparency. Moreover, it is essential to ensure that all levels of management understand their responsibility for progressing toward shared goals. This can be achieved only by adding layers

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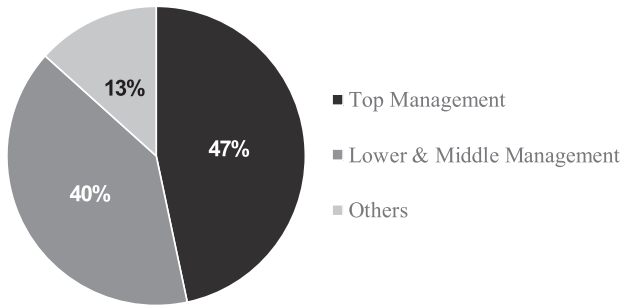
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Fig. 3. Breakdown of key quotes by interview categories for TM roles.

of trustworthiness, exemplified by TM. Providing a comprehensible illustration of initial results to stakeholders is an effective means of promoting change within an organization.

"Are we able to articulate what we are trying to do, how we think about roles and responsibilities in a way that obviously resonates with the people we try to bring on board?" (Interview 26)

8) Successfully Steering Artificial Intelligence Culture and Change Management:

"AI is transformational technology […]. At its core, it is a technology that changes the way you think and the way you operate. You cannot start to use transformational technology if you do not transform yourself first, or if you take it as a side hustle." (Interview 8)

As exemplified in the above statement, the role of TM is to steer the organization's AI culture and manage change effectively. The process of cultural change requires active management to foster a corporate culture that allows failures and an environment that encourages knowledge sharing. Furthermore, the transformational aspect of AI must be established as a critical part of the organization's value system, and the resulting changes must be closely aligned with the company's mission. However, change can occur only if every employee understands and internalizes this value system. According to our empirical findings, excessive change initiatives may overwhelm an organization. Therefore, TM is responsible for striking the right balance of prioritized changes.

"The CEO left after three to four months because the nature of the transformation was too fast, too drastic for many lower managers […]. It is an incredibly complex interplay." (Interview 9)

"Change is often viewed in three areas: processes, people, and technology. […] If you see AI as a technology problem, I don't think you fully understand what it's about. I would rather say that it has to do with people. […] It requires you to think in a different way, and that has a lot to do with processes, and culture, and a general willingness to question yourself." (Interview 1)

9) Summarizing the Roles of Top Management in Artificial Intelligence-Enabled Business Model Innovation: This section of the article summarizes the key quotes from the interviewees regarding TM roles in AI-enabled BMI. Table III lists all TM roles identified and compares key quotes from the interviews conducted.

Fig. 3 shows the breakdown of key quotes on TM roles by interviewee categories. Comparable to the results for the competencies in AI-enabled BMI, the respondent category of

TABLE III
SUMMARY OF THE TM ROLES IN AI-ENABLED BMI

Roles	Key interviewee quotes	Interview ID
Defining the sustainable artificial intelligence direction	*People need to be led, inspired, and passionate about getting somewhere. [...] So my role is [...] to point the way and make myself available to help people who do not know how to progress towards our shared goals.*	Interview 46
	Making sure we have the right people, asking the right questions, framing the problem statements, and then applying the technology that we build, making sure there are feedback loops on communication. And then we have been growing as an organization [...] It is now about how to go to market and commercialization—how to capture that value.	Interview 47
Committing to artificial intelligence ambitions	*You need top management that stands behind you and says, we need this, and I want to afford this.*	Interview 20
Granting access to resources and artificial intelligence knowledge	*It is about providing the company with the appropriate expertise. That means I need developers. I need data scientists. I need people to apply and develop it.*	Interview 24
	Ensure that they team up with someone who has really learned how to do it or seek advice from someone who is really an expert in implementing AI solutions.	Interview 21
Preparing organizational form to implement artificial intelligence enabled solutions	*When you see a significant discovery or invention, you need to think about how to scale it to the entire organization. When it comes to AI and machine learning, you need to have your strategy, and it could be to have a lighthouse strategy, digital twins, incubation, or a moon-shot laboratory—and it depends, and there are different purposes for that.*	Interview 23
	It depends on the company; some of them are more needs-driven [...] and others are more strategy driven [...] and, in order to achieve that, we need a department or teams that do that—the approach depends on whether it is top-down or bottom-up.	Interview 17
Providing freedom and room for experimentation	*It is important not to misjudge that the direction is clear, and that it is a paradigm shift, and the goal is clear—just get there via experimentation. Also, to bring my organization along at all.*	Interview 14
	Do I need to connect different systems to align the data? That requires you to do more frequent changes to your systems or to your business process to make AI successful.	Interview 15
Evaluating and prioritizing artificial intelligence cases	*Especially in the areas of top-management and innovation, it is important that these people know their users and know what their needs are and then think about how solutions could look.*	Interview 10
	AI is a buzzword that unfortunately is not deeply understood, and the new challenge for top managers is to better classify, better assess, and thereby better prioritize.	Interview 14
Ensuring transparent and trustworthy communication	*Are we able to articulate what we are trying to do, how we think about roles and responsibilities in a way that obviously resonates with the people we try to bring on board?*	Interview 26
Steering the artificial intelligence culture and change management	*AI is transformational technology [...]. At its core, it is a technology that changes the way you think and the way you operate. You cannot start to use transformational technology if you do not transform yourself first, or if you take it as a side hustle.*	Interview 8
	The CEO left after three to four months because the nature of the transformation was too fast, too drastic for many lower managers [...]. It is an incredibly complex interplay.	Interview 9
	Change is often viewed in three areas: processes, people, and technology. [...] If you see AI as a technology problem, I don't think you fully understand what it's about. I would rather say that it has to do with people. [...] It requires you to think in a different way, and that has a lot to do with processes, and culture, and a general willingness to question yourself.	Interview 1

TM is also most strongly represented here at 47%, followed by the "Lower and Middle Management" category at 40%, and then the remaining respondent categories at 13%. Thus, it can be concluded that, in this case, the most representative results of our research regarding the role of TM in AI-enabled BMI were essentially derived from the different management levels of our sample companies.
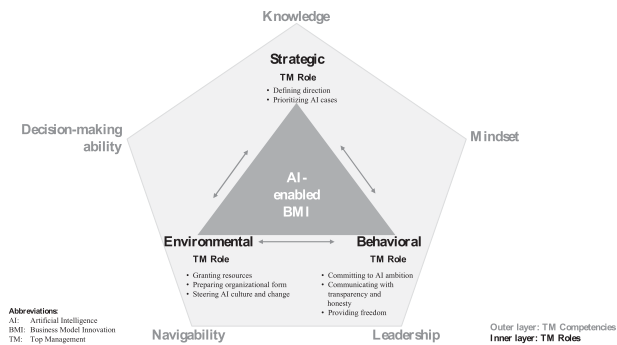
Fig. 4. Model of TM competencies (outer layer) and roles (inner layer) in AI-enabled BMI.

C. Bringing it All Together

To enhance the academic discussion and answer the research question ("How can TM encourage and facilitate AI-enabled BMI?"), it is important to identify emerging concepts from our empirically collected data, explain their relationships, and ensure their interrelationships transparent. For this reason, we derived a new model based on the extracted interview data. This helped to discover the required competencies and roles as well as their interrelationships when aiming for AI-enabled BMI.

As observed, a distinction is made between roles and competencies, which is consistent with other researchers (e.g., Trenerry et al. [84] and Imran et al. [43]). By initially connecting individual concepts and drawing the interrelations to form a dynamic picture in an interactive process, it is evident that a combination of different competencies leads to a specific TM role. Hence, the bundling of multiple competencies is a prerequisite for fulfilling individual roles. In-depth analysis revealed three additional emerging concepts within the TM roles that influence and relate to each other. In particular, TM roles in AI-enabled BMI can be divided into strategic, behavioral, and environmental roles. An overview regarding the allocation of second-order themes to the three categories is illustrated as follows.

1) TM strategic roles include defining the organization's sustainable AI directives, as well as evaluating and prioritizing AI use cases.
2) TM behavioral roles include committing to AI ambition, providing freedom and room for experimentation, and ensuring transparent and trustworthy communication.
3) TM environmental roles include granting access to resources and AI knowledge, preparing organizations to implement AI-enabled solutions, and successfully steering AI culture and change management.

Combining all previously explained elements, Fig. 4 presents our final model of TM competencies and roles in AI-enabled BMI.

The competencies of TM represent the outer layer of our model and are the core prerequisites that TM needs to successfully innovate business models with AI technologies. The inner layer of the model highlights TM roles (including three subcategories) in AI-based BMI and is strongly rooted in the core competencies that we have specified. In other words, the roles of TM can be executed appropriately only when TM possesses the required competencies. As indicated earlier in this section, there is no clear one-to-one relationship between the respective competencies and roles. Rather, it is a complex intertwined model in which different combinations of competencies lead to separate roles. Moreover, the respective competencies and roles have a multidimensional interrelationship with one another.

V. CONCLUSION: IMPLICATIONS FOR THEORY AND MANAGEMENT

A. Theoretical Contributions

This article discloses essential academic contributions to the literature on AI-enabled BMI as well as TM competencies and roles by implementing grounded theory. Our research is underlined by the dynamic capabilities view, which includes the identification of business opportunities ("sensing"), the mobilization of internal and external resources ("seizing"), and the implementation of change ("transforming"), as demonstrated in our research process [81]. These theoretical aspects must be augmented by further research, especially on the subjects of differences among TM roles and competencies for digital transformation in general and AI-enabled BMI in particular; therefore, we further add to contributions made by Helo and Hao [38], Matsunaga [55], and Trenerry et al. [84]. Without the identified competencies and roles summarized in Fig. 4, attributes such as "sensing" may lead to deceptive business opportunities (e.g., if TM lacks AI knowledge, it may be difficult to rank and prioritize AI initiatives successfully). Furthermore, mobilized resources may be guided in inefficient directions (e.g., if TM is unable to navigate AI on different levels). Neglecting our proposed framework would hinder a sustainable change in culture (e.g., if TM has a narrow perspective, this would prevent the organization from sustainable AI development).

We also expanded upon the academic discussion related to TM and AI-enabled BMI. Garbuio and Lin [33] emphasized the importance of the composition of TM teams, particularly with regard to funding concerns. Our research contributes to these findings by highlighting the essential competencies required in TM teams, such as AI leadership capabilities, knowledge and understanding of AI, and decision-making abilities. Therefore, TM teams are able to fulfill their corresponding role of evaluating and prioritizing AI cases, providing access to resources, and preparing the organizational structure.

Narayan et al. [59], Rodríguez-Espíndola et al. [70], and Volberda et al. [87] emphasized the commitment and support of TM teams when introducing AI technologies. We underscored these findings by identifying the AI mindset as a necessary competence for TM teams to commit to AI ambitions in their roles. Finally, Volberda et al. [87] and Narayan et al. [59] articulated the importance of cognitive diversity in TM teams. Our findings further extend this observation by highlighting the significance of AI leadership skills in steering the AI culture with transparent and open communication.

According to Brem et al. [14] and Dwivedi et al. [28], generative AI is a recent example of how AI drives the innovation of the product and service portfolios of firms. Our research builds upon this phenomenon and contributes to an understanding of

the prerequisites for suitable utilization of generative AI for BMI by identifying the elementary competencies and roles required for successful implementation.

Therefore, the presented framework (see Fig. 4) narrows the gap in the literature, addresses the proposed research question ("How can TM encourage and facilitate AI-enabled BMI?"), and thus plays a vital role in guiding the management of AI-enabled BMI. Furthermore, it makes a crucial contribution to the theory and will help future researchers build upon findings to position themselves and to further drive academic discussion.

B. Managerial Contributions

The roles and competencies of managers are expected to change in the future with regard to the successful implementation of AI-enabled BMI. Other researchers, such as Lee et al. [52] and Mishra and Tripathi [56], have formed the same conclusion. Although AI will not replace managers completely, it may force firms to replace managers who do not understand how to use AI for BMI. Thus, it is crucial for TM to prepare for future challenges and actively explore new opportunities to ensure companies are successful in the long term.

The presented framework highlights the necessary roles, e.g., knowledge, mindset, leadership, navigability, and decision-making ability, which are promising skill sets for successfully implementing AI-enabled BMI. TM teams can use this information to conduct self-assessments and identify potential gaps in their personal skill sets and address them.

The strategic, behavioral, and environmental roles, along with their subroles, outlined in the framework can guide TM teams to not lose track of the most important tasks in AI-enabled BMI and to make informed decisions.

Overall, TM must be conscious of the potential of AI to disrupt business models and create new chances for value creation. However, TM must also be mindful of the associated challenges, such as the need for new competencies and the potential impact on business operations, employees, culture, and organizational structure. By utilizing the framework and understanding the necessary roles and competencies, TM teams can lead their organizations toward the successful implementation of AI-enabled BMI in a way that is consistent with the interests of the company and its stakeholders.

C. Future Research Avenues and Limitations

Our findings emphasize the existence of wide-ranging industry differences concerning the relevance and importance of AI-enabled BMI. Some industries, such as manufacturing and pharmaceutical development, reveal that failure to implement AI-enabled solutions places firms at a competitive disadvantage in recent AI development. However, most companies do not focus entirely on redesigning their business model; instead, they make incremental changes. Future researchers may elaborate on industry-specific needs and their effects on the roles and competencies of TM.

To build upon our study, future research could test the framework for different organizational types (such as large companies, small- and medium-sized enterprises, and startups) to examine

commonalities, differences, and managerial implications. Moreover, additional stakeholders, such as policymakers, could be investigated. In this context, it can be assumed that trustworthy AI could play a vital role, as well as the effects on society, legal and ethical concerns, and regulatory and security issues.

Interviewees stated that they recognize ongoing trends in AI and adjacent fields, such as no-code, deep learning frameworks, and the combination of AI solutions with quantum AI. Another potential research avenue is the analysis of these trends and the robustness or extension of the introduced framework. Complementary research may include conducting quantitative studies to measure the correlations and the effects of TM competencies on the various roles described in our framework (see Fig. 4).

Our initial study was limited in some respects. A larger sample of interviewees may reveal new considerations not covered by our current framework. Another limiting factor of the current study is its agnosticism toward company size and industry specifics. Segmenting respondents by company and industry is a possibility for future research.

VI. SUMMARY: CALL FOR A NEW ROLE OF MANAGEMENT WITH NEW COMPETENCIES

Previous research failed to focus on TM competencies concerning AI-related BMI. We addressed this research gap by making this the focus of our study. In our empirical research, we uncovered valuable insights from interviewees that constitute a significant contribution to this field of research. We have determined that unique TM competencies are required to fulfill emerging needs in the industry. Thus, we presented a novel framework categorized into five competencies and eight roles, which we have clustered into the three categories of strategic, behavioral, and environmental roles required to successfully manage AI-enabled BMI.

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