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Centre for the
Fourth Industrial
Revolution

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Empowering Small and Medium-Sized Enterprises through Digital Business Model Innovation

WHITE PAPER

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Foreword



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Countries around the world are continuously investing to stimulate innovation in manufacturing and supply chains to drive productivity, competitiveness and sustainability, thereby facilitating economic and societal growth. In 2023, Brazil launched its policy for neo-industrialization – guided by six missions, such as the digital transformation of the industry to increase productivity – to help its industry move beyond the domestic market and reinstate its relevance in the global economy.¹

With megatrends such as geopolitical tensions, emerging technologies and climate change altering the business environment and consumer needs, manufacturing companies, particularly small- and medium-sized enterprises (SMEs), are under pressure to modernize and reposition themselves. For many years, leading manufacturers have been investing in their digital transformation journey to unlock value from data and Fourth Industrial Revolution technologies. However, financial and business constraints have made investments in this journey challenging for SMEs.²

Digital business model innovation – which combines digital transformation with the reinvention of a business model to address new markets, products and services – can help unlock efficiency and revenue streams. This creates new opportunities for manufacturers, particularly SMEs, to transition from survival to sustained growth, competitiveness and longevity.

This white paper is an output of the partnership between the World Economic Forum's Centre for Advanced Manufacturing and Supply Chains and the Centre for the Fourth Industrial Revolution affiliate in Brazil. It describes the opportunity from and pathway to digital business model innovation, highlights the most common barriers that can be encountered on this journey and presents an example of a step-by-step process to rethink and innovate business models through new technologies. We trust this work will help manufacturing and supply chain companies of all sizes in countries such as Brazil rethink their business models to unlock new value and modernize their production systems.

Executive summary

Digital transformation and business model innovation present an opportunity for industrial companies to develop new levels of competitiveness and access global supply chains.

The global manufacturing sector is undergoing significant transformations driven by geopolitical tensions, emerging technologies and the sustainability imperative. These factors are fundamentally changing the business environment, altering consumer habits and presenting new challenges to global value chains. In response, leading manufacturers are re-evaluating their global value chain configurations and business models from bottom-up and end-to-end perspectives.

This redesign is shaped by five key trends described in the World Economic Forum white paper on [A Global Rewiring: Redefining Global Value Chains for the Future](#), including a shift towards multi-local value chains and a focus on customer value rather than cost efficiency. As manufacturing leaders reshape their value chains, increasing investment in multi-local supply chains, countries like Brazil are enhancing their competitiveness by prioritizing digitalization and decarbonization of the industrial sector.

Emerging technologies offer opportunities for manufacturing companies to not only improve efficiency and achieve sustainability goals but also to innovate business models and create new revenue streams, enabling economic and societal growth. By embracing digital business model innovation – which combines digital transformation with the reinvention of a business model – to explore new products and services, markets and segments, industrial companies can reinvent their business and position themselves for long-term success in an evolving global manufacturing landscape.

Brazil's manufacturing sector, including small- and medium-sized enterprises (SMEs), stands to benefit significantly from embracing digital business models

to enhance its positioning both domestically and internationally. However, challenges persist in technology adoption and business model evolution, especially among SMEs. The path to digital business model innovation in manufacturing requires investments, careful planning and consideration of factors such as organizational culture shifts, skill development, operational changes and technology testing. A structured approach involving multistakeholder perspectives, including supply chain participants, funding organizations and the government, is crucial for guiding companies, especially SMEs, through the complexities of digital business model innovation.

Building on the World Economic Forum's global approach and the January 2022 white paper *Unlocking Business Model Innovation through Advanced Manufacturing*, this white paper is an output of the partnership between the Forum's Centre for Advanced Manufacturing and Supply Chains and the Centre for the Fourth Industrial Revolution Brazil. It aims to shed light on how to best empower SMEs through digital business model innovation, using Brazil as a reference country. It outlines the opportunity from and pathway to digital business model innovation, highlights the common barriers encountered. The report also presents a step-by-step process to successfully rethink and innovate business models through new technologies, thereby unlocking new value and fostering economic and societal growth.

The insights and lessons gathered will serve as a reference for manufacturing companies, including SMEs, to guide decision-makers in facilitating the adoption of innovative business models through the digitalization of industrial operations.

Introduction

Intensifying global value chain disruptions present an opportunity for countries to reconfigure and modernize their manufacturing sectors.

Several headwinds, such as geopolitical tensions, changes in consumer habits, inflation, availability of inputs for production, lack of talent, climate change and the energy transition, have put further strain on global value chains.

These factors and resulting performance challenges are fundamentally transforming the business environment, requiring manufacturing leaders to go beyond operations, productivity and efficiency improvements to remain competitive. The most

forward-looking organizations have been re-evaluating their global value chains and operating and business models to adopt a more innovative, sustainable and inclusive approach to value creation that benefits customers, workers, society and the environment.

According to the 2023 World Economic Forum white paper [A Global Rewiring: Redefining Global Value Chains for the Future](#), the shifts in global value chain configurations are dominated by five main trends, summarized in Table 1.

TABLE 1 Trends towards reconfiguring global value chains

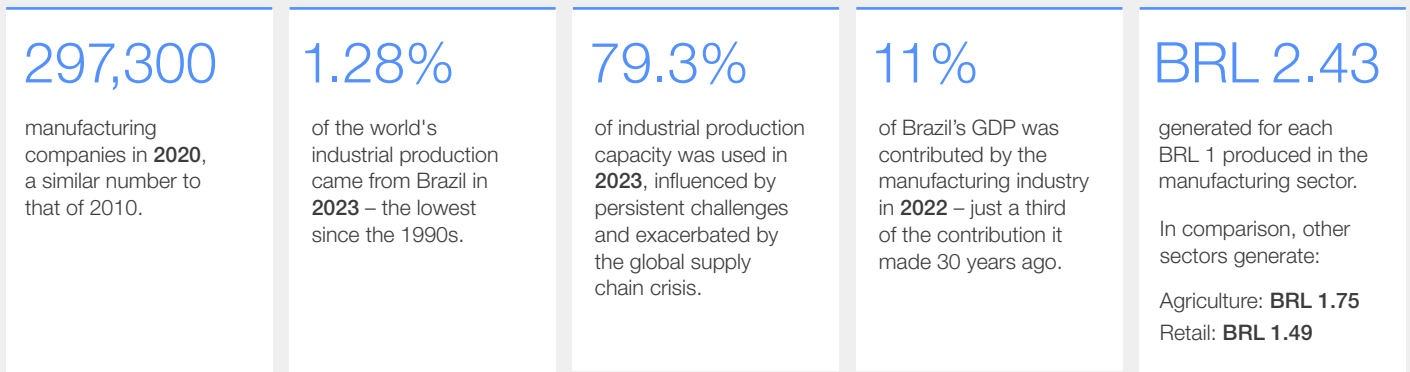
Trend	Description
From global to globally connected multi-local value chains	Global value chains are moving towards multiple globally connected but highly localized value chains – relying on more local suppliers and customers.
From “doing” digital to “being” digital across end-to-end operations	With the decentralization of production and the reshaping of value chains, automation and advanced analytics will become second nature, helping control inflationary pressure, increase visibility and agility, and reduce labour costs.
From economies of scale to economies of skill	In this context, economies of scale based on cost reduction will be more difficult to achieve, requiring organizations to identify additional ways to gain competitive advantage. A key differentiator will be economies of skill, as new technologies require workforce upskilling and new talent to join the sector.
From regulatory compliance to innovative sustainability	Supply chain leaders are moving away from merely complying with legal and regulatory requirements to ingraining sustainability at the core of their end-to-end operations.
From cost-driven to customer-value-driven	Customers seek innovative products and services associated with greater transparency and sustainability. As a result, value chains will encounter trade-off decisions between cost, performance, resilience and sustainability.

Source: World Economic Forum. (2023). *A Global Rewiring: Redefining Global Value Chains for the Future*.

Across the world, adapting to the new trends impacting manufacturing and value chains is critical to economic and societal prosperity. As manufacturing leaders reshape their value chains, increasing investment in multi-local supply chains, different countries have the potential to reinforce their position as manufacturing world leaders or establish themselves as new manufacturing hubs. Major economies are already strengthening their domestic production ecosystems and industrial policies to build resilience and attract investment while maintaining critical roles within a global economy.

While the manufacturing sector generates higher value compared to other sectors, such as agriculture and retail, the Brazilian manufacturing sector, especially small- and medium-sized enterprises (SMEs), is still in the early stages of adopting technology and evolving business models. This resulted in a stagnating number of manufacturing companies from 2010 to 2020. Additionally, the sector’s share of gross domestic product (GDP) fell by a third in 30 years to 11% in 2022.^{3,4,5,6}

FIGURE 1 | Brazil's manufacturing sector in key numbers



Note: BRL = Brazilian real

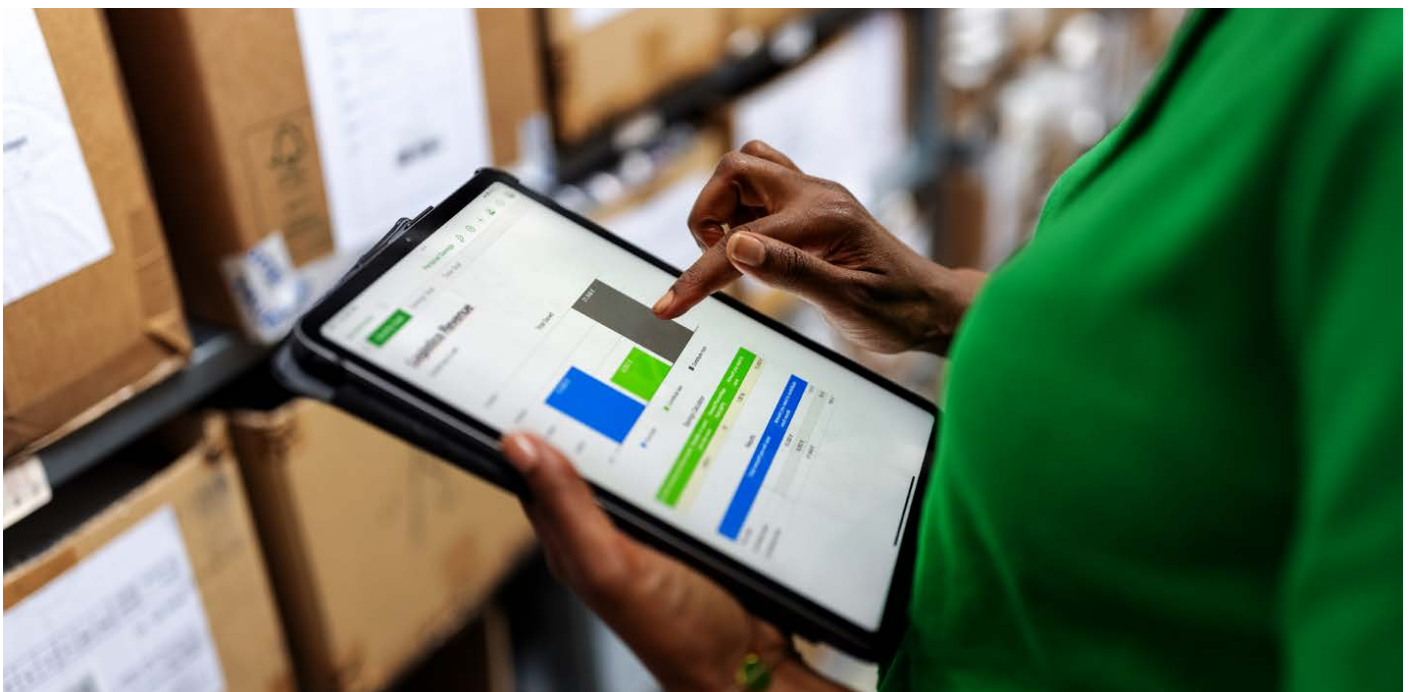
Source: Brazilian National Confederation of Industry (CNI), Brazilian Institute of Geography and Statistics (IBGE), Fundação Getulio Vargas (FVG).

The role of countries like Brazil in the global manufacturing sphere relies heavily on their ability to harness technology to lead modern, innovative production systems and transition to higher-value-added offerings. In fact, Brazil is actively advancing its neo-industrialization agenda, with a notable emphasis on digitalization and decarbonization initiatives to drive productivity and global competitiveness. Concerted efforts are directed towards rejuvenating SMEs, acknowledging their significant contributions to overall employment and industrial output.

Such geographical shifts in value chain design, novel technology trends, and strengthened domestic industrial agendas also create new opportunities for local companies of all sizes to undertake a transformative journey and access new markets globally. Leading manufacturers globally are progressing beyond the initial stages of digital transformation, using technology to enhance

operational efficiency and drive innovative changes in their business models. The journey to digital business model innovation involves venturing into new products, services, markets and segments to bolster agility, develop novel revenue models and attain a competitive edge in accessing global supply chains.

Despite these trends and potential, many manufacturers, especially SMEs, still face barriers to fully harnessing technologies to transform and innovate their business models. To address this, the Brazil Centre for the Fourth Industrial Revolution and the World Economic Forum's Centre for Advanced Manufacturing and Supply Chain collaborated closely to build on the insights from the World Economic Forum's global approach and the *Unlocking Business Model Innovation through Advanced Manufacturing* white paper. The teams consulted with manufacturing experts to identify best practice strategies, lessons learned and pathways to digital business model innovation.



1

Digital business model innovation in manufacturing

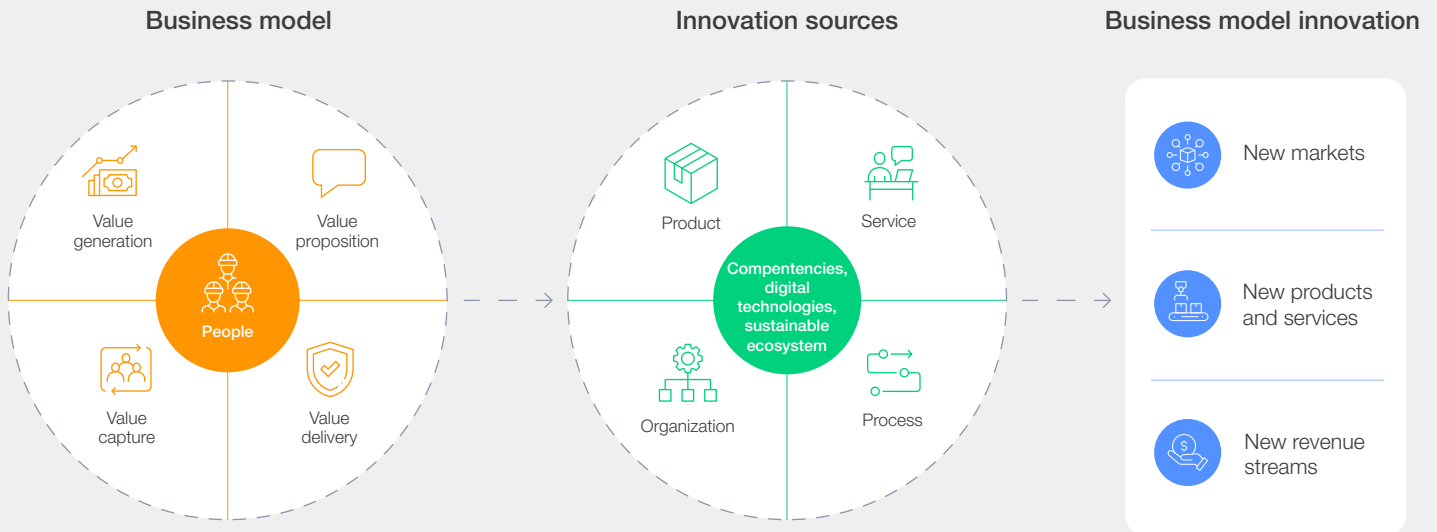
Manufacturers can ensure continuity and growth by redesigning their business models and adopting new trends and technologies.

Digital transformation exposes the entire organization to technologies that enhance efficiency, productivity and sustainability, including leadership, middle management and operations. It also extends the use of data for control and decision-making, which helps to empower firms to innovate incrementally and radically.

Digital business model innovation builds on the positive effects of digitalization; beyond efficiency improvements, companies can explore new products and services, markets, and segments and internationalize operations. Figure 2 describes a simplified representation of various sources that

can drive business model innovation: any or all the five elements comprising a business model (value proposition, value generation, value delivery, value capture and people) are subjected to evolve. These changes are fuelled by competencies development, digital technologies adoption and ecosystem development, all aligned with the new sustainability paradigm. They may also originate from traditional innovation sources such as products, services, processes and organizations. Combined, these sources can help reinvent business models – exploring new markets, creating a new portfolio of products and services, and enabling new revenue streams.

FIGURE 2 The innovation sources driving the evolution of the business model



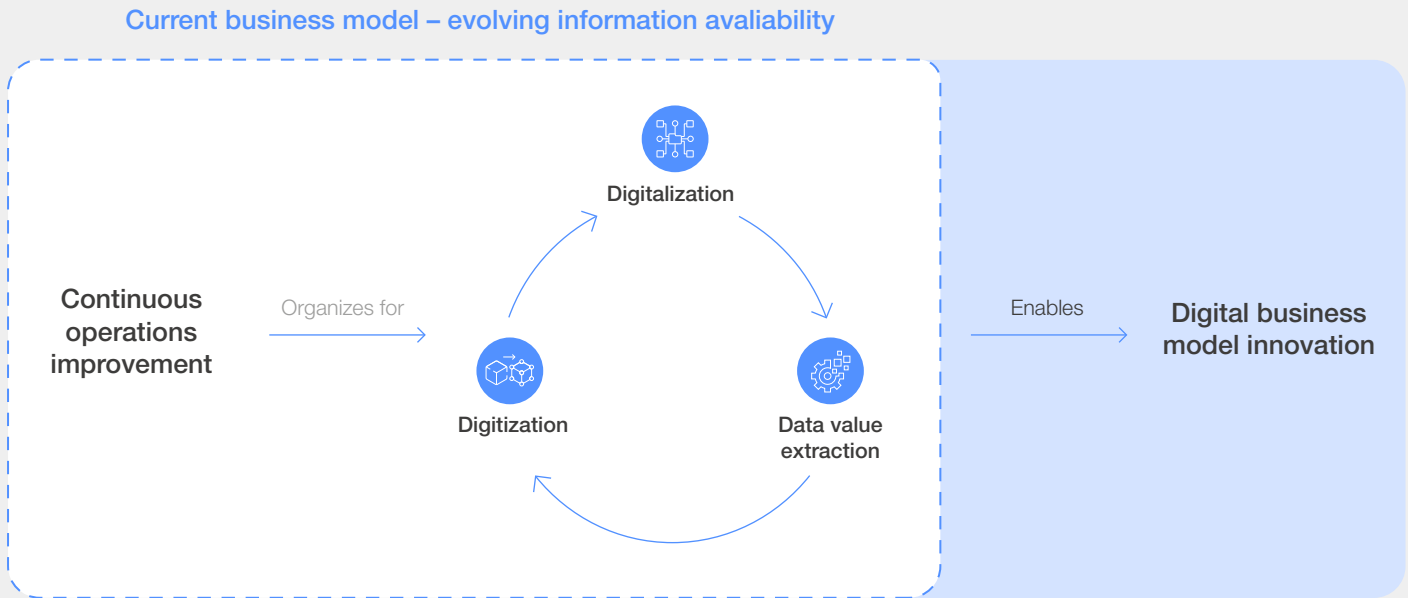
Long-term competitiveness, with revenue growth and better margins, requires a deeper analysis of the business and the identification of opportunities for incremental improvements. This preparation sets the stage for a cycle of continuous evolution. In this cycle, organizational transformation is supported by the adoption of technologies that align with business objectives.

As digital technology becomes second nature for manufacturers, expert systems support activities at all levels of the organization, and decisions are increasingly being made based on data. Furthermore, technologies are embedded in products and services, providing new levels of reliability and functionality and reshaping the relationship between customer and supplier.

Continued computerization, systems integration and data standardization facilitate the maturation of the organization's culture towards the daily and efficient use of information systems. Dashboards and reports summarize data, consolidate it and enable comprehensive reading across the company.

Therefore, innovating on a digital business model requires that a process – enabled by data – takes shape in the organization, from continuous operations improvement to digitization, digitalization and data value extraction to, ultimately, digital business model innovation (see Figure 3).⁷

FIGURE 3 From continuous improvement to digitalization to digital business model innovation



Source: Adapted from: Bican, P.M. & A. Brem. (2020). Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is There A Sustainable "Digital"? *Sustainability*, vol. 12, no. 13, pp. 5239. <https://doi.org/10.3390/su12135239>.

Continuous operations improvement

Continuous operations improvement involves organizing processes, optimizing resources, avoiding waste and eliminating unnecessary activities. This takes the organization to a new level of quality, agility and profitability.

Digitization

Digitization promotes the collection and storage of data digitally, eliminating paper, making room for the demand for information systems and improving the effectiveness of controls. Technologies such as the internet of things (IoT), connectivity and cloud computing allow the expansion of the scope of data collection and storage, covering points such as the operational status of equipment and the pace of production.

Digitalization

At this stage, the focus is to enable the flow of data between the various information systems in operation, allowing other areas of the company to have access to information to carry out their functions in a more agile and efficient manner. The relationship between data sources, such as financial, production and maintenance, expands the ability to interpret the company's current situation and plan actions.

The knowledge obtained from the continuous adoption of technologies enables the company to better interact with its customers, partners and suppliers, expanding the channels for delivering value, interaction and collaboration. Innovation actions are facilitated and gain a new dynamic, enabling the organization to manage the use of resources better.

Data value extraction

Data manipulation and storage technologies such as big data, cloud computing, machine learning and artificial intelligence (AI) enable capabilities such as pattern identification and prediction, which drive the company to become even more efficient and productive.

As expertise in technologies and their potential applications grows, organizations can reap the benefits and witness enhanced business performance as well as mature their culture to adapt and operate in a data-centric paradigm.

This evolutionary path sets the stage for digital business model innovation for manufacturing companies, using their skills, capabilities and ecosystem to create more sophisticated products and services, access global markets and generate new revenue sources.

“ This evolutionary path sets the stage for digital business model innovation for manufacturing companies, enabling them to access global markets and generate new revenue sources.

2

Most common challenges to business model innovation

Several challenges hinder business model innovation.

Applying digital technologies and innovating the business model is a multifaceted task. Beyond investments in new technologies, careful planning and consideration of factors such as organizational culture shifts and skilling, as well as the involvement of the entire organization across several departments, are needed. As such, in the search for the path to digital business model innovation, companies face

many challenges, some internal to the organization and others external. Understanding these roadblocks opens a new path to think through and derive proper solutions.

Table 2 summarizes these challenges based on interviews with industrial companies, government entities, academia and industry associations and a vast analysis of academic articles.

TABLE 2 Challenges faced by companies when innovating business models

Category	Challenge
Strategy	<ul style="list-style-type: none"> - Lack of clear strategy and roadmap - New business paradigm with multi-faced environmental considerations
Market readiness	<ul style="list-style-type: none"> - Economic conjuncture and competition - Inability to absorb new value proposition
Investment needs	<ul style="list-style-type: none"> - High costs associated - Financial challenges - Access to funding (e.g. for technology adoption, training and development)
Ecosystem partnering	<ul style="list-style-type: none"> - Identifying the right technology partners - Lack of established partnerships
Governance	<ul style="list-style-type: none"> - Inadequate organizational structure - Lack of defined processes - Unclear roles and responsibilities to create and manage innovation projects
Skills and capabilities	<ul style="list-style-type: none"> - Difficulties attracting and retaining talent needed - Lack of relevant technical competences - Absence of soft and leadership skills
Corporate culture	<ul style="list-style-type: none"> - Absence of stakeholder engagement and communication strategy - Resistance to change - Risk aversion - Short-termism - Conflicting internal interests
Infrastructure	<ul style="list-style-type: none"> - Absence of suitable technology (e.g. cloud), energy or logistics infrastructure
Legal structure	<ul style="list-style-type: none"> - Trust - Data and intellectual property protection - Standards and regulation
Privacy and security	<ul style="list-style-type: none"> - Data privacy - Cybersecurity

Sources: Adapted from: 18 interviews; Bocken, N. M., & Geradts, T. H. (2020). Barriers and drivers to sustainable business model innovation: Organization design and dynamic capabilities. *Long range planning*, 53(4), 101950; Gaddekar, R., Sarkar, B., & Gaddekar, A. (2022). Assessment of risks for successful implementation of Industry 4.0. *Recent Advances in Computer Science and Communications*, 15(1), 111-130; Horváth, D., & Szabó, R. Z. (2019). Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? *Technological forecasting and social change*, 146, pp. 119-132; Madrid-Guijarro, A., Garcia, D., & Van Auken, H. (2009). Barriers to innovation among Spanish manufacturing SMEs. *Journal of small business management*, 47(4), pp. 465-488; Müller, J. M. (2019). Assessing the barriers to Industry 4.0 implementation from a workers' perspective. *IFAC-PapersOnLine*, 52(13), pp. 2189-2194; Rüb, J., Bahemia, H., & Schleyer, C. (2017). An examination of barriers to business model innovation. In 2017 *International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, pp. 335-350; Kamble, S. S., Gunasekaran, A., & Sharma, R. (2018). Analysis of the driving and dependence power of barriers to adopt Industry 4.0 in the Indian manufacturing industry. *Computers in Industry*, vol. 101, pp. 107-119; Kumar, P., Bhamu, J., & Sangwan, K. S. (2021). Analysis of barriers to Industry 4.0 adoption in manufacturing organizations: An ISM approach. *Procedia Cirp*, vol. 98, pp. 85-90.

The number of challenges and the intensity with which they present themselves differ for each company. Addressing them requires a structured approach with thorough planning and orchestrated execution with the leadership's full support and involvement.

3

A path to digital business model innovation

A structured process guides organizations through developing and implementing new business models, involving continuous decision-making and stakeholder engagement.

When driving digital business model innovation for new products, markets or services, the guiding questions listed in Table 3 are crucial.

They have demonstrated effectiveness in offering a starting point and establishing a foundation to address the challenges outlined chapter 2.^{8,9}

TABLE 3 Guiding questions when initiating digital business model innovation initiatives

Topic	Question	Rationale
Strategy	How can the organization be more adaptable to market changes?	Outlining key characteristics needed to enable collaboration within and outside company's boundaries as well as increase agility
Structure	How will operations be affected, from the shopfloor to senior management?	Anticipating shifts in work set-up and roles and responsibilities
Processes	How will the processes evolve as a result of the shifts in the business model?	Mapping digitalization's foreseen impact on current business processes
Rewards	How can engagement and commitment be built throughout the entire journey?	Identifying the most suitable change management approaches and upskilling or reskilling needs
People	How can a team be built to support the initiative?	Designing an environment and culture that supports and encourages change to achieve et objectives

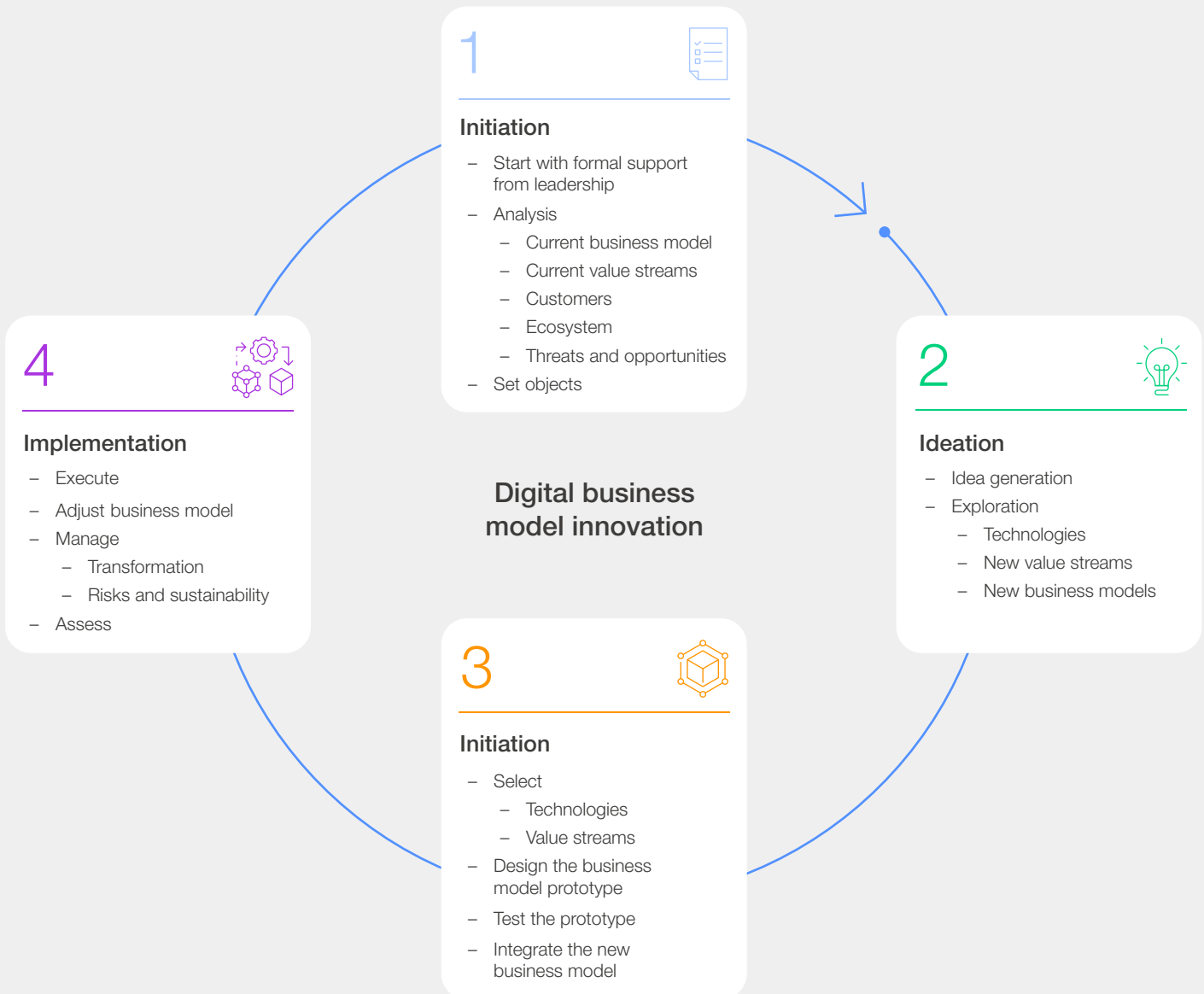
Source: Adapted from: Mintzberg, H. (1980). Structure in 5's: A Synthesis of the Research on Organization Design. *Management Science*, vol. 26, no. 3, pp. 322-341.

Answering these questions enhances visibility and sensitivity to the potential for business innovation. Structuring such initiatives is crucial due to the involvement of various actors in the organization and the need for constant decision-making throughout the process. Moreover, a critical success factor lies in the organization's ability to develop a new line of business while sustaining the current operation and revenue generation. This entails activities such as maintaining and enhancing the existing business and strategically choosing specific vital elements,

including skills, capabilities, products, processes and markets, to test and bring the initiative to life.

To effectively develop the planning and execution of such shifts in business models, a structured process can help to serve as a reference and a checklist on what should be done at each stage. Figure 4 presents a simplified step-by-step approach,¹⁰ which aims to be adaptable and friendly for small- and medium-sized industrial companies looking to reinvent their business model.

FIGURE 4 | Executing digital business model innovation – a simplified process



Source: Adapted from: Bachmann, N. & Jodlbauer, H. (2023). Iterative business model innovation: A conceptual process model and tools for incumbents. *Journal of Business Research*, vol. 168: 114177. <https://doi.org/10.1016/j.ibusres.2023.114177>.

At **initiation**, the main goal is to identify the pain point to be solved and the new business model opportunity at stake. This requires understanding the company's business priorities and the broader ecosystem of partners and suppliers. For example, manufacturing companies must understand whether price competition is increasingly exerting pressure on their margins. Existing knowledge and processes can enable them to enter markets where they do not currently operate, compete with new rivals offering more advanced and affordable solutions, understand the potential of emerging technologies and understand the unmet needs of their customers.

In **ideation**, the objective is to generate several ideas for business models to explore business possibilities regarding value proposition and determine the means necessary to produce and deliver.

With a qualitative focus, the **integration** phase will distinguish the best business concepts and integrate ideas to develop a business plan. In this phase, a deeper understanding of the mechanisms that generate value exists. The business model involving customers, partners and suppliers will be tested and validated. With the results of the tests, it will be possible to develop an action plan for implementation.

In **implementation**, action plans are put into practice, and the new business model is operationalized. As the new model succeeds the previous one, monitoring and alignment activities must be carried out, such as developing new skills and adjusting management practices to the new reality. Finally, stakeholders, especially customers, must evaluate the model to identify points for adjustments and improvements.

Conclusion

Manufacturing companies can use new technologies and advanced digital maturity to drive efficiency, agility and sustainability, as well as rethink current business models and explore new markets to expand their global reach. Digital business model innovation can help manufacturing companies reimagine their business transition from survival to sustained growth, competitiveness, and longevity. This positions them for long-term success in an evolving global manufacturing landscape.

Addressing a wide array of challenges that might hinder digital business model innovation requires the development of a collaborative ecosystem. In this ecosystem, manufacturers work with government support to establish regulations and industrial policies that promote stability and business dynamicity while aiming for integration into global supply chains.

Such initiatives require a comprehensive approach, aligning different functions and securing engagement and commitment at all levels. This entails establishing a clear vision and strategy and implementing a structured, step-by-step process to guide internal and external stakeholders through the journey. Equally crucial is the focus on people's

development across all organizational levels, involving acquiring new skills to deploy and operate new technologies and promoting the right mindset to break away from traditional thinking.

To support this path, particular attention should be paid to SMEs, recognizing their role as vital job creators and acknowledging their economic vulnerability. Supporting SMEs involves helping them expand their horizons beyond immediate survival goals and providing them with the necessary knowledge and resources for sustainable long-term growth. The Brazilian policy for neo-industrialization, through its six missions (e.g. mission 4: digital transformation of the industry to increase productivity), seeks to strengthen the whole industrial sector in strategic areas to drive societal and economic growth.

Moving forward, the World Economic Forum's Centre for Advanced Manufacturing and Supply Chains will continue promoting an exchange of best practices, lessons learnt and use cases. These exchanges will guide companies of all sizes in successfully deploying technologies at scale and unlocking value from innovative digital business models.

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