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HOW TO ADDRESS THE INCOHERENCE OF BUSINESS MODEL INNOVATION IN DIGITAL TRANSFORMATION

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ABSTRACT

Business Models are a key determinant of an enterprise's performance, and Business Model Coherence (BMC) is a key metric for the analysis and understanding of enterprise performance. A *business model* is an activity system that connects the internal perspective of the firm, such as resources and routines, with the external perspective, such as partners, markets, and customers, and therefore articulates how the firm goes to market to implement its strategy. In doing so, the business model articulates the customer value proposition, how value is created, the means of value capture, and the partners in the value network. Hence, the business model is the "architecture" that provides the bridge between the value created for customers and the value captured by the business in terms of profit. The *operating model* is the means of driving operational excellence to achieve superior enterprise performance. *Coherence* is a measure of the degree of alignment between the components of the business model and the operating model in order to achieve the core objectives of the firm.

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Executive Summary

Introduction

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Business Model Coherence (BMC) matters for all enterprises:

- Enterprises undergoing transformation need to design coherent new business and operating models explicitly, to ensure optimal performance and business value.
- But BMC is relevant to all enterprises, since every enterprise has business and operating models (even if they were never designed explicitly), and these models tend to drift over time, as the enterprises make operational and marketplace improvements. This drift can be thought of as a form of entropy. Hence periodically, enterprises should examine the coherence of their business and operating models.

In this paper, we examine the common forms of business model *incoherence* – the 'blockers' that inhibit ideal business performance – and provide a framework for executives to analyze, understand and eliminate business model incoherence in their enterprises.

Background

Digital technology adoption can be divided into three stages, the first stage being the digitization of manual activities, the second being the transformation of processes as a result of digitization, and the third stage being the transformation of business models, often known as digital transformation (DT). As the logic of a firm, a business model explains how the firm operates, creates value, and captures value, internally and externally. Exploring a new business model, which is new to the world or new to the industry, leads to business model innovation (BMI). When existing business models and operating models become misaligned because of DT, firms encounter various points of incoherence, or blockers, in their business models. The ultimate aim

of business model coherence scorecard (BMCS) research is to create a practical scorecard, complete with specific attributes and parameters, enabling an actual score to be computed. As a preliminary step, qualitative research, including interviews, workshops, and case studies, was conducted to identify elements of the scorecard, focusing on points of incoherence that impact corporate performance. This research is designed to help managers identify and understand the types and sources of incoherence in BMI in DT in their firms. We recommend appropriate solutions to manage the incoherence, thus creating and capturing more value.

Top four insights from our research

1. A framework for Business Model Coherence

Business model coherence is the alignment between the activity system that constitutes the 4Vs, which enables alignment between a firm's capabilities and its strategic intent.⁴ Superior performance is achieved by maintaining congruence between the different components of the business model to ensure that the positive or enhancing feedback is harvested, while managing the conflicts arising from the negative or mitigating feedback. These feedback effects need to be examined both within the firm as well as across partner firms within the network. It involves identifying the core capabilities that a coherent business model requires and developing them to be best in class and ensuring that partner firm activities are complementary and value enhancing. By doing so, a firm can focus on aligning its capabilities with the right marketplace opportunities, resulting in sustained superior returns.

The BMCS is a proposed framework to help firms identify BMI opportunities when adopting new digital technologies. It addresses the "piecemeal syndrome", where technologies improve the efficiency of sub-processes but disrupt the overall congruence of the business model components. Traditional accounting systems focus on profitability but do not adequately capture the interactions and dynamic consistency of the business model elements. The BMCS measures the alignment between components to effectively achieve the firm's objectives as digital technologies are implemented.

The framework analyzes the enhancing and mitigating effects of technology adoption on both internal coherence within the firm's value chain and external coherence across the ecosystem. It also examines the coherence of the revenue and cost architecture. This enables management to identify opportunities to reactivate, relink, repartition, or relocate activities, forming the basis for BMI. Implementing the BMCS requires leadership changes to drive business model thinking, inter-firm coordination, and implementing information systems that capture data on component interlinkages. The BMCS provides a systematic view to help leaders maintain the business model's dynamic consistency and spot innovation opportunities. It complements traditional financial reporting to support business model innovation in the digital age.

2. Five sources of business model incoherence

Our research identifies five key sources of incoherence from the BMCS perspective: decision rights, business performance measurement, information flow, material flow, and appropriate partner engagement. These types of incoherence arise because of misalignments in these critical

areas, which can stem from adopting new business models or conflicts between existing business models and the operating model. Each type of incoherence can be further divided into sub-types, providing a more nuanced understanding of the challenges that firms face. This detailed categorization allows firms to pinpoint specific areas of incoherence and address them more effectively, enhancing the overall coherence of their business models.

- a) **Decision rights:** Allocating decision-making authority affects every aspect of the business, from resource allocation to determining production quantity, and from pricing to employee evaluation. If decisions are made at the wrong level or place in the organization, they may not align with the overall objectives, resulting in suboptimal outcomes and hindering value delivery.
- **b) Business performance measures:** Inconsistencies in performance measures and rewards between new digital initiatives and traditional businesses, or between reactive measures and proactive measures, can lead to conflicting priorities and behaviors that undermine value creation and capture.
- c) Material flow: The flow of physical goods and resources is fundamental to delivering value. Incoherence can arise from changes in the type or demand for materials needed for new digital offerings compared to traditional ones, changes in the frequency of material usage, or materials not being in the right place at the right time. Misalignment in material flows hinders the ability to efficiently create and deliver customer value.
- d) Information flow: Smooth exchange of data and communication are critical for effective decision-making and coordination. Relevant information needs to flow to the appropriate management in order to make the right decisions. A lack of information flow between a firm and its customers, or among internal departments, leads to misunderstandings, inefficiencies, and an inability to deliver value optimally.
- e) **Partner engagement:** As DT often involves ecosystems, inappropriate engagement models that fail to balance cooperation and competition among partners can inhibit the creation and delivery of value to end customers.

Each of these five types of challenge/change can be further divided into sub-types that provide more specific aspects of the incoherence sources. Understanding these sources of incoherence helps managers to identify where BMI may be hindered in the DT journey so they can take appropriate action to resolve them.

3. Interrelated sources of incoherence

Our findings suggest that the sources of incoherence are interrelated and equally significant, indicating the need for a holistic approach. Addressing one source without considering others may not resolve the underlying issues. Firms should adopt a holistic approach, simultaneously managing multiple sources of incoherence to achieve coherent and aligned business models.

4. Solutions to incoherence

To manage incoherence effectively, we recommend the following approaches: 1) *Realign decision rights*: Ensure that decision-making authority is allocated to those best positioned to make timely and informed decisions. 2) *Refine performance measures*: Develop key performance indicators (KPIs) that accurately reflect business strategy and customer needs. 3) *Improve information flow*: Implement systems for real-time data sharing and ensure that the right information reaches the right people at the right time. 4) *Optimize material flow*: Redesign material flow processes to align with new business models, potentially investing in new infrastructure, and streamline supply chain management. 5) *Enhance partner engagement*: Strengthen collaboration with partners through clear communication and aligning objectives to achieve mutual benefits.

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3. Findings

3.1 Decision-rights-related challenges/changes

To illustrate how different types of decisions can lead to incoherence in BMI during DT, it is helpful to break down decision-rights-related challenges into specific categories. These challenges or changes can be categorized based on the underlying business logic and the types of decisions that need to be made within an organization. These categories include:

1. Resource allocation decisions: These decisions involve determining how to allocate resources such as budget, personnel, and technology across different business units, projects, and initiatives. Incoherence can arise when resource allocation decisions are made without considering the needs and priorities of both the traditional and digital aspects of the business.

2. Product development decisions: These decisions relate to the design, development, and launch of new products or services. Challenges occur when product development decisions are made without proper coordination between different teams, such as engineering, marketing, and sales, or when there is a lack of alignment between digital and non-digital product strategies.

3. Customer engagement decisions: These decisions concern how to interact with and serve customers across various channels and touchpoints. Incoherence emerges when customer engagement decisions are made in silos without considering the overall customer experience or when there is a mismatch between digital and non-digital customer engagement approaches.

4. Data management decisions: These decisions involve how to collect, store, analyze, and use data across the organization. Conflicts can arise when data management decisions are made without proper governance or when there is a lack of data integration between different systems and processes.

5. Partnership management decisions: These decisions concern how to select, engage, and manage relationships with external partners, such as suppliers, distributors, and technology providers. Challenges occur when partnership management decisions are made without due diligence or when incentives and objectives between the organization and its partners are misaligned.

These categories of decision-rights challenge relate to the next section on business performance measures in several ways. For instance, misaligned resource allocation decisions can lead to suboptimal outcomes that impact key performance indicators (KPIs). Inconsistencies in product development decisions between digital and non-digital strategies can affect metrics like time-to-market and product success rates. Siloed customer engagement decisions that fail to consider the overall customer experience can negatively influence customer satisfaction and retention metrics.

There is also a reverse impact. If the firm's KPIs are not congruent with the new business model, then management decisions will be suboptimal, and it may not be clear whether the issue is *who* is making the decision or whether the 'right' managers are making bad decisions.

Furthermore, the decision-rights categories also relate to subsequent sections, such as the impact of data management decisions on information flow and the effect of partnership management decisions on partner engagement. By breaking down decision-rights challenges into these specific categories, we set the stage for discussing how incoherence in decision-making can lead to other areas of the business, ultimately affecting business performance measures and the overall success of BMI in DT.

By examining these categories of decision rights, we can identify specific cases where decisions are made at the wrong managerial level or in the wrong place within the organization, leading to negative outcomes and incoherence in the BMI process during DT.

Rights allocation among traditional business and DT-related business, among groups and regions, among similar teams, and among digital-driven and human-ability-driven solutions

A world-leading cosmetics firm sells a diverse range of beauty and cosmetic products, including skincare, haircare, make-up, fragrances, and men's grooming items online through retailers such as Amazon and Walmart. The challenge lies in reconciling operational processes among the group (headquarters) and regions. Traditionally, decision rights regarding pricing and output production were centralized in the finance and production teams. This meant decisions were made far from the actual customers, and slowly-nowhere near the real-time decision-making required in an online world. Adopting online distribution therefore created conflict in the allocation of decisions on pricing and output production between the central group and the local teams responsible for the various markets. Since the online systems provide real-time competitors' prices (e.g., promotional discounts), and their effect on sales, the conventional approach of the regional teamscoordinating closely with the central brand teams who make pricing and volume decisions proved to be too slow and inaccurate. The central finance and production teams were unable to contribute effectively to the local pricing and production decisions. The online platforms made it both necessary and possible for more decision authority to be devolved to the local marketing team. This centralized decision-rights allocation reduced the ability to execute the online distribution model effectively. In addition, the weak alignment with customers was exacerbated by inefficient decision allocation between the center and the countries. Without appropriate decision-rights allocation among the group and the regions, the firm struggled to achieve its global objectives for its online business.

At a global hearing-aid manufacturer, the traditional hearing-aid product was principally hardware-based, with product improvements made every 24 months. These product innovations were led by audiologists with training in electrical and mechanical engineering. Recent technological developments in hearing aids have enabled software to become a core part of the product. Embedding software within the hearing-aid product enables various functionalities. including the ability to upgrade the product after purchase. Hence, the firm built a team of software engineers with a computer science and data analytics background. The software engineers were comfortable using AI/ML techniques based on large data samples to develop features like noise cancellation for the hearing aid. However, the traditional engineering team were less comfortable

with this approach, as they were using a hypothesis-driven approach based on engineering theories to test and develop the product. This created conflicts in decision authority between the traditional engineers and software engineers, which caused sub-optimal product development. In particular, the muddled decision authority resulted in a flawed product-testing and quality-control process. For example, a new version of the hearing aid caused a major problem with connectivity with a cell phone once released to market because of a reliability issue, resulting in reputational damage and significant price reduction to the product.

Furthermore, a major pharmaceutical firm provides a comprehensive range of healthcare solutions, including pharmaceuticals, vaccines, and consumer healthcare products. The firm has limited resources to devote to its business. The firm's top management has traditionally focused on the generic pharmaceutical business, which has created stable revenue for the firm. However, they are now shifting from generic medicines to personalized medicine. This transition requires significant changes to manufacturing, moving from large-scale bioreactors that prioritize efficiency and scale economies to smaller, more agile "plug and play" factories that can handle smaller batches and switch between campaigns more easily, emphasizing economies of scope to ensure sufficient personalization. This shift creates a conflict between the existing decision-making framework of supply chain managers, who previously had decision rights focused on efficiency and predictability for mass-market drugs, and the new requirements for agility and customization required by personalized medicine. The manager who is incentivized to deliver generic drugs at the lowest cost through scale efficiencies in manufacturing may now find their objectives at odds with the personalized medicine business, which requires economies of scope to ensure sufficient personalization. This conflict affects decisions about planning processes, production, and distribution, highlighting the incoherence in decision rights between the two business models.

Moreover, a financial firm offers a variety of financial information and analytics services. Their offerings include credit ratings, market intelligence, data, and research across various sectors. Traditionally, the analysts relied partly on their instincts and intuition in their credit rating. However, in the post-financial-crisis era and the subsequent criticism of rating agencies, there was a shift toward hyper transparency and algorithmic decision-making processes. The intention was to remove the human element from decision-making and make processes more transparent by relying on programmed systems. This shift led to the development of a generation of analysts who primarily follow rulebooks and algorithms, lacking the instinctual decision-making skills of their predecessors. Hence, conflicts in decision authority arose between human instincts and algorithms, leading to sub-optimal products and services for clients. These conflicts create an important incoherence.

A company provides robotics manufacturing and services. They adapted their product development as part of the digital transformation initiative. It initiated business model innovation by shifting from primarily standalone robotic hardware development towards incorporating more software-focused solutions to meet evolving customer demands. This transition, however, revealed external market-driven incoherence. The hardware R&D team traditionally madethe decision to define hardware specifications, possibly without sufficient input or requirement to integrate software needs driven by external customers. The hardware team's key performance indicators (KPIs) focused on hardware cost, reliability, or production timelines, potentially conflicting with the need to adapt hardware designs to accommodate specific, potentially costly or complex,

software functionalities demanded by customers. This incoherence meant hardware features might not support desired software functionalities, or vice versa. The result was poor integration between the two and a final product ill-suited to market demands, representing poor market fit. The solution involved establishing a formal coordination mechanism to synchronize hardware and software priorities and revising decision rights to ensure market needs influenced both development streams. Additionally, KPIs for both hardware and software teams were adapted to reward collaboration and the successful delivery of integrated, market-driven solutions, thereby improving product integration and customer alignment.

Rights for understanding and support of DT

A materials technology firm specializes in materials and recycling in the metal and mining industry. Over time, they have explored and developed expertise in diverse domains, directing their endeavors toward harnessing DT to gain competitive advantage. However, the challenge stems from the initially undefined concept of DT in the firm, leading to varied employee beliefs about their digital expertise. Different employees have different decision rights in understanding and implementing DT that goes beyond their own expertise. Some employees think they understand DT but have limited insight and ability to implement it. Decision rights are misaligned, hindering effective decision-making. Without aligned decision rights for understanding DT, the firm has difficulty effectively implementing it, leading to the incoherence.

Similarly, a transportation intermediary firm that provides long-haul logistics services fears that the entry barrier in its industry is enabling new entrants to cannibalize its market. Larger customers like Amazon and Walmart often need intermediaries for specific requirements. Most intermediaries are focused on DT to streamline operations and reduce costs. The logistics firm also promotes DT in its business. However, it faces a challenge in its DT journey. The difficulty lies in employees' understanding of the role of DT in enhancing or substituting human labor. This is because employees have different decision rights about whether to use DT that goes beyond their own job expertise. Employee fears about job displacement hamper the firm's ability to decisively implement digital tools. Without aligned decision rights for understanding the role of DT and using it in the job, it is hard for the firm to effectively and extensively implement DT, which leads to the incoherence.

In addition, a traditional transportation firm provides mass transit services, including commuter railway, light rail, and feeder bus services. The firm has a consensus-driven culture, where decisions are made by a 10-member executive committee. The chief innovation officer (CIO) faced difficulties implementing innovative solutions because of the consensus-driven culture. The CIO's former boss, who was on the executive committee, provided support and dealt with the committee, allowing the CIO to focus on creating solutions. However, the CIO's current boss is not on the executive committee. The absence of the CIO and their boss from the executive committee leads to incoherence in the business, as the decision rights for innovation are not supported by the top management, making it challenging for the CIO to implement innovative solutions and drive change within the organization.

In addition, a global transportation firm operates its train systems in various cities. It is challenging for this traditional and government-owned entity to innovate. It has a unique business model— "rail plus property" (R+P) —in a region where public transport is funded by private enterprise. The government provides land-use rights for transportation projects, leading to property price increases, which are then auctioned off to fund the building of a new transportation system. This approach has allowed the firm to innovate and expand. The business model is based on the synergy between developing transportation infrastructure and the resulting increase in property value, which is used to fund the expansion. However, replicating this model in other regions is challenging because of regional regulations and stakeholder dynamics. The decision rights regarding replicating the new business model in different regions have not been supported by the regional regulators, making it difficult for the firm to replicate its new business model and maintain a coherent business model across different markets.

Rights affected by stakeholders such as solution suppliers

The pharmaceutical firm emphasizes change management and seamless integration of digital solutions for better cohesion. They integrate digital and operational transformations for enhanced workforce efficiency, cost savings, and patient benefits, and they receive numerous emails and proposals from consultancies such as McKinsey and BCG, offering new digital solutions and AI technologies. This constant influx of external ideas and proposals—and the ability to properly filter and manage them—can create conflict within the organization. On the one hand, there is a faction within the firm that is eager to engage with external consultants and explore new digital solutions. They feel these external insights are valuable and necessary for the firm's DT. On the other hand, there is another faction that believes in the importance of focus, prioritization, and stability in executing their current DT plans. They view the constant influx of new ideas from external consultants as a distraction that overwhelms the decision-making process and unnecessarily complicates the work of subordinate teams with limited resources. This tension between the two factions leads to conflicts in decision rights regarding the firm's DT approach.

3.2 Business-performance-measure-related challenges/changes

Business-performance-measure-related challenges or changes can be understood in two key ways. First, there may be discrepancies in the KPIs used to assess the success of new digital businesses compared to traditional ones. These KPIs may include metrics such as growth rate, costs, and risks. Second, there may be a shift in the emphasis of performance measures from being primarily driven by customer demand to being more proactively driven by the organization's own strategic goals and initiatives. Incoherence in decision-making and resource allocation can arise when business performance measures are not properly aligned with the overall objectives of the organization or fail to adequately capture the distinct characteristics of digital businesses. For instance, if traditional businesses are evaluated based on short-term profitability while digital businesses are assessed based on long-term growth potential, this can lead to tensions and conflict in prioritization and investment decisions.

Furthermore, misaligned performance measures can interact with decision-rights challenges, amplifying incoherence in BMI. When decision-makers are incentivized and rewarded based on metrics that do not align with the strategic objectives of the DT, they may make choices that optimize their own performance outcomes rather than the overall success of the organization. This can result in siloed thinking, a lack of collaboration, and suboptimal resource allocation across different business units and functions.

To address these challenges, organizations must thoughtfully design and implement business performance measures that are consistent with their DT goals, while ensuring that decision rights and accountability structures are properly aligned with these measures. This may involve developing new KPIs that capture the unique value drivers of digital businesses and creating incentive systems that encourage cross-functional collaboration and long-term thinking.

Business performance metrics such as growth rate, costs, and risks between new business and traditional business

Regarding the first way in which these challenges or changes can be understood, let us look at MAS, a large global apparel manufacturer and a vendor to many of the world's largest brands, such as Nike, Lululemon, and H&M. These retailers predict trends up to 9–12 months in advance in order to set production targets, but excess inventory or shortages can result in wasted capacity or discounted prices. The challenge is to reduce inventory costs. Through DT, MAS adopted a print-on-demand model nearer the customer's retail outfit. The aim was to integrate its vision system with digital printing software to print on specific coordinates on garments, which was not possible with popular printers. The technical integration challenges were significant with the most popular printers. Therefore, it was a major challenge to integrate and develop a seamless business model for the print on demand with suppliers' existing systems. The reason for this is that there is a conflict of incentives for printer suppliers between the profits and costs of integrating with the firm's new system. For example, it would be difficult for suppliers to sell their high-priced specified print heads and ink if they accepted the print-on-demand business model and integrated their systems with MAS's new system. Without innovation and collaboration-related incentives for printer suppliers, they would have no incentive to integrate their system with the firm, potentially affecting the success of the print-on-demand model and the reduction of inventory costs. In conclusion, MAS focuses on cost reduction (low inventory), efficiency, and customer satisfaction through a print-on-demand model. Suppliers prioritize profitability, market share, and business stability by selling high-priced equipment. The incentive-related incoherence lies in their focus on profitability versus cost reduction, short-term versus long-term goals, and product-centric versus process-centric approaches.

Furthermore, MAS's customers were reluctant to adopt the model because of the changes required in their existing operating model, IT system, and warehouse management system, which were not compatible with the new print-on-demand business model. They had a system whereby they were incentivized to receive inventory in 6–9-month cycles, with payment being made on a periodic monthly cycle, enabling better cash-flow management. The print-on-demand model requires more frequent cash payments on a short-cycle basis, which affects the incentives of the cash-flow and inventory management, respectively. Without specific incentives on inventory management optimization, customers are not willing to accept the print-on-demand model, which requires more frequent cash payments on shorter cycles.

An infrastructure firm that provides fittings, valves, sensors, and actuators in the building industry wanted to enhance sustainability in its value chain. The firm planned to offer optimization solutions for customer sustainability efforts, using sensors and data to optimize customer systems and reduce emissions. The firm shifted from a traditional product sales model to a data-driven service model to support its sustainability goals. However, this shift presented challenges in pricing, risk assessment, and managing the uncertainties associated with potential revenue. The traditional

teams prefer the certainty and familiarity of the traditional product sales model. This created tensions between the senior management and the business managers because of their limited understanding of the trade-offs involved in the transition. Despite the value of data, the low initial revenue and uncertainties posed challenges for the firm. The limited understanding of the trade-off about incentives leads to conflict between sustainability goals and traditional business practices.

A manufacturer produces industrial instruments, such as thermal resistance sensors, pressure transmitters, and valves. The firm navigated digital transformation by evolving their traditional product offerings. The firm undertook business model innovation by shifting from selling hardware products, such as thermal resistance sensors, pressure transmitters, towards providing integrated solutions combining hardware, software and service, such as condition-based maintenance for equipment. This transition encountered significant issues: externally, customers were used to buying hardware based on its physical specifications and price. When the manufacturer introduced the integrated solution, customers did not fully value the software/service component in the same way they valued the tangible hardware. The customers might initially have seen it as an unnecessary add-on. This represented market-driven incoherence where customers' purchasing criteria limited the price they were willing to pay for the software and service component. Internally, the company's strategy was to invest in and grow this new, promising software and service business. However, the reality was that the low prices achievable in the market did not generate enough revenue from the software and service component. This created strategic incoherence because the incentives for the software and service team were relative weak compared to the hardware team. The software team could not be rewarded adequately compared to the established, profitable hardware teams. This also hindered investment in the new software and service capabilities and caused friction between hardware and service teams. The solution involved multiple approaches: clearly communicating the software's value proposition, engaging customers in collaborative R&D partnerships to share development costs and exploring alternative revenue models like subscriptions to better align pricing with value delivered.

The hearing-aid manufacturer, traditionally proficient in monetizing hardware products, decided to shift its business focus from hardware to software. The firm wanted to generate revenue from software products, leveraging the opportunities presented by DT. As the firm transformed from developing and selling hardware products to offering an integrated solution that includes hardware, software, and services, it encountered challenges measuring the success of its new business model. The existing performance metrics, such as units sold, revenue, and profit margins, were primarily designed for hardware products and did not adequately capture the value created by software and services. The misalignment between the firm's traditional performance metrics and the new business model created incoherence in assessing the success of its integrated offerings. The lack of metrics tailored to software products and services, such as user adoption rates, customer retention, and customer satisfaction scores, made it difficult for the firm to evaluate the performance of its new business model effectively.

The logistics firm serving clients such as Amazon and Walmart adopted digital technologies in its operations. The firm wanted to achieve growth and improve efficiency by implementing DT initiatives. As the firm embraced digital technologies in its operations, it encountered difficulties measuring the success and impact of these initiatives using its existing operational performance metrics. The firm's established KPIs were designed for traditional logistics operations and did not

adequately capture the efficiency and effectiveness gains brought about by digital technologies. The misalignment between the firm's operational performance metrics and its DT efforts created incoherence in assessing the true value and success of these initiatives. The existing metrics, such as on-time delivery rates, order accuracy, and cost per shipment, did not fully reflect the benefits of real-time inventory visibility, automated order processing, and data-driven optimization enabled by digital technologies.

Business performance metrics between reactive measures and proactive measures

The logistics firm has in the past focused on fulfilling existing customer needs, while customers had KPIs for finding new needs. However, the firm itself lacked KPIs for discovering potential customer needs, leading to a reactive, capacity-focused approach to business. Embracing DT, the logistics firm now collaborates closely with customers, utilizing data analytics to proactively identify potential customer needs and understand recurring transportation challenges. The firm aims to transition from a reactive model to a proactive one that anticipates and addresses potential customer needs, ultimately improving resource planning and profitability. The shift from a reactive measure to a proactive one and the balance between the two measures present challenges for the logistics firm. Without a clear transition and balance in its KPIs to support this change, the firm struggles to explore potential demand and balance potential and existing demand effectively.

3.3 Information-flow-related challenges/changes

Information flow is a prerequisite for effective decision-making and performance measurement in organizations. Without accurate, timely, and relevant information, decision-makers at all levels of the organization cannot make informed choices that align with the overall objectives of the business. Similarly, without robust information systems and processes, it becomes difficult to track and measure performance against key metrics and targets.

In the context of BMI during DT, information-flow-related challenges can act as significant blockers to progress. These challenges can arise in two main forms: first, a lack of data flow between a firm and its customers; and, second, a lack of information exchange and communication among internal departments.

When there is insufficient data flow between a firm and its customers, it becomes difficult to gain insights into customer needs, preferences, and behaviors. This can hinder the development of new value propositions and the identification of opportunities for BMI. Moreover, without customer data, it becomes challenging to measure the success of new digital initiatives and to make data-driven decisions about resource allocation and prioritization.

Similarly, when there is a lack of information exchange and communication among internal departments, it can lead to siloed thinking, duplication of efforts, and a lack of coordination in decision-making. This can result in missed opportunities for synergies and collaboration, as well as a failure to identify and address potential conflicts or tensions between different parts of the organization.

A lack of data flow between a firm and its customers

MAS, the global apparel manufacturing firm, wanted to promote its innovative print-on-demand business model to reduce inventory. However, the firm faced challenges, as its customers' IT,

financing, and warehouse management systems were incompatible with MAS's new business model. Despite MAS adopting DT and promoting the print-on-demand business model, customers hesitated to embrace the new model. The lack of information flow between the firm's new systems and its customers' existing systems was identified as one of the main reasons for this reluctance, and this incompatibility hindered the establishment of a seamless information flow. This lack of information flow made it difficult for MAS to promote its BMI. Without a proper exchange of data and insights, it became challenging for the firm to demonstrate the benefits and feasibility of the print-on-demand model to its customers, ultimately impacting the adoption and success of the BMI initiative.

Furthermore, the infrastructure firm specializing in advanced building products faced challenges enhancing sustainability through data transparency in the value chain. The firm encountered interdepartmental conflicts within its customer organizations because of the restricted information flow. The customers' data control departments limited the flow of data from the customers to the firm because they concerned with data security, privacy, and compliance with regulatory standards, while the customers' internal departments demanded an information flow from the firm to support innovation. This created a conflict in the exchange of data. This lack of smooth information flow between the firm and its customers hindered the firm's ability to provide its customers with new DT offerings. Without access to the necessary data and insights from customers, the firm struggled to develop and deliver innovative solutions that could enhance sustainability in the value chain.

A lack of information exchange and communication among internal departments

Looking at the second way in which these challenges and changes can be understood, the cosmetics firm faced challenges competing with its rivals on retailers' online platforms, such as Amazon and Walmart. These retailers also sold products from the firm's competitors. Previously, the firm sold its products through its own physical channels, but with the advent of online platforms it gained access to real-time information, particularly regarding pricing. The firm's marketing team adopted DT to monitor sales every hour and make corrections to their strategy when competitors outbid them. However, DT adoption by the marketing team alone did not solve the problem. The finance and production teams struggled to cooperate with the marketing team in real time and to react to changes in prices and volume mix. The financial analysis was not automated and updated in real time because of legacy systems. The production team faced issues with excess inventory, misplaced products, and algorithms and automation in supply chain management that were not suitable for frequent adjustments to deal with real-time changes. The lack of real-time information exchange among departments, and the absence of digital solutions to facilitate information flow, posed a significant challenge to coordination and collaboration within the firm. The marketing team's DT adoption did not extend to the finance and production teams, leading to a disconnect in information sharing. The legacy systems in finance and the inadequate automation in production hindered the firm's ability to respond to real-time changes in the market. To compete with its rivals, the firm had to establish a real-time and efficient information flow among its internal departments, enabling them to work together seamlessly and adapt to the dynamic market conditions.

3.4 Material-flow-related challenges/changes

Material-flow-related challenges or changes relate to changing the type or demand for material from traditional offerings to new ones and changing the frequency of use of material.

Change type or demand for material from traditional offerings to new ones

A leading multinational firm that manufactures personal-care products decided to pursue personalized skincare. The firm believed that mass-market products would become less sustainable and that consumers were increasingly seeking personalized offers. The firm wanted to capitalize on this trend and develop a new business model focused on personalized skincare products. As the firm began to make this shift, it encountered difficulties arising from differing perspectives on the speed and cost of implementing product personalization. This is partly because personalized products involve smaller batches to meet niche demand, but they require substantial material flow from outside/inside of the firm to enable scale economics in manufacturing for fast production and low cost. This shift created a conflict in material demand within the firm. However, the firm struggled to reconcile this increased material demand with its existing processes and resources. The conflict in material demand led to incoherence within the organization, hindering the firm's ability to effectively promote its new personalized skincare business in the context of DT. The lack of a streamlined and optimized material flow posed challenges meeting the unique requirements of personalized products while maintaining efficiency and profitability.

Change the frequency of use of material

MAS, the international apparel manufacturing firm, sought to promote its innovative print-ondemand business model to minimize inventory. The firm wanted to reduce inventory costs and improve efficiency by adopting a more responsive and flexible production approach. As MAS promoted its print-on-demand business model, it encountered resistance from customers. The proposed model required a change in the frequency of inventory material flows, shifting from monthly to weekly cycles. This change in frequency posed challenges for customers, as their existing warehouse management systems and order management systems could not be easily adapted to accommodate such frequent adjustments. The change in the frequency of inventory material flows, from monthly to weekly, had a significant impact on the material flow between MAS and its customers. Customers' existing systems and processes were designed to handle monthly inventory cycles, and the shift to weekly material flows required substantial modifications and adaptations. The more frequent use of materials necessitated changes in inventory management, order processing, and logistics, which were not easily implementable within customers' current set-up. This resistance to change and the difficulty adjusting material flow frequency hindered MAS's ability to successfully promote its BMI to its customers. The lack of alignment between the firm's proposed print-on-demand model and customers' existing material flow processes created barriers to adoption and posed challenges for MAS in implementing its BMI strategy.

3.5 Appropriate-partner-engagement-related challenges/changes *Balance between competition and collaboration*

In the infrastructure firm the majority of sales were conducted through traditional distributors. The firm relied heavily on dealers to assist customers in acquiring the various building-related materials necessary to construct buildings. This established distribution model had been the primary channel for the firm's business. The firm sought to innovate its business model by shifting toward direct customer engagement; it wanted to connect directly with end customers, offering tailored solutions and water-saving services. This shift represented a departure from the traditional distributor-led sales approach and required the firm to balance its new direct engagement strategy with the ongoing reliance on dealers for many of the materials supplies, who still accounted for 95% of

business. The shift toward direct customer engagement created a challenge for the firm in managing its partnerships with traditional distributors. Despite the firm's intention to disintermediate and establish direct connections with end customers, collaboration with dealers remained necessary because of their significant contribution to the firm's overall business. The balance between competition and collaboration with partners became a point of incoherence for the firm. On one hand, it wanted to innovate its business model and engage directly with customers, potentially competing with its dealers; and, on the other hand, it recognized the importance of maintaining strong partnerships with dealers to ensure the continuity of its core business. This conflict between competition and collaboration made it difficult for the firm to effectively promote its new business initiatives in the context of DT. Without finding a suitable balance and aligning the interests of both the firm and its partners, it faced challenges successfully implementing its direct customer engagement strategy while preserving valuable relationships with its traditional distributors.

4. Discussion

4.1 Prioritization among the sources of incoherence from the BMCS perspective Developing coherence in BMI in DT must stem from a clear business strategy. This strategy drives the design of both the business model and operating model to ensure coherence between them. Understanding and addressing the sources of incoherence begins with ensuring that the business model and operating model are explicitly aligned with, and designed to support, the overarching business strategy. To illustrate this point let us consider the shift from traditional manufacturing to additive manufacturing in home appliance industry.

In the case of a home appliance manufacturer adopting additive manufacturing (AM) for washingmachine replacement parts,¹ when a part in a customer's washing machine is identified as faulty, the IoT system within the machine automatically orders the part from the manufacturer. Instead of holding a large inventory of spare parts, the manufacturer uses AM technology to print the required part on demand. Once the part is printed, it is shipped to the customer or a designated repair service provider for installation. This approach reduces inventory costs but introduces delays due to slower production times, as parts are printed on demand compared to holding inventory. The shift in decision-making responsibility to the production teams from the inventory and logistics team for managing AM inadvertently disrupt the established material flow and delivery timelines. The AM technology, while reducing inventory costs, is slower and more complex, leading to delays in getting parts to customers. Additionally, the information flow between the IoT system, production, and logistics needs to be seamless to prevent further delays, but the new process may introduce bottlenecks. This misalignment highlights the incoherence caused by changes in decision rights and business performance measures, impacting overall efficiency and customer satisfaction. The example highlights the interrelated and delicate balance among material flow, information flow, decision rights, and business performance measures, emphasizing the need for a holistic approach to manage and resolve incoherence in business models during DT. With a new coherent business model, washing-machine repairs can be transformed into a win-win situation: better service for the customer and increased efficiency for the manufacturer.

^{1.} Velu, C. (2020). Business Model Cohesiveness Scorecard: implications of digitization for business model innovation. In *Handbook of Digital Innovation* (pp. 179–197). Edward Elgar Publishing.

4.2 Solutions to incoherence

Based on this research, to deal with business model incoherence, we have looked at diverse solutions to address various aspects of DT within organizations. These solutions are summarized in Table 1.

	Type of incoherence	Managerial solution
1	Decision rights	(1) Understand how specific decisions affect results. (2) Determine whether better decisions could be made, and, if so, how. (3) Decide who is in a better position to make these decisions at the necessary speed. (4) Reallocate rights and responsibilities between central and regional teams and between functions based on objectives; ensure that information flow and performance measures are aligned with the newly designed decision rights.
2	Business performance measure	Redefine KPIs to align with the business strategy and the current and emerging needs of customers. This process will require mapping out the new processes to understand how they interact, followed by the establishment of appropriate performance standards. Additionally, conducting a value creation exercise to identify key components that drive customer satisfaction will be essential. The complexity and strategic importance of these tasks would require significant resources to implement as they form the foundation for more coherent business operations and long-term success.
3	Information flow	Ensure timely and accurate information delivery to the right individuals as needed, including real-time data access. Improve inter-departmental collaboration via information systems, ensuring that the right information reaches the right people at the right time.
4	Material flow	Redesign material flow processes to align with new business models, potentially involving investments in new factories, distribution centers, and so on. This may require significant lead times and capital. Develop an integrated agile supply chain management system that manages the material flows and assists customers with integration to adjust manufacturing, the supply chain, and distribution.
5	Partner engagement	Identify the needs of partners and find appropriate win–win solutions by balancing cooperation and competition with partners. This is another critical and difficult strategic exercise.

 Table 1 Solutions to incoherence

4.2.1. Decision rights

Decision rights might need to be reallocated in order to facilitate business model innovation. Such reallocation could improve inter-departmental communication through reshaping responsibilities between central and regional teams and changing objectives between business functions. For

example, in the case of the global cosmetics firm, the firm found it challenging to balance how much to centralize versus how much to allow for local adaptability when it started to use thirdparty online channels to sell its products. Reallocating pricing and production decision authority to regional marketing teams who were closer to the online marketplace dynamics would help to resolve this issue. However, the central groups would also argue that without their control it is very hard to maintain a consistent product image around the world. Moreover, the role of the central finance and production teams' decision rights needs to be changed to focusing on setting and monitoring the overall strategic parameters for the production and pricing decisions of the regional teams.

Reallocating decision rights is often challenging. There can be cultural resistance, as centralized teams may be reluctant to relinquish control and decision-making power to regional teams. The central teams may doubt the capabilities of the regional teams to make sound decisions. Overcoming this requires strong change management and trust-building efforts. Additionally, enabling regional teams to make effective decisions requires providing them with the right data, tools, and resources. This often necessitates significant investments in IT systems to provide real-time information flows and integrate data across the organization. Moreover, appropriate data and analysis need to be provided to the central finance and production teams so that they can set overall policy directions based on day-to-day sales outcomes.

In the case of the hearing-aid manufacturer, the firm faced challenges integrating the expertise of traditional engineers and software engineers specializing in AI methods. Rather than balancing two competitive groups, the real challenge lay in creating a cohesive system that leverages the strengths of both teams. Traditional hardware engineers, who rely on hypothesis-driven engineering theories, need to work in conjunction with software engineering teams that use AI methods and inductive reasoning based on data patterns. This integration requires governance models that allocate responsibilities appropriately, fostering collaboration rather than competition. The firm must focus on overcoming the differences in approaches and designing a governance model that integrates the diverse methodologies of traditional and AI-driven engineers. This approach aligns with successful tech firms like Apple, which have effectively integrated hardware and software engineering into a unified system.

4.2.2. Business performance measures

Business performance measures can become incoherent when they do not accurately reflect the characteristics of a digital business or when a firm's focus shifts from meeting customers' current needs to identifying and responding to new customer needs. To address incoherence in business performance measures, firms need to align metrics between new and traditional business, rewarding the successful identification and satisfaction of new customer needs. At the enterprise level, KPIs should focus on core metrics like revenue, profit, and market share, prioritized based on the product life-cycle stage. The early stages may emphasize market share to establish a foothold, while the later stages may prioritize profit as the product matures. At division, department, or work-unit level, KPIs should measure intermediate activities and results that contribute to enterprise-level KPIs.

It is also critical to understand the difference between leading and trailing indictors when designing KPIs. For example, real-time inventory accuracy can impact overall efficiency. Microsoft

developed the ability to measure customer engagement with its software tools, and demonstrated that this is a reliable predictor of future revenue growth.

A further example, in the case of the logistics firm, clients such as Amazon and Walmart need intermediaries like this logistics firm to adopt digital technologies in its logistics service, but the firm's traditional KPIs cannot accurately measure the DT-enabled benefits (real-time visibility, automation, data-driven optimization) that these tech giants value, creating incoherence and ineffective service evaluation. Leading indicators such as real-time inventory accuracy and automation-driven efficiency can provide early insights into the success of DT efforts, while trailing indicators such as revenue and profit margins will reflect the eventual financial outcomes. The logistics firm needs to redefine its KPIs to align with its DT and client needs. By collaborating with clients, it should create metrics that accurately measure DT benefits such as real-time inventory accuracy and automation-driven efficiency. As the firm transitions from reactive operations that meet clients' current needs to proactive operations that respond to new client needs, new KPIs should also gauge their ability to anticipate client needs, measuring factors such as predictive demand accuracy. This approach aligns their metrics with both their DT efforts and evolving business model, enabling better evaluation of their services' true value and supporting their shift to a more data-driven, anticipatory operational style. The logistics firm might face challenges redefining KPIs such as client reluctance to share data, difficulty quantifying DT benefits, internal resistance to change, technical issues in data integration, and the lack of industry benchmarks for customized KPIs aligned with DT efforts. Addressing these challenges requires understanding the specific needs of different business units and ensuring that performance measures at all levels contribute to the enterprise's overall goals.

4.2.3. Information flow

The issue with information flow is that it can act as a significant blocker to BMI during DT when there is insufficient data flow between a firm and its customers, or among internal departments, whereby the information is not delivered in a timely manner to the relevant decision-making authority. A lack of customer data hinders the development of new value propositions and the identification of opportunities for BMI. Similarly, poor information exchange and communication among internal departments can lead to siloed thinking, duplication of efforts, and a lack of coordination in decision-making. An additional challenge is presented when multiple systems are used, resulting in conflicting sets of data. One single 'source of truth' is an essential precursor to effective data sharing.

To resolve these issues, firms need to improve both external and internal information flows. Externally, establishing seamless data exchange with customers can provide valuable insights into their needs, preferences, and behaviors, which can inform the development of new offerings and measure the success of digital initiatives. Internally, enhancing communication and data sharing among departments ensures that all parts of the organization are aligned and can collaborate effectively.

For instance, the cosmetics firm faced challenges integrating real-time marketing, finance, and production data across departments. The key issue was the lack of real-time data sharing and analytics mechanisms and tools, which hindered coordination between the marketing, finance, and production teams. This resulted in inefficiencies and slow responses to market changes and

customer demands. The firm resolved this by implementing advanced and integrated information systems that facilitated real-time data sharing and analytics across departments. This system integration enabled the finance and production teams to collaborate effectively with the marketing team, ensuring accurate and timely financial updates and production adjustments. Challenges in the systems that are integrated in the firm included overcoming technical barriers to data integration, ensuring data accuracy and reliability, and addressing resistance to sharing information across departments. Additionally, establishing robust data governance frameworks was crucial to maintaining data security and privacy. Furthermore, the firm developed an "information vision"— a data-based model of how the overall business operates and how all the individual departments and groups play their roles. This allowed each group and leader to see their performance and understand how it affects the performance of the overall enterprise.

4.2.4. Material flow

The problem with material flow arises when traditional manufacturing, supply chain, and distribution processes are not aligned with the requirements of new digital business models. This misalignment can stem from changes in the type or demand for materials, as well as the frequency and flexibility needed to support digital offerings. Ineffective material flow can significantly hinder a firm's ability to create and deliver value efficiently. To resolve this issue, firms need to adjust their manufacturing, supply chain, and distribution processes to accommodate the specific needs of digital business models. This involves reconfiguring operations to ensure timely and accurate material delivery, optimizing inventory management, and enhancing the flexibility of supply chain operations. Adjusting manufacturing processes involves adopting more flexible production techniques, such as modular manufacturing and connected factories system, which can quickly adapt to changes in product demand and customization needs. Supply chain adjustments include integrating advanced analytics for real-time inventory tracking and demand forecasting, ensuring that materials are available exactly when needed. Distribution processes need to be streamlined to support faster delivery times and more dynamic routing to meet customer expectations.

For instance, an international apparel manufacturer promoting a print-on-demand model faced challenges with traditional monthly inventory cycles, which were incompatible with the new requirement for weekly cycles. By implementing an integrated agile supply chain management system and assisting customers with integration, the firm could synchronize material flows with the new business model, thus reducing inventory costs and improving responsiveness to market demands. This may also require investing in new factories, distribution centers, and other infrastructure to support the new material flow requirements. Additionally, flexible manufacturing may be less efficient than dedicated factories for certain high-volume products, which might warrant maintaining dedicated facilities. Challenges in reconfiguring material flow include the need for substantial changes in existing systems, overcoming resistance from supply chain partners accustomed to traditional processes, and the financial investment required for technological upgrades. Additionally, firms must ensure that all stakeholders in the supply chain are aligned and capable of handling the new material flow requirements, which may involve training and supporting partners to adapt to new processes and technologies. Achieving detailed alignment with business objectives, for both the core business and the new digital business, is crucial in this transition.

4.2.5 Partner engagement

The issue with partner engagement arises when there is a misalignment between a firm's DT goals and the collaboration models with its partners. Inappropriate engagement models can inhibit value creation and delivery, especially when balancing cooperation and competition among partners becomes challenging. This misalignment can lead to conflicts and inefficiencies, ultimately hindering the firm's ability to innovate and respond to market needs effectively. To resolve this issue, firms need to develop engagement models that align with their DT objectives while fostering a balanced relationship with partners. This involves identifying the needs of partners and finding win–win solutions that encourage both competition and collaboration. Effective partner engagement requires clear communication, mutual understanding of goals, and shared incentives that drive joint success.

For instance, an infrastructure firm transitioning from traditional sales through distributors to direct customer engagement faced challenges balancing its relationships with existing dealers. To address this, the firm developed a dual engagement model that allowed it to maintain strong partnerships with distributors while gradually building direct relationships with end customers. This model included tailored incentives for distributors to support the new strategy, ensuring that they remained integral to the business while enabling direct customer engagement. Challenges in improving partner engagement models, aligning incentives across different stakeholders, and ensuring consistent communication and coordination. Additionally, firms need to manage the potential conflicts arising from competition among partners and balance these with collaborative efforts to drive innovation.

5. Conclusion

In conclusion, through case studies from diverse industries, this research has categorized the sources of business model incoherence into five main types: decision rights, business performance measurement, information flow, material flow, and appropriate partner engagement. Each type has been further divided into sub-types, providing a comprehensive framework for understanding the challenges and changes that firms encounter. Furthermore, the study has discussed the prioritization among the sources of incoherence and a range of solutions that firms have employed to address the incoherence. This research provides valuable insights for managers seeking to identify, understand, and manage incoherence in their firms' DT journeys, enabling them to create and capture more value through coherent BMI.

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About the research (Methodology)

This report is mostly based on 14 semi-structured interviews with 13 firms and on 2 workshops with 14 firms in 2022–24 across the US, Europe, and Asia. Our interviewees include the chief R&D officer, chief innovation officer, general manager of innovation, VP of innovation, head of commercialization, director of innovation, and founding partner, illustrating that BMI in DT impacts various functions. The firms operate in nine different industries, such as light manufacturing, heavy manufacturing, logistics, transportation, pharmaceuticals, healthcare, personal care, software, and finance, providing insights into common blockers across sectors. Additionally, the white paper incorporates insights from other sources, including discussions within the Conference Board Councils on innovation and digital transformation, the Advisory Board of the Innovation & Digital Transformation Institute of The Conference Board, the BMI Research Group at the Institute for Manufacturing of the University of Cambridge, and referenced research on DT, innovation, and business models.

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