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# A Concept for an Enhanced Future Readiness Model (FRM) for Firms in the Context of Industry 4.0

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***Abstract***

*Since the pandemic organizations have focused on ways to improve engagement, adapt to the new world and develop strategies for survival. In support of these goals an enhanced future-readiness model is proposed that encompasses concepts from ambidexterity, strategic foresight and organisational resilience applied to the industry 4.0 context. The model identifies thirteen primary (13) internal and external factors that can be used to design and apply a future readiness model within organizations to improve agility and preparedness for the challenges and opportunities posed by industry 4.0. It also identifies eleven (11) sub-factors that together with the primary factors provide a conceptual framework for managers to consider in their planning and preparations for industry 4.0 and other disruptive events. The model connects dynamic capabilities with the firm's strategic preparedness. It attempts to fill gaps in existing future readiness models and forms the basis for ongoing, applied research into its utility in product and service industries. This paper also refers to the dilemma of innovation and the need for change as it relates to industry 4.0. Concept for how new opportunities can be addressed and how strategy development and execution can be built on with other aspects of organisational maturity and agility to improve future readiness. The model proposes an approach to risk tolerance and reward management based on the resources of the firm, including its organizational culture and how its utilization of internal and external analyses prepares it for a dynamic environment in the context of industry 4.0. It incorporates the influence of people and digitization with the more traditional dynamic capabilities of the firm and proposes possible applications of the model to industries significantly affected by industry 4.0.*

**Keywords:** Future readiness model, industry 4.0, strategic foresight, organizational agility, organizational resilience

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## INTRODUCTION

The pace of change presented by Industry 4.0 (i4) and post pandemic challenges are forcing firms to re-imagine what it means to be future-ready. Digitization has affected supply and value chains and enterprise operations as well as how staff work and how opportunities are assessed and processed. A major challenge arising out of i4 is the need to sustain a competitive advantage in the current market while identifying opportunities in the future. This has become more challenging and has raised the question of what future readiness looks like.

Sustainability of the competitive advantage in the context of i4 affects the pace with which the firms products and its business models change. Previous

 

work (Ghobakhloo, 2020) [1] has identified sophisticated precedence relationships that exist among various sustainability functions of i4 and the ability of the firm to future-proof its operations. Such a relationship between the economic sustainability functions, including production efficiency and business model innovation affects the ability of the firm to innovate as well as to respond to unexpected changes in its external environment. This includes changes to business models, production methods, supply chains and distribution networks. Business models built on i4 assumptions are more immediate and they last for shorter periods of time than more classical business models and this presents a significant challenge to firms. In the absence of a dynamic strategic model, the business risks being forced out of its market. In practice this means that firms need to do more in both qualitative and quantitative terms to remain future ready.

Raj et al. (2020) identify barriers to the adoption of i4 technologies in the manufacturing sector and reasoned that the most prominent barrier in both developed and developing economies is the ability of firms to identify and use a viable and relevant future readiness model [2]. An examination of the difficulties in the diffusion of technological innovation revealed that diffusion of innovation is a function of the future readiness model adopted by the firm. In the absence of such a model, and it being dynamic and encompassing, responding to strategic changes becomes more challenging.

## LACUNAE IN EXISTING WORKS

While readiness for industry 4.0 has attracted much attention, the adoption of relevant future readiness models that are applicable to small and larger organizations has received far less input. The implications of this are that practitioners lack the requisite theoretical framework with which to design business operations that address this readiness.

Industry 4.0 readiness models have been studied (Hizam-Hanafiah et al., 2020) to identify their dimensions, including how they affect the business, to what extent, and the ability to use these models to innovate and to adapt. A detailed literature review of i4 readiness models (Hizam-Hanafiah et al., 2020) [3] identified six specific dimensions: Technology, People, Strategy, Leadership, Process and Innovation. These can be considered as the most important dimensions for organizations wishing to pivot to i4. Of these, technology was identified as the primary factor considered in such reviews as the driver for i4.

## FUTURE READINESS AND FUTURE READINESS MODELS

Connectivity and digitalization are considered main factors that enable firms to utilise their networks, access data and utilise that data to create a competitive advantage (CA). The CA's resilience is affected by the changes in the external environment – the changes that future readiness predicts and deals with. The Volatility, Uncertainty, Complexity and Ambiguity (VUCA) elements of the external environment make harder for firms to adapt to i4. Having a model that brings together elements such as risk management, organizational culture, unique industry skills and data decisions may help improve the firms future readiness.

These factors, combined with operational and financial constraints make it harder for firms to plan for and implement strategies that position them to take advantage of i4 opportunities (Kumar et al., 2020) [4]. This is particularly the case in developing economies and where firms have little access to funding. Such constraints are evident in the decisions of many firms to not adopt new technologies for fear of failure in migrating to new systems due to change management challenges, leadership reluctance and a lack of understanding of i4 implications. This emphasizes the need for a model that allows managers to develop a future readiness resilience model.

### Dynamic Capabilities

Frameworks that describe the dynamic capability of the firm, particularly in transforming or fast-changing markets can help the firm better understand how it needs to change to take advantage of new

 

opportunities (Lin et al., 2020). One such model was developed by Lin et al. (2020) by analysing the utility of existing maturity models and how useful they are in fast-changing markets. Despite the existence of several models, most appear to be unable to identify the firms dynamic capabilities and so limit its potential to compete in changing markets such as those experiencing i4. Key capabilities (an internal environmental factor of the firm) appear to drive the resilience of the firm (Lin, et al., 2020) and dynamic capabilities (those that the firm can change quickly) have positive effect on the transformation of manufacturing enterprises. The model developed by Lin et al. (2020) presents process, technology, organisation, and transformation as the four components of a future readiness model, but does not address the internal leadership styles or the ability for strategic foresight in interpreting their impact on future readiness [5,6].

**The Innovators Dilemma**

The Innovator's Dilemma (Christensen, 2013) [7] identifies the challenges facing firms that are ahead of the curve, particularly at times of market or technology volatility. Dynamic capability can sometimes lead firms to innovate at the expense of the broader future readiness agenda or the most attractive markets (Akiike & Iwao, 2015) [8]. The use of a model that can link internal and external factors considered necessary for future readiness can help firms develop ambidexterity and market orientation. Firms that have lower levels of strategic foresight due to owner or manager limited time or scope, such as family firms, often struggle to develop viable future readiness plans (König et al., 2013). This is further exacerbated by low levels of formalization of process, a lack of an encompassing future readiness model that encapsulates internal and external factors and dependence on investors who are reluctant to fund unclear or non-integrated (into existing operations and resources) future directions. This can lead to organizational paralysis and an inability to address the i4 future (König et al., 2013) [9].

Whether organizations can adapt or not depends on organizational ecology – the ability of the firm to use its resources, adopt a specific framework and integrate its strategic assets (O'Reilly & Tushman, 2008). Ambidexterity is an example of one such ecological factor and it leads to firms reviewing the organizational context (where the firm is, what it does, how it does it, when and why) to take advantage of future opportunities and to adapt to currently-occurring fast changes. The need for a model that enables faster decision making is highlighted by the fact that the ability of the firm to reconfigure or redeploy assets and to use existing capabilities is often time-sensitive (O'Reilly & Tushman, 2008) [10].

**Change and Future Readiness**

The change organizations must go through when adapting to i4 or other large external events can affect the perception of the importance of future readiness models and the use of those models. Change is affected by leadership, the management of change initiatives and organizational culture as well as leadership characteristics (Kavanagh & Ashkanasy, 2006). However, the absence of a future readiness model that links these with other internal and external factors makes future-orientation of firms harder, particularly when historical change initiatives have failed. The past may affect the view of change in the future and may reduce the readiness potential of the firm. An example of this is the change that arises when a merger or an acquisition takes place (Kavanagh & Ashkanasy, 2006). Both of these transactions can help improve the future readiness of the organization and its ability address i4 as they may provide resources, skills, market access or capabilities that improve future readiness. The fast pace of change and the lack of a clear model for future readiness within the acquired firm, acquiring firm or merged firms can inhibit the potential of such strategies to future-proof the organization, though this may be moderated by forward-thinking leadership (Kavanagh & Ashkanasy, 2006) [11].

**INDUSTRY 4.0 AND FUTURE READINESS MODEL**

Openness to future readiness strategies has been found to correlate with better performance. (Cugno et al., 2021) [12]. It is also associated with greater understanding of the challenges and rewards of i4 leading to the need to associate resources, leadership and unique industry skills. A better understanding of assets, skills, technology capability and the impact of artificial intelligence (AI) on the business affect

 

the level and pace of organisational transformation as part of the i4 readiness of the firm (Ghobakhloo et al., 2021) [13]. Further, digitalization of business process increases the success rate of i4 future readiness planning and the allocation of resources to implement it (Hizam-Hanafiah & Soomro, 2021) [14]. This was also found to increase the firms agility and openness to innovation (Hizam-Hanafiah & Soomro, 2021).

The ability to offer new products and services, taking advantage of a comprehensive model of future-readiness planning and a perception that i4 needs to ne resources are factors that have helped improve future-orientation of firms. Barriers reduce the readiness level of firms, but once adopted, i4 future readiness models are quickly integrated into business operations (Stentoft et. al 2021) [15]. This is also in line with earlier work showing that digitization of the firm helps re-orient its production, services and processes to i4, but that there is a need for broader strategic integration that extends to the way in which the firm thinks and acts (Canetta et. al, 2018, June). A Digitalization Maturity Model has been developed by Canetta et al (2018) [16] to assess the state of a company journey towards i4.0 which considered the dimensions of strategy, processes, technologies, products and services and people. However, the model did not address risk management, organizational culture, unique industry skills or the impact of leadership on future readiness.

Though digital transformation is seen as a precursor to i4 readiness (Jones, et. al, 2021) [17], “Strategic Doing” has been presented as the necessary component of strategy that enables this transformation. Considering that implementing strategy is hardest when the technology is disruptive (Wamba and Queiroz, 2022), being able to refer to a future readiness model may help leaders make more informed strategic decisions regarding i4. Such a model may also help the application of a “multi-stage model of adoption” (intention, adoption, and routinisation stages) (Wamba and Queiroz, 2022) [18].

Efforts in advanced manufacturing (Lin et. al, 2020) have included transformation to digitization and an exploration of the capabilities of the firm, but this has not included change management models or governance considerations as part of the i4 future readiness strategy.

The time taken to develop and implement a strategy has an influence on the ability to implement it and this requires a detailed plan and a willingness to do the detailed work of translating the strategy into tactics. “It doesn't matter how good the plan is if you can't make it happen” (Zagotta and Robinson, 2002) [19]. This lends credit to the notion that a future readiness model that encompasses more than just the dimensions of strategy, process, technology, products and people can add value to the execution of strategy for i4 preparedness. Another dimension that appears to be lacking in current future readiness models is the examination of risk. Risk management, in the context of strategy, is a dynamic process (Kwak and LaPlace, 2005) [20] and is affected by financial viability, financial stability, the level of diversification and the entrepreneurial direction of the firm (Antonites and Wordsworth, 2009) [21].

A challenge that is commonly reported when examining future readiness models is the change that is required at the operating level when external factors are disruptive (Botha, 2018) [22]. “Future readiness levels (FRL)” are based on readiness at the capability levels of technology, behaviour, event, and future thinking, but does not include strategic foresight, unique industry skills, workflow management or change management in a technology sense. Firms that enjoy ambidexterity are able to learn faster and implement strategy more confidently and yet there does not appear to be an encompassing model that helps firms identify a viable path to i4 or for broader future readiness initiatives (Brix, 2019) [23]. Ambidexterity has been found to be useful in enabling future thinking orientation when exploration of what the future may look like is undertaken and when commercial exploitation of that future is planned (Karrer & Fleck, 2015) [24].

Organizational agility is also dependent on the capacity of the organization to explore the future and consider the assets, resources and skills it needs for that future (Lee et. al, 2015) [25]. As the

 

organization adopts new technology, its dynamism increases as it becomes more accustomed to change, but it is also required to view its business in a broader context because the firms internal and external environments need to be considered. This broader context may be captured through a future readiness model that includes strategic human resources management and a link between the leadership of the organization and its staff through a bottom-up relationship (Mom et. al, 2019) [26]. Flexibility of the firm and a degree of autonomy in experimentation enhance ambidexterity, future readiness and dynamism in response to disruptions such as i4 (O'Reilly & Tushman, 2013) [27].

Gaps in research particularly in the reality of expected outcomes of future readiness planning and the moderators of that process have been reported (Raisch & Birkinshaw, 2008; Simsek, 2009; Tarba et al., 2020) [28,29,30] and indicate that organizational maturity is represented by an ability to change, adopt a holistic approach to i4 and cover commonly neglected areas of future innovation such as people (Trotta & Garengo, 2019) [31].

Unexpected external factors or severe industry changes often catch firms by surprise as they struggle to address these new threats in a systematic way (Hughes et. al, 2020) [32]. “Crises provoke a profound impact on executives' sensemaking, as they attempt strategically navigate these events” (Hughes et. al, 2020). Though various models exist to aid senior executives address these challenges, there are gaps in the practical application of these models due to a lack of broad relevance to the functional areas of the firm [33] (Engida et. al, 2022; Alzarooni et al., 2022; Banerjee, 2022; Prasetio et. al, 2022) [34,35].

The development of an enhanced future readiness model for firms in the context of i4 may help better position these firms to take advantage of external and internal factors by extending current models and improve organisational agility and resilience [36].

## PROPOSED CONCEPTUAL FUTURE READINESS MODEL

The proposed model is conceptual and will be the subject of industry field testing over the next 2 years. It is built on identified gaps in current future readiness models, changes post the pandemic and initial industry feedback.

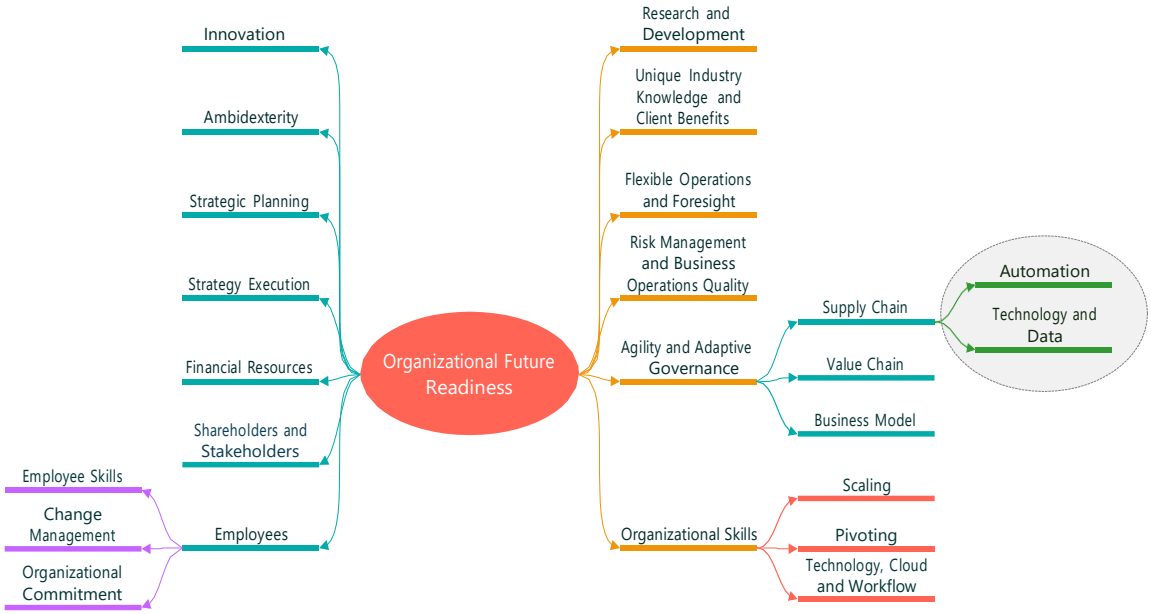


**Figure 1.** Conceptual enhanced future readiness model.
***Source:*** *online.*

*Innovation:* The model proposes an approach to innovation that is based on an agile methodology and one that consistently reviews the internal and external environment of the firm.

 

*Ambidexterity:* The ability to identify external opportunities created by i4 through a scanning of the external environment and the ability to exploit those opportunities forms part of the management approach to i4 in the model

*Strategic planning:* Strategic intent is proposed to be linked with a strategic plan and a tactical plan that places ambidexterity at the centre of strategic thinking.

*Strategy execution:* While the strategic plan needs to revolve around ambidexterity, the execution of the strategy requires resourcing and a willingness and intent to execute.

*Financial resources:* A specific i4 financing plan is proposed to be put in place to ensure that the i4 strategy can be implemented and that the funding is realistic.

*Shareholders and stakeholders:* need to be kept informed of the i4 future readiness roadmap.

*Employees:* are key players in the future readiness model and have a major impact on the success of the model. They should be consulted and made part of the change management plan.

*Employee skills:* need to be re-developed and staff re-skilled in an array of technology and strategy elements of the model.

*Change management:* needs to be made a systematic part of the firms strategy and a standing item in governance deliberations due to the fact it is likely to be a regular activity as i4 evolves and the future readiness model matures.

*Organizational commitment:* is required through buy-in of staff and management of the future readiness model and its application to the firms business.

*Research and development:* must be adaptive and adopt an agile approach that links with the external market analysis and gets closer to customers to make the model viable.

*Unique industry knowledge and client benefits:* a stock take of the unique knowledge, skills, benefits and competencies of the firm so as to enable their utilisation as part of the future readiness model.

*Flexible operations and foresight:* the firm's operations need to be designed or re-designed to build-in flexibility and to become more adaptable to technology and market changes.

*Risk management and business operations quality:* though risk management is an inherent part of managing business operations, it needs to become more agile and more regular in its evaluation of risks, some of which may be regularly changing.

*Agility and adaptive governance:* are needed to make sure that the board of directors has an in-depth understanding of the model and is able to use its elements to direct the organization.

*Supply chain:* the supply chain of the firm may be affected by the changes brought about by the future readiness model and its implementation. The supply chain members may need to be consulted and some may need to work with the firm to make the implementation of the model possible.

*Automation:* automation efforts need to be viewed as more than merely a technology upgrade and consider staff, training, skills development and cyber security.

*Technology and data:* need to be protected from cyber-attacks. Data needs to be more focussed, specific and useful to allow its genuine utilization as part of the future readiness model.

 

*Value chain:* the value chain of the firm as represented by its distribution network will likely be affected by the future readiness model and included in the planning for i4.

*Business model:* perhaps the business model of the firm may need to be revisited and contextualized to the new external environment that i4 will create and the utilization of the future readiness model as part of the pivoting to i4.

*Organizational skills:* the firm will need to consider re-development of skills and potentially a re-alignment of those skills to the new strategy and the model underpinning it.

*Scaling:* the production capacity, processing capacity, administrative and managerial capacities need to be scaled up or down to manage changes brought about by i4.

*Pivoting:* needs to become faster and more agile so as to allow the firm to pivot to new markets, new industries and perhaps diversify its product range as part of the future readiness orientation.

*Technology, cloud and workflow:* the implementation of technology upgrades as part of the future readiness model will need to factor in the changes in other areas of the business such as in the supply and value chains or in the customer proposition.

These concepts, as illustrated in the future readiness model may be tested for organizational health in the field to identify relevance, applicability and rigour of the proposed model to develop benchmarks and a future readiness index.

## CONCLUSION

The complexity and un-predictability that i4 brings to industries has major implications for strategic planning and execution. Though future readiness models have been proposed in the past to help firms navigate complex or fast-changing environments, there is a gap in this field due to the lack of comprehensiveness of these models. Future readiness for i4 and other disruptive events requires a more integrated model. The current conceptual proposed future readiness model brings together 13 primary areas of business strategy and operations and 11 sub-areas to help managers develop the organization and consider their future readiness in a more holistic and practical way. The conceptual model will be tested in the field with both product and service industries and presented here to elicit feedback from academic and practitioner perspectives.

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