

School of Business & Management

Industry 4.0

The case of Vietnam

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Foreword

This report presents key aspects associated with the emerging Industry 4.0 phenomenon drawn from the extant academic and industry literature. The report examines four main sections where content, directly or indirectly, has implications for the planning, organisation, and implementation of Industry 4.0 in Vietnam from a managerial perspective.

These sections include the participating companies'

- Business models,
- Organisational models,
- Digital capability, and
- Brand experiences.

To explore these sections, data were gathered from 503 Vietnamese business managers operating nationwide through an online survey. The survey was developed in collaboration between RMIT International University Vietnam and Consulus Vietnam, using Consulus' proprietary framework called Unity 4.0. This is part of an initiative by the Industry Advisory Board of RMIT Vietnam - School of Business and Management, Hanoi campus.

A second survey was developed by RMIT researchers to gather qualitative data; using a combination of face-to-face and online interviews, 101 usable responses were collected. Sections covered in this second survey include:

- Opportunities and threats stemming from Industry 4.0 adoption,
- External and internal support to fulfill the promise of the Industry 4.0 phenomenon,
- Adding value to companies' products/ services through Industry 4.0,
- Staff's reaction to their company's involvement in Industry 4.0, and
- The extent to which Industry 4.0 could help businesses cope with the long-term effects of COVID-19.

Overall, the research provides a timely and valuable contribution to understand and appreciate the Industry 4.0 phenomenon in Vietnam more deeply. Building on these insights, Consulus will produce a global strategic guide for Vietnamese companies in their global growth and innovation. It will include business ideas for business leaders and recommendations for industry leaders to harness Industry 4.0 to guide Vietnamese firms to succeed in a new world.



Executive summary

This report analyses the results from two research projects associated with Industry 4.0 (hereafter I4.0) adoption. Through an online survey conducted among 503 managers operating in 8 industries, the data analysis provides a number of practical insights. For instance, in assessing companies' business models, the importance of gaining competitive advantage through mainly a) meeting customers' requirements, and b) regular reviews to enhance the company's core competencies was revealed. With regard to companies' organisational models, the findings highlight the significance of interactions between colleagues, the company, and customers, that includes fostering innovative thinking, therefore suggesting the usefulness of adoption of I4.0 in maintaining or raising interactions to a new level.

However, most items examined resulted in scores with a mean agreement level below 4.0. This overarching finding underlines various existing gaps in adoption, organisation, and implementation. A similar outcome was noticed when examining the role of digital capabilities, the modest mean scores indicate a gap in this area. Indeed, all items surveyed, including one assessing companies' digital strategy's embeddedness in their business strategy were below the level of agreement, or below 4.0. Further in line with the above results, the brand experience section also points to areas for future improvement or consideration including, but not limited to, having clear brand identity guidelines, or dedicated channels to communicate companies' brand stories. Unsurprisingly, participants' responses concerning the level of perceived reliability in providing high quality solutions among their customers and partners are also below agreement level.

The quantitative results, therefore, identify numerous current gaps at organisational and technological levels that are preventing companies from fully benefitting from the potential advantages of I4.0 adoption. More importantly, the findings also illustrate that, regardless of their level of I4.0 adoption, companies need to make needed enhancements at different levels to enhance their future competitiveness.

The above results are supported and complemented by the qualitative data collected among 101 managers involved across 8 industries.

First, there is a strong perception that I4.0 can enhance systems, improve a business's performance, including through more efficiency, speed, and even increase sales. **Second**, one perceived threat is the lack of embracing I4.0, especially as numerous other companies, regions, and nations are jumping onto the I4.0 bandwagon, and by doing so, increasing their competitiveness. This adoption of technology threatens that of other companies where I4.0 is still under-developed or inexistent. **Third**, observations concerning external support include the alleviation of bureaucratic procedures, allowing companies to embrace I4.0 in a speedier and prompter manner. Among other observations, internal support needs stronger knowledge, expertise, and understanding from those leading industry associations.

Fourth, and in line with observations associated with the opportunities of I4.0, through its adoption, companies can add significant value. Moreover, the comments ascertain that the uptake of technology supporting purchasing systems, automation, or operation management software, contributes towards companies' efficiencies, and capability maximisation, enhancing their productivity. **Fifth**, participants' comments underline the role of managers and their organisation in providing guidance and training to staff in preparing for the new regime, where technology-based I4.0 routines will inevitably become more critical for companies' operations. Clearly, embracing complexity while introducing new technologies can, by extension, present obstacles, and resistance, creating anxiety and other negative reactions among staff. Thus, educating, reassuring, and inculcating the appropriate message concerning the benefits of upskilling and absorbing new I4.0-related knowledge is imperious for many companies to proceed.

Finally, participants' comments underscore different ways in which I4.0 can assist businesses in adapting and coping with the impacts of COVID-19. On one hand, I4.0's adoption during COVID-19 appears to be 'a road of no return' for many businesses. Digital transformation, for instance, is considered as an extremely effective tool to enable the manufacturing industry to enhance performance and contribute to companies' competitiveness even under extreme circumstances or events. With the increasing competitiveness in production and performance, this report offers useful practical insights to different key stakeholders of the I4.0 phenomenon, including industry players, government bodies, and educational institutions.

Based on the findings, the study provides various recommendations. First, the potential of I4.0 to improve businesses' practices, including improvements to customers' experiences, human resource management, and other forms of streamlining business processes suggests the crucial value of this phenomenon, and the importance for companies to embrace it and nurture it. Second, there are clear challenges for businesses in the form of human and financial resources. While governments cannot fill in for all the current gaps and limitations; the government's facilitation of I4.0 uptake, through training courses and workshops to enable knowledge dissemination, could be considered. Third, the extension of I4.0 uptake in years to come calls for more involvement among educational and training institutions and entities to provide more hands-on learning experiences to future managers and business owners.



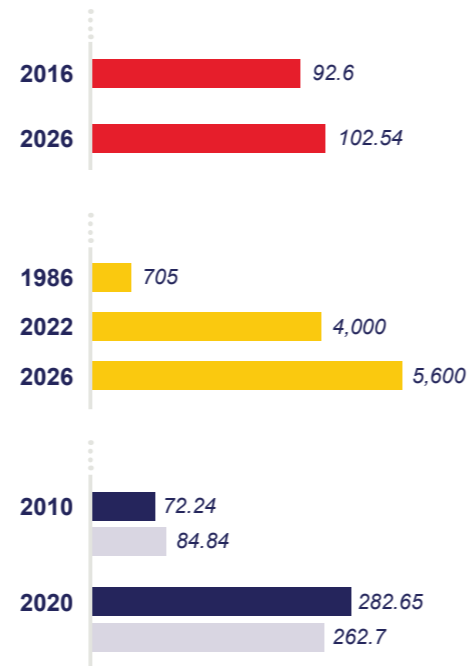
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Vietnam - Brief country background

Figures from Statista, partly collated from other sources (e.g., Vietnam's authorities, International Monetary Fund (IMF), World Bank (WB), and World Trade Organisation (WTO), illustrate significant economic growth potential.

First, while Vietnam's population is nearing 100 million people, from 92.6 million in 2016 to a projected 102.54 million in 2026 (Statista, 2022a), unemployment has been kept under three percent for several decades (Statista, 2022b).



Second, gross domestic product (GDP) per capita has experienced a steady and important increase over the decades, from US\$ 705 in 1986 to almost US\$ 4,000 in 2022, with a forecasted growth of over US\$ 5,600 by 2026 (Statista, 2022c).

Third, exports have increased in value, from 72.24 billion US\$ in 2010 to 282.65 billion in 2020 (Statista, 2022c), while imports have increased from US\$ 84.84 billion to US\$ 262.7 billion in the same time period (Statista, 2022d).

Like most nations, Vietnam faces a number of challenges. For instance, Walsh et al. (2021) cite an underperforming public sector, low productivity across its economy, or an under-developed technological application in production. In addition, the informality of Vietnam's economy accounts for as much as 56 percent, excluding farming activities (IMF, 2021). Economic informality or the 'shadow economy' entails those activities concealed from public authorities due to various reasons that include the avoidance of:

- a) payments of value added- as well as other taxes, income, social security contributions,
- b) meeting certain standards deemed as legal labour (e.g., safety standards, maximum working shifts, minimum salaries), and
- c) compliance with administrative procedures (e.g., statistical surveys, other administrative forms) (Schneider, 2005).



Despite these challenges, the overall figures documenting Vietnam's decade-long economic growth could also have, both directly and indirectly, implications for the future development of I4.0.





The I4.0 phenomenon - Definition

Oberer and Erkollar (2018) refer to I4.0 as the fourth industrial revolution, which entails the rapid transformation of products, components, and manufacturing systems, particularly in their service, operation, implementation, or design. Thus, I4.0 represents a disruptive paradigm, which challenges existing manufacturing philosophies regarding knowledge-intensive industrial processes, where manufacturing becomes smarter, more effective, and flexible (Oberer and Erkollar, 2018). More specifically, I4.0 is driven by nine pillars associated with technology advances: The Industrial Internet of Things (IIoT), horizontal and vertical system integration, cybersecurity, simulation, the cloud, autonomous robots, additive manufacturing, big data and analytics, and augmented reality (Rüßmann et al., 2015). In essence, I4.0 is an all-embracing paradigm, which comprises numerous firm-related dimensions, such as technological, financial, organisational, and managerial (Agostini and Filippini, 2019).

■ The growth of I4.0

Originally an initiative from Germany's government to promote automation within the manufacturing industry (Oberer and Erkollar, 2018), I4.0 is growing exponentially (Ghobakhloo, 2020). This growth is illustrated by a significant increase in the number of I4.0-related reports and scholarly contributions in recent years, including investigations focusing on emerging economies (e.g., Cezarino et al., 2019; Koilo, 2019; Luthra and Mangla, 2018). More recently, research has examined the different technologies, ideologies, varying levels of application and maturity that are part of I4.0 in the manufacturing industry (Zheng et al., 2021).

Mirroring this rise in industry and academic interest, the I4.0 phenomenon has gained in significance and has also been studied within the context of Vietnam. At a government/industry level, a report attributing the views of various experts (Ministry of Construction, 2022a) indicates that, compared to low-middle-income nations, Vietnam is in a better position to make gains from I4.0 and breakthrough development. Partly illustrating this potential, Vietnam's Internet usage is among the world's highest 20 nations, with 70 percent, well above the global average of 51 percent (Ministry of Construction, 2022b). Further, 45% of Vietnam's population uses smartphone technology, ranking 15th in the world (Ministry of Construction, 2022b). Available data suggest important developments in Vietnam's I4.0 area, for example, in the e-commerce industry, an outgrowth of I4.0 (Gao and Xu, 2021, 2020). In 2012, e-commerce revenue in Vietnam represented US\$ 0.7 billion, and, in 2020, US\$ 11.8 billion (Statista, 2022f). Furthermore, in 2021, the size of the internet economy in Vietnam was US\$ 21 billion (Statista, 2022g).

Despite this optimistic outlook, several challenges threaten the full exploitation of I4.0's potential. First, there is a need of at least 400,000 individuals with skills and qualifications to undertake the digital transformation; currently, training programs for individuals involved in the information technology (IT) industry have yet to meet the development needs of Vietnam (Ministry of Construction, 2022b). Citing a survey carried out by Vietnam's Institute for Information and Communication Strategy, the report by the Ministry of Construction (2022b) underlines that as many as 70 percent of IT graduates need to be retrained to be able to address the demands of businesses; this void is especially obvious in computer programming (80%). Thus, there are calls for the education sector to play a central role in adapting and in updating general education, thereby strengthening the quality of teaching in digital culture and skills and paving the way for Vietnam's digital transformation (Ministry of Education and Training, 2022). In

addition, based on conclusions by the International Labour Organisation (ILO), there are fears that, for instance, one component of I4.0, artificial intelligence, could actually lead to redundancies in various fields (e.g., retail, agriculture, apparel) through job automation (Ministry of Construction, 2022b).

At an academic level, Pham-Duc et al. (2021) found that the number of publications has steadily increased, with the main I4.0 research themes being artificial intelligence, the Internet of Things (IoT), data mining, neural networks, and machine learning. Among other authors, Nguyen and Luu (2020) surveyed 415 small and medium enterprises (SMEs) operating in the city of Ho Chi Minh on factors affecting the adoption I4.0. Their findings revealed a positive effect between actual SME I4.0 adoption, adoption intention, and perceptions of improved firm-customer relationships. In their examination of the usage of advancing technologies, and in particular 3D printing in the Vietnamese transportation industry, Akbari and Ha (2020) highlight the opportunities for positive disruptive changes, yet also recognised limited future investments.

A 2017 survey of 188 respondents from companies operating in Vietnam (Price Waterhouse Coopers, PWC, 2018) illuminates fundamental aspects related to I4.0. For instance, respondents do not appear to understand the impacts of I4.0. However, they estimate that significant upskilling will be required, which, in turn, will affect ways of operating, their organisation, and will personally benefit them (PWC, 2018). Respondents also perceived improved access to customers and operational efficiency, mainly as a result of integration and digitisation of value chains (PWC, 2018). In terms of the challenges in adopting I4.0, the results of the survey indicate insufficient skills, concerns of data privacy and security, alongside the lack of digital standards and data analytics capabilities. In addition, respondents expected significant expenditures in automation and digitisation within the next five years (PWC, 2018).

Regarding the implementation of I4.0, there was a perception that the organisation's management needed to take the lead; this lead was to be complemented through government's involvement, and through collaboration between private organisations, industry, and government bodies (PWC, 2018). Likewise, a Hong Kong Productivity Council Report into Vietnam (HKPC, 2019) further suggested that, while there is much room for growth, the Vietnamese government has invested in 'Hi-Tech' parks as hubs in major cities to connect research and development, attracting foreign technology firms to setup bases in the country. The subsequent development of training centres and technology parks have created a means to upskill and futureproof the workforce (HKPC, 2019).

Nevertheless, Pham-Duc et al. (2021) acknowledge that, when compared to data on a global scale, the yearly growth rate of I4.0 research was lower in Vietnam. More broadly, Dalenogare et al. (2018) assert that "little is known about how industries see the potential contribution of the I4.0 related technologies for industrial performance, especially in emerging countries" (p. 383).

Thus, there is potential for exploring different aspects that would inform industry and government stakeholders, as well as the research community. This report makes an additional and timely contribution to extant research. The report will shed more light on the I4.0 phenomenon focusing specifically on Vietnam. Moreover, the report will shed light on crucial aspects that include perceived strengths and challenges of I4.0 uptake, companies' adaptation process, and how I4.0 is helping companies to cope with the challenges of COVID-19 from the perspective of managers of businesses operating across Vietnam.



Methodology

To study the I4.0 phenomenon in Vietnam in depth, a mixed methodological approach was chosen. A mixed methods approach enables the collection of rich qualitative information that is complemented by structured quantitative data. This approach provides depth and robustness in the methodological process and its subsequent analysis, allowing the strengths of both methods to support the achievement of research objectives (Bell et al., 2022). The qualitative approach entails a subjective element; it enables interactions between researchers and respondents, which, in turn, allows for gaining greater details and more in-depth enquiring of issues (Nykiel, 2007). Thus, the role of the researcher is pivotal, collecting data, gathering information, viewing the settings, and constructing realities through her/his eyes or years (Lichtman, 2010). Through qualitative observation, researchers “can understand the reason of a particular response...” (Gramatikov et al., 2010, p. 47), thus, gaining “deeper knowledge of the researched phenomena” (Gramatikov et al., 2010, p. 47). Thus, qualitative research allows for a more in-depth and rich understanding of the issues being investigated (Dworkin, 2012), focusing on the commentary and stories collected from respondents.

In comparison, quantitative research is objective in nature, where the results of quantitative analyses can be statistically reliable, and the findings might be projectable to the population (Nykiel, 2007). Quantitative researchers' role in the data analysis is more limited; for instance, they choose a statistic, which is suitable to test hypotheses, where in contrast qualitative researchers are involved in the critical tasks of interpreting, organising, and reporting their data (Lichtman, 2010). Applying quantitative research occurs through measurement, which requires the collection of different types of quantitative data, and their processing in order to address the research questions (Gramatikov et al., 2010). Thus, quantitative research only shows “how the user rates the procedure, but not why” (Gramatikov et al., 2010, p. 47), which could be addressed by qualitative research. Therefore, to complement statistical results, and to better understand the ‘how’ and ‘why’ (e.g., Dworkin, 2012), a qualitative approach is also applied.

To gather qualitative data, during June and August of 2021, the contacts of 275 businesses operating in various industries (Table 1) were identified and collected through Internet searches. Subsequently, a message explaining the goals and aims of the research project was sent to the attention of the owner/

manager of these businesses. These efforts led to the recruitment of 101 participants (36.7% response rate), and to the completion of face-to-face and online interviews during the months of September of 2021 and March of 2022. The interviews lasted between 45 and 90 minutes; the collected data were analysed using various tools, including content analysis, which entails “a consistent set of codes to designate data segments that contain similar material” (Morgan, 1993, p. 114). Content analysis allows the research team to identify consistent themes that are emergent from the data, revealing the prevalent issues that respondents have highlighted (Coughlan, Lycett, and Macredie, 2003).

In addition, the study quantitatively gathers the views of business owners/managers across Vietnam. Consequently, a survey was developed in consultation with a partnering organisation, whose interests aligned with those of the research team. To further guide in developing the content of the survey, various academic contributions discussing aspects of I4.0 were consulted (e.g., Arnold, Kiel, and Voigt, 2016; Bai et al., 2020; Ciano et al., 2021; Dalenogare et al., 2018; Ibarra, Ganzarain, and Igartua, 2018; Lasi et al., 2014; Müller and Däschle, 2018; Müller, Kiel, and Voigt, 2018). During August and September of 2021, the contacts of an additional 1,527 businesses were gathered using various company databases and Internet searches. These firms were operating in eight different industries (Table 1); efforts were made to recruit a similar number of companies operating in these industries.

As with the qualitative data collection process, invitations were sent to the attention of company owners/managers through email correspondence. In outlining the goals of the study, recipients were presented with a link to an online survey and invited to complete it. The online survey link remained active between October of 2021 and February of 2022. During this period, 503 useable responses were gathered, a 32.9 percent response rate. The questionnaire used 5-point Likert-type scales where participants were to rank their perceptions. In terms of agreement, for instance, 1= strongly disagree, 2= disagree, 3= neither agree nor disagree, 4= agree, and 5= strongly agree. To analyse the data, the software SPSS was used to run different statistical tests and descriptive results. Table 1 provides a summary of the descriptive data pertaining to the participants and their firms.



Results

Demographic characteristics of the participants and their companies

Quantitative data – 503 respondents

Table 1 shows that more than half of the participating firms are owned privately, with joint stock and government firms being a distant second and third, respectively. A similar number of firms operate in each of the eight selected industries. Arguably, there may be some overlap in the activities some industries undertake, including exports/imports (international business), manufacturing, hospitality/tourism, and finance and banking. The majority of the participating firms (64.4%) employ 50 or more staff, and almost half (47.7%) are involved in international business activities, including imports/exports, and collaborative relationships.

Type of firm	n=503	%
Private enterprise	263	52.3
Joint stock company	149	29.6
State-owned company	62	12.3
Foreign investment enterprise	19	3.8
Training institution	10	2.0
Industry in which the firm operates	n=503	%
Education	63	12.5
Finance and banking	61	12.2
IT-Technology	64	12.7
Manufacturing	64	12.7
Medical/Health care	62	12.3
Real estate	64	12.7
Hospitality/Tourism	64	12.7
International business (exports, etc.)	61	12.2
Size of the firm (in full-time employees)	n=503	%
1-9	38	7.6
10-49	141	28.0
50-249	180	35.8
250 and above	144	28.6
Whether the firm is involved in international business (e.g., exports, etc.)	n=503	%
Yes	240	47.7
No	263	52.3
Location of the firm	n=503	%
Hanoi	186	37.0
Da Nang	79	15.7
Nghe An	69	13.7
Binh Dinh	49	9.7
Ho Chi Minh City	22	4.4

Vung Tau	19	3.8
Other (multiple regional locations)	79	15.7
Role of the participant	n=503	%
Manager	485	96.4
Owner	18	3.6
Experience in the industry (years)	n=503	%
Less than 2 years	37	7.4
Between 2-5 years	159	31.6
Between 6-10 years	173	34.4
11 years or more	134	26.6
Gender of the participant	n=503	%
Male	258	51.3
Female	245	48.7

Figure 1 – Location of the participating firms





Over one-third of the participating firms are located in Hanoi, with other cities also being the home of many firms, thus, illustrating the diverse geographic setting of the participating firms (Figure 1). Regarding the respondents, almost the entire sample (96.4%) are managers; 61 percent have at least six years of industry experience, and a similar percentage of males and females partook in the research.

Figure 2 provides a visual display of the spread of responses from males and females across 8 industries. Broadly, the gender spread of respondents is relatively balanced with 'tourism, hospitality, food and beverage (F&B)' and 'real estate' having a greater male response rate, with 'manufacturing, importing and exporting' displaying more female respondents.

Figure 2 – Gender of respondents in different industries

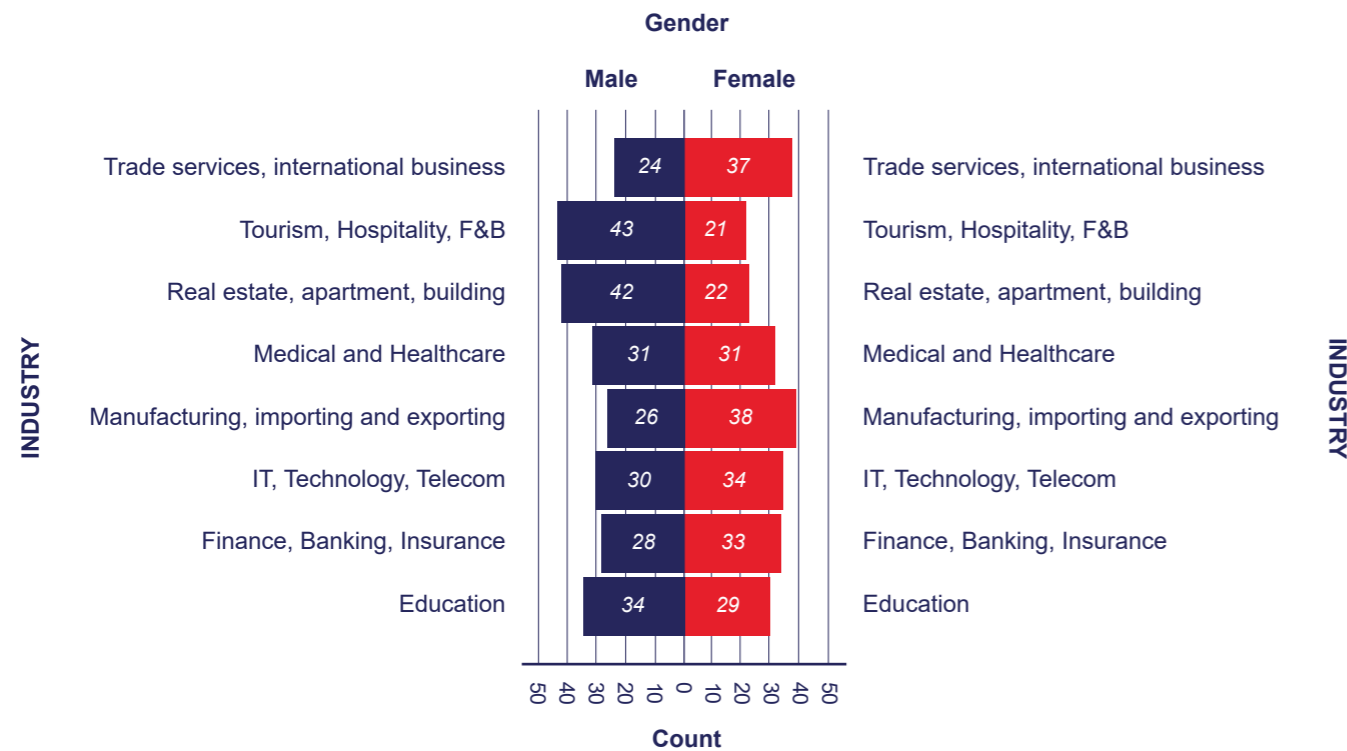


Figure 3 displays the spread of internationally focused businesses against those that were focused on the local marketplace split by the different industries. In particular, the medical and healthcare industry, has a greater proportion that is focused on local businesses, where sensibly, the tourism, hospitality and F&B industry has a greater number with an international dimension.

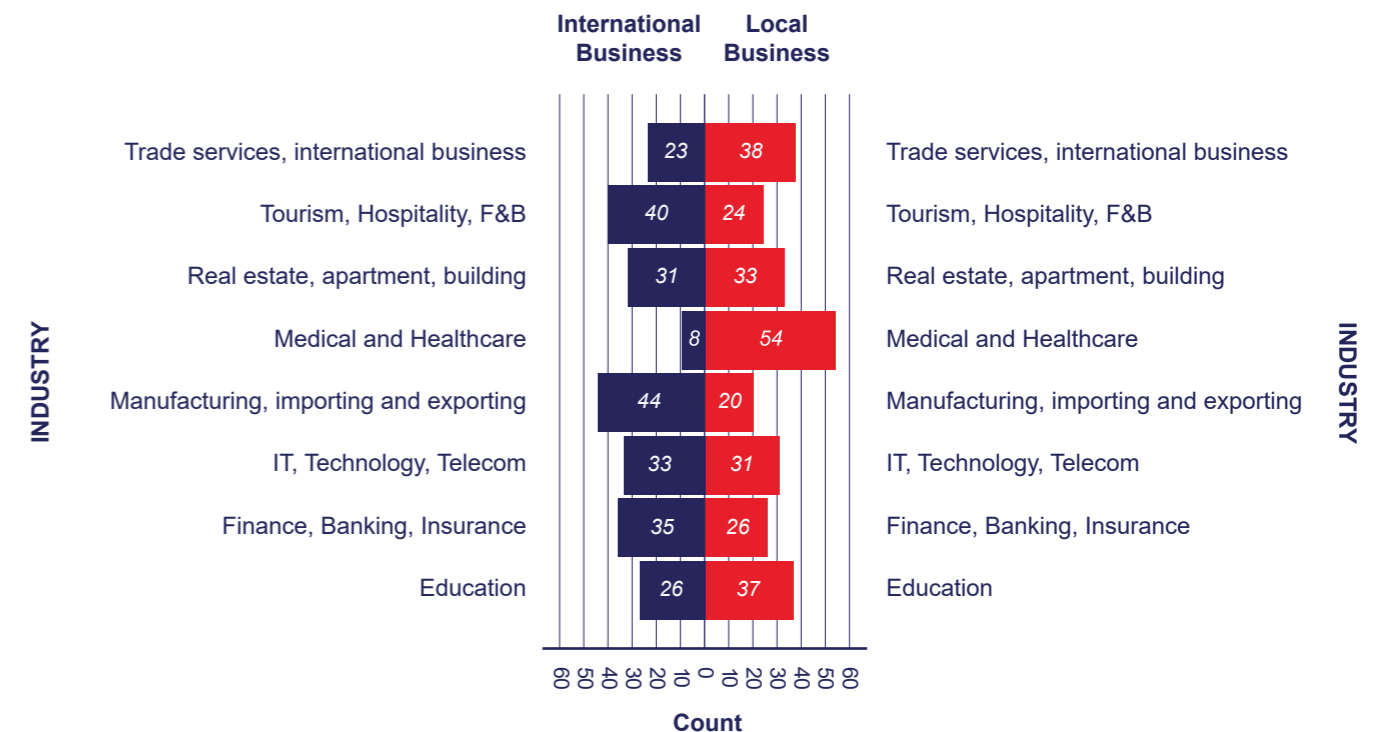
Quantitative data analysis

Business model-related items

The first section of the analysis is comprised of aspects related to companies' business model in the context of I4.0 (Tables 1-7). Müller and Däschle (2018), explain that, by combining the extended integration of product, customer, and employee users, as well as production facilities that are technologically perfected, I4.0 can support the development of a new business model. Furthermore, Arnold, Kiel, and Voigt (2016) suggest that one component of I4.0, the IIoT, can have significant impacts on firms' business models, including among manufacturing firms.

Ibarra et al. (2018) posit that, in order to embrace the emergence of I4.0 through digitalisation, firms' innovation processes must consider, among other aspects, a) enhancing customer relationships, b) optimising external and internal processes, c) developing smart services and products through disruptive business models, and d) designing new value networks. In an SME setting, Müller, Buliga, and Voigt (2018) identified the effects of I4.0 on three business model facets of manufacturing firms: value offer, capture, and creation. These facets have direct implications for firms' competitive advantage. According to Davies, Coole, and Smith (2017), maintaining competitive advantage into the future is the true incentive for firms "to maintain the manufacturing function as a strategic enabler to meet the diverse needs of an increasingly complex customer base" (Davies et al., 2017, p. 1294).

Figure 3 – Spread of international and local business in different industries



The following analysis selectively focuses on items where participants were most in agreement. In various instances, linkages with part of the I4.0 literature above, including but not limited to customer relationships, value, competitive advantage, and digitalisation emerged. First, as shown in Table 1, when it comes to gaining competitive advantage, participants almost equally agree with the importance of meeting customers' requirements (mean=4.07), and with that of regular reviews to improve core competencies (mean=4.06).



Table 1: Business model - My company gains competitive advantage through:	Mean
Meeting the requirements of customers.	4.07
Regular reviews to improve our core competencies.	4.06
Regular sharing and collating of holistic insights to enhance and develop organisational knowledge and know-how, hence enabling greater value creation for customers.	3.87
Offering product promotions and discounts to customers.	3.55

Second, and similarly, they seem to agree with working alongside customers to develop more holistic/customised solutions (Table 2, mean=3.88). Along these lines, the mean scores are also close to the level of agreement concerning the recruitment of talent, with induction processes designed to immerse new employees into the company's culture (mean=3.80) and having formal processes to evaluate staff's competency or discuss growth within the company with staff (mean=3.78).

Table 2: Business model - What is your current negotiating power with customers?	Mean
We work closely with customer to develop more holistic and customised solutions for them.	3.88
We command strong influence in the industry and with customers. As such, we are consulted on industry insights and enjoy strong customer loyalty.	3.76
Our products and services are very price-sensitive and as such, we need to compete on price to maintain our customer base.	3.51
While we enjoy good customer relationship, our customers are price-sensitive and may switch to cheaper options offered by competitors.	3.46

Additional aspects linked to the participating companies' business model scored near the agreement level (Table 3). For instance, participants viewed favourably strategic plans to enable members of staff to understand their company's purpose/goals in the near future (mean=3.79).

Table 3: Business model - When my company sets goals:	Mean
My organisation has formulated strategic plans to ensure staff on all levels understand the company's purpose and goals for the next 3-5 years.	3.79
My organisation has set and reviewed 3-5 year strategic goals but participation is limited to the top and middle management.	3.74
My organisation operates on direct instructions from immediate superiors. Activities are not linked to strategic goals but are directed from top-down instructions.	3.43
My organisation has established goals but they are only shared at the top management level.	3.27

While overall close to the agreement level regarding the potential to collaborate with suppliers and create solutions for their customers (mean=3.79), managers' perceptions also denote partial gaps (Table 4). First, the almost neutral view (mean= 2.83) that the companies do not collaborate with partners/suppliers in developing products/services denotes an area for potential improvement. Further analysis reveals that 101 participants (20.1%) agree and 47 (9.3%) strongly agree with their company's lack of collaboration.

Table 4: Business model - Our current negotiating power with suppliers is:	Mean
Most of our suppliers are open to collaborate with us to enhance solutions for our customers.	3.79
We have some regular suppliers and our negotiation power is dependent on purchasing volume.	3.63
We lead and define the terms of engagement in our partnership with partners and suppliers. We receive more invitations from prospective partners to collaborate than we can commit to.	3.56
We do not collaborate with partners and suppliers to develop products or services.	2.83

Favourable views emerged with regard to expansion/evolution of the company's product/service portfolio, positive impacts (e.g., in revenue/profitability, enhanced customer loyalty). As Table 5 illustrates, these impacts could be tracked digitally (mean=3.77), as well as in terms of increasing opportunities for internal groups to cross-sell services (mean=3.74). Nevertheless, almost one-third of the participating managers (162, 32.2%) perceive the existence of increased competition among the company's departments (mean=2.74), which results in a detrimental cannibalising process.

Table 5: Business model - The expansion and evolution of product and service portfolio of my company result in:	Mean
Positive impact on revenue, profitability and customer loyalty that can be tracked digitally through our sales and customer data.	3.77
Increase opportunities for upselling and cross-selling, leading to greater revenue.	3.74
A proliferation of products and services resulting in additional stress on internal resources and greater confusion.	3.21
Increased competition amongst departments, creating a cannibalising effect on existing products.	2.74

In terms of future capabilities and strategic acumen, the findings also suggest areas for future improvement and building critical mass (Table 6). Moreover, compared to the means that are close to the agreement level (4.0), the item "My organisation has the capacity to scale up its operations as we have capable leadership, ability to innovate, proper and scalable processes (digital and non-digital), adequate financial reserves/resources" (mean=3.67) underlines a further need to strengthen the current business model. At the other end, lack of resources is a prevailing barrier, as demonstrated by the number of responses agreeing (128, 25.4%) or strongly agreeing (57, 11.3%) with this statement.

Table 6: Business model - When it comes to scaling or international growth:	Mean
My organisation has the capacity to scale up its operations as we have capable leadership, the ability to innovate, proper and scalable processes (digital and non-digital), and adequate financial reserves/resources.	3.67
My organisation has capable leadership and talent to support an expansion of business locally and overseas.	3.64
Although my organisation has adequate internal financial resources, the leadership in my organisation has not developed or articulated a roadmap for expansion.	3.14
My company does not have enough resources and the processes to consider further expansion locally or overseas.	2.95

Similarly, the mean allocated to the item "My organisation has capable leadership and talent to support an expansion of business locally and overseas." (3.64) implies opportunities for future strengthening. Another area for potential improvement concerns 'my company develops new products/services based on...' Here, 'analysing sales data/market trend studies (mean=3.60), and 'analysing customer data using digital tools/processes (mean=3.54) denote a gap that companies should consider addressing as the I4.0 phenomenon increasingly becomes commonplace in their industry (Table 7).

Table 7: Business model - My company develops new products/services based on:	Mean
Analysing sales data and market trend reports.	3.60
Analysing customer data using digital tools and digital processes on the usage of our products & services, customer feedback as well as inputs from our customer-facing colleagues through regular internal product review sessions.	3.54
Matching our competitors' range of products and services.	3.47
Spontaneous response to a market condition change.	2.70



• **Organisational model**

This section, illustrated in Tables 1-3, highlights the importance of such aspects as internal collaboration, sharing knowledge/information, or organisational change that, together, could facilitate the process of introducing and maximising the potential of I4.0. Agostini and Filippini (2019) proposed a framework illustrating the organisational and managerial context, which applies in this case, in a firm's pathway toward embracing I4.0. Three dimensions emerged: 1) human resources, which includes employees' skills, organisational support, training, and internal social capital; 2) supply chain, where information is integrated and open innovation encouraged; 3) firm processes, with lean management and continuous improvement being some of the key elements (Agostini and Filippini, 2019). Therefore, I4.0's focus is beyond technology adoption and implementation to also include a range of managerial and organisational practices that are vital in facing the fourth industrial revolution (Agostini and Filippini, 2019).

A literature review undertaken by Lenart-Gansiniec (2019) identifies the strong relationship between organisational learning and I4.0, in stimulating the acquisition, usage, development, and transformation of new knowledge, all elements that are vital in implementing I4.0. Organisational support from a firm's management is therefore crucial in this implementation process (Lenart-Gansiniec, 2019). Managerial support could encourage members of staff to engage in innovative activities, seeking solutions to existing problems, including regarding the use of I4.0 (Lenart-Gansiniec, 2019). In addition, when a common knowledge framework is developed within the organisation, behaviour towards issues the organisation encounters, common meaning, and its associated consistent interpretation could also be developed (Lenart-Gansiniec, 2019). Further, with employees' cooperation and by working in teams to solve problems, decision-making processes could be accelerated, thereby enabling the implementation of innovation while facilitating learning (Lenart-Gansiniec, 2019).

The results align with some of the points brought forward by the above authors. More specifically, the analysis highlights the importance of managers' interactions with other colleagues, both beyond work-specific duties, as well as those centred around work, in nurturing an innovative and problem-solving culture. The mean score (3.80), near the agreement level, demonstrates the important role of the organisation, in providing an environment of collaboration and knowledge managements. Similarly, participants' perceptions were near the agreement level (Table 1) regarding the significance of the firm's employees, in voicing opinions or sharing ideas (mean=3.80).

Table 1: Organisational model – Where can you find those shared information and insights?	Mean
My organisation has collaboration and knowledge management platforms that not only facilitate systematic sharing of key work-related documents, but also promote company corporate culture and sharing of inspirational messages/stories.	3.80
My organisation has relevant platforms/channels to facilitate the sharing of documents and work-related processes.	3.78
Information is shared verbally and informally. There is no systemic documentation to capture institutional information about the company and its interactions with its clients.	2.73
I am not sure how to access information about the company to support my work.	2.60

Similar scores were revealed regarding the processes in place for employees to submit ideas, implement, and monitor those ideas' effectiveness (Table 2, mean=3.74). A closer look at the lowest mean scores in both Tables 1 and 2 identifies potential areas of improvement and the need for company managers to be attentive. For instance, regarding the item 'There is no systemic documentation to capture institutional information about the company and its interactions with its clients. Information is shared verbally/informally.' One-third of participants indicated their level of agreement (24% agree, 9% strongly agree). Additionally, 28.5 percent of the participants adhere to the statement 'I am not sure how to access information...', with 102 (20.3%) selecting 'agree', and 41 (8.2%) 'strongly agree.' 99 managers (19.7%) also selected 'agree' and 39 (7.8%) 'strongly' agree when assessing the item 'No action is taken on ideas raised.'

Table 2: Organisational model - How do you know if your ideas or your team's ideas are put into practice?	Mean
My organisation has a clear process for staff to submit ideas and ideas implemented are tracked for effectiveness.	3.74
My organisation encourages ideas by creating a channel for different departments to contribute and provide feedback on ideas raised.	3.74
Ideas that are raised do not get implemented systematically.	2.93
No action is taken on ideas raised.	2.60

Other areas associated with companies' organisational model vis-à-vis the potential for embracing I4.0 demonstrated further gaps. Table 3 shows a tendency among participants to settling for modest responses, and, consequently, to modest means, while the bottom items accumulated between 26-29 percent of responses in the agreement level:

- 'My work rarely requires me to interact with anyone in my organisation.'
- 'I do not have any internal and external channels to help me to resolve conflict that I face at work.'
- 'I rely on external support outside of my office to help resolve conflicts...'
- 'I am not aware of any review processes.'
- 'My department is cautious of the other departments...'
- 'Sharing is not generally practised in the organisation.'
- 'The top management is resistant to change...'

Table 3: Organisational model – Sharing with one's colleagues:	Mean
Interactions with colleagues extend beyond specific job duties. Exchanges include experiences with customers and personal reflection. This contributes to the company's culture and nurtures innovative thinking.	3.88
Interactions centre around work and how to cooperate to solve problems together.	3.80
Interaction is purely on work tasks.	3.36
My work rarely requires me to interact with anyone in my organisation.	2.56
Organisational model - When there is conflict at work, I tend to:	Mean
I am comfortable raising them as the organisation has a culture that encourages individuals to discuss conflict matters and find a joint resolution.	3.71
I look for support and resolution of issues through accessible institutional channels designed for conflict management.	3.55
I do not have any internal and external channels to help me to resolve conflict that I face at work.	2.64
I rely on external support outside of my office to help resolve conflicts and challenges faced.	2.63



Organisational model - Reviewing process of doing things is:	Mean
There are institutionalised processes for departments to review their work processes and they are regularly practised. We use digital tools and data to review the efficiency of improvement practices.	3.67
A review of work processes is encouraged but not institutionalised and as such, it is practised by some departments and not all.	3.08
A review of work processes is done when problems are identified and solutions are required.	3.06
I am not aware of any review processes.	2.67
Organisational model - My company guidebook aims to:	Mean
Provide staff with reliable information and encourage teamwork and collaboration.	3.82
Educate staff about the purpose of the company, inspire them to contribute and enable them to relate their work activities to the organisational purpose. The guidebook promotes the culture of sharing and innovation.	3.77
Provide essential policy information to staff on how to operate and what is expected of each staff in terms of performance.	3.76
There is no such guidebook.	2.61
Organisational model - When do you share with your colleagues? (e.g., beliefs, interests, working style, thinking process, etc.).	Mean
The organisation has institutionalised channels and sessions scheduled annually to nurture sharing.	3.69
Beyond institutionalised sharing sessions and organised activities, our corporate culture encourages us to share freely beyond job roles. Staff initiate activities on their own to promote sharing.	3.68
Sharing is done on an informal basis, such as during lunch and after work.	3.23
Sharing is not generally practised in the organisation.	2.71
Organisational model - What is the current decision making process in your company?	Mean
Staff are encouraged to provide ideas and opinions of a possible decision. Once the top management makes a decision with inputs from the ground, staff are committed to implementing the new decisions.	3.80
Decision-making in my organisation is a very involved process that takes into account staff suggestions, market data and internal buy-in. Key follow-through actions are documented to ensure that a decision is implemented.	3.70
Decision-making is not binding and hence even when a decision is taken, steps are not made to ensure compliance with the decision made.	3.05
Decision-making process is limited to the top echelons of the organisation. Feedback from the ground is not sought.	2.82
Organisational model - What is your management's ability to shape organisational change?	Mean
The top management of my organisation is open to changes and suggestions from different levels of the organisation. This approach is adopted to ensure that the company remains vigilant/relevant.	3.72
Changes in the organisation must be initiated from the top level of the echelons.	3.34
The top echelon is relatively conservative and not open to changes. The culture of the organisation is so entrenched that management is unable to shape it.	2.81
The top management is resistant to change and there is a generally inertia towards change in the whole organisation.	2.73
Organisational model - In my opinion, I feel that:	Mean
My department has no problem accessing information from the other departments.	3.62
My department has no problem working with and receiving support from the other departments.	3.59
My department works in silo, isolated from the other departments.	2.77
My department is cautious of the other departments and avoids interactions with other departments.	2.72

Even more concerning are the results of other statements, where a level of agreement between 30 and 36 percent agreement was noticed.

- 'The top echelon is relatively conservative and not open to changes. The culture of the organisation is so entrenched that management is unable to shape it.' 32 percent of participants' responses fall within the agree and strongly agree level.
- 'My department works in silo, isolated from other departments' (31% agree/strongly agree).

The apparent inconsistencies in the ways in which a company's organisational model is perceived highlight a cautionary note. Moreover, the fact that agreement scores ranged between 27 and 37 percent underscores the need for companies to flag and further analyse these responses.

If left unaddressed, many companies could be sending the 'wrong message' to their staff, for instance, failing to emphasise or reinforce sufficiently such key areas and organisational behaviours as openness, collaboration, idea, or knowledge-sharing, delegating duties/tasks, or even sufficient support to resolve complex situations. Failure to address these issues could be extremely detrimental to companies' competitiveness and future development.

• **Digital capabilities**

This section of the analysis provides practical insights into the role of digital strategy in helping transform participants' firms. As depicted by Table 1, participants' perceptions of digital strategy as a key integral part of their companies' strategy or concerning the company's know-how in digital capacity and technical skills to support digital marketing activities were close to the agreement level (mean=3.71). While the last item ('We don't need a digital strategy...' scored a low mean, further analysis reveals that 28.1 percent are in agreement. Together with 140 (27.8%) who feel neutral regarding this item, in total, over 50 percent of participants do not clearly disagree, which suggests that there appears to be either limited need, or even some degree of scepticism, even resistance, in considering I4.0.

Table 1: Digital Capability - What's the role of Digital Strategy in growing your business?	Mean
Our digital strategy is embedded in our business strategy as an enabler and driver of our organisational performance; hence, my organisation has put in place a strategic digitalisation plan for the next 3-5 years involving all levels of the organisation.	3.71
Digital strategy is an integral part of our business strategy to drive certain areas of the business. Only a few key personnel and departments are involved in the briefing and roll-out of the activities.	3.57
Digital strategy comes after we have determined our business strategy, and only the IT department is involved.	3.15
We don't need a digital strategy and we don't see any relationship between digitalisation and business performance.	2.69

Table 2 shows that progress appeared to be made in the cases of some companies regarding the development of a clear vision of their digital future (mean=3.65). While overall participants tended to be more in agreement with regard to the development of a strategic initiative to be implemented in the future, 151 (30%) agreed or strongly agreed with the item 'There has been no effort to communicate any digitalisation plans'.



Table 2: Digital Capability – How do you communicate your digital strategy?	Mean
There has been detailed internal communications on the company's digital vision and strategic initiatives, covering all internal and external processes and related aspects.	3.65
My company has elaborated its digital strategy and communicated its plans to implement it internally.	3.62
It has been communicated that there are plans to digitise some processes and cut costs.	3.47
There has been no effort to communicate any digitalisation plans.	2.79

A similar outcome was initially noticed with regard to participants' perceptions (Table 3) of their company's plan to develop digital professionals or upskill existing staff (mean=3.64). However, several shortcomings appear to prevail. For instance, participants were above the neutral level when they assessed the second item ('My company doesn't have a formal process...'). Moreover, 44.5 percent of managers were in agreement (171, 34%), or strongly agreed (53, 10.5%).

Table 3: Digital Capability - When it comes to technical and professional skills to support digital business:	Mean
My company has a digital capability development plan that is aligned with our strategic road map and involves both acquiring new digital professionals as well as providing planned technical training to up-skill our existing staff's digital capabilities.	3.64
My company doesn't have a formal process to assess the staff's digital skills required for their job but supports existing staff to take up digital skills training if requested.	3.29
My company hires digital or technical professionals based on emergent needs and provides some training for existing staff to gain digital skills.	3.11
My company is not sure what technical or professional skills gaps may be limiting the success of our business goals and activities.	3.03

Participants also leant towards agreement (Table 4) concerning having a digitalisation plan to cover key processes (customer, processes) (mean=3.63). Finally, having a digitalised process (Table 4) to gather data, to organise a digital team to manage the data) was also perceived at nearly agreement level (mean=3.57).

However, as with previous sections, some of the findings invite further reflection on potential barriers that might prevent companies from successfully implementing a digital strategy. For instance, the item "My company doesn't have a formal process to assess the staff's digital skills required..." was rated slightly above the neutral level of agreement (mean=3.29), suggesting that, to some extent, there is a need for further improvements of such process. Another item ("My company hires digital or technical professionals...") only scored a mean of 3.11, which again hints at further needs in this area. Further, the item "My company has a complex digitalisation strategy...", with a mean of 3.52 again suggests some existing weaknesses or issues. In addition, the item "It has been communicated that there are plans to digitise some processes and cut costs." (mean=3.47) denotes that the digitalisation process is still under construction. In support of this finding, the neutral level of agreement (mean=3.05) regarding the item "My organisation collects data manually..." (mean=2.89) partly reveals that many organisations are still implementing this strategy.

Table 4: Digital Capability - Which statement describes the most accurately the digital future of your company and the pathway to get there?	Mean
A digitalisation plan is in place covering key customer and production processes.	3.63
My company has a comprehensive digitalisation strategy which will transform all business operations; the digital innovation strategy is known outwardly and inwardly and we have a dedicated team of project leads across the organisation.	3.60

My company has a complex digitalisation strategy to streamline particularly customer-related processes across all systems and to make them paperless and more flexible.	3.52
Plans are to implement some new digital systems to cover processes which were manual or done only with MS office tools.	3.47
Digital Capability - How is data management like in your company?	Mean
My organisation has an integrated process to collect data digitally and a sound digital storage solution to store our data assets security. We have a team responsible for managing and analysing the data to help us make real-time decisions.	3.57
My organisation has a process to collect data digitally but do not have clear processes to ensure that our data is being managed properly. We have a team responsible for managing our data but this data is not analysed.	3.15
My organisation collects data manually. The data collected are not stored in any digital database. They are mainly used to fulfil the obligations required by the institutions/the government.	3.05
My company doesn't have much digital data yet.	2.89

These last results are not surprising. In fact, contemporary research reports on the numerous barriers precluding companies from implementing a digital strategy. For instance, Raj et al. (2020) explain that both resource scarcity and the absence of a digital strategy are the two key causes preventing firms' adoption of I4.0 technologies. Raj et al. (2020) therefore conclude underlining the important role of management in developing strategic plans that would enable companies to thrive when embracing the digital revolution. These plans include a) investments in resources, and b) guiding company actions towards the transition to I4.0 (Raj et al., 2020).

- **Brand experience**

The last section of the questionnaire examined a company's brand experience in the context of I4.0, where much of the focus was on firms' customers/consumers. Bär, Herbert-Hansen, and Khalid (2018) emphasise the importance that the customer experience is gaining "in the new Industry 4.0 supply chain" (p. 747). Customer experience characterises an individual's acceptance that a product she/he purchased is value for money; it is also associated with how a customer relates to the seller or the goods, and overall, to "how they feel and trust about the relationship between the parties" (Gilchrist, 2016, p. 215). A customer's experience begins with a first-hand information process and can result in after-sales; it entails all interactions between an enterprise and a customer (Bär et al., 2018). Bär et al.'s (2018) case study investigation of a German SME led to the development of a five-step framework for I4.0 fulfillment, with beneficial impacts on firms' supply chain:

- Build a team, whose members have experts and represent all functions of the supply chain,
- Prepare the data collection process, which considers an external view (customer's perspective), and an internal view (firm's processes),
- Define optimum I4.0 realisation, for instance, regarding customers' desired experience,
- Analyse the actual status towards I4.0 fulfilment, including evaluating internal processes, revealing weaknesses, determining the actual customer experience, or identifying customer needs, and
- Derive an action plan, for instance, developing core competences in order to fully maximise I4.0 benefits (Bär et al., 2018).

Concerning IoT and customers, Gilchrist (2016) observes that leading retailers are investing significantly, adopting high-tech advertising, or in-store virtual customer experience, with lucrative returns. In the Industrial Internet environment, customers' evaluations of products "is everything" (Gilchrist, 2016). With issues surrounding intrusive marketing practices, and because the advertising of products can become as valuable as- or more valuable than- the customer experience, firms are



making attempts to redesign the latter (Gilchrist, 2016). Hence, it is sensible for firms to plan for new services or products with customers' experience in mind (Gilchrist, 2016).

Overall, the responses suggest areas for future improvement. The reliability element (Table 1), with perceptions among customers/partners that the company could deliver high quality solutions (mean=3.76), and that of being innovative and forward-looking (mean=3.68), were the items where participants' responses neared the agreement level (mean=4.0).

Table 1 - Brand Experience – What do you think is the customer perception of your brand's value?	Mean
Our customers perceive us as a reliable brand capable of providing high-quality solutions.	3.76
Our customers perceive us as an innovative and forward-looking market leader.	3.68
We are a brand of convenience, when people need us, we are there.	3.66
Our customers generally perceive us as a value-for-money brand.	3.41

In line with the above studies, the firm's dedication, and efforts in 'connecting' with customers and 'telling' its story (Table 2, mean=3.73) illustrate how businesses are seeking to enhance customers' experience. In the same vein, the mean concerning participants' confidence in the company's brand identity guidelines/documentations, and the firm's purpose (mean=3.71).

Table 2 - Brand Experience – Which material do you use to refer to when you are introducing the company to someone (customers, newcomers, suppliers, etc.)?	Mean
The organisation has dedicated brand materials (e.g. brand guidebook) and manuals (employee handbook) to help communicate the organisation's brand story internally and externally. The organisation leverages key online and social media platforms to share its message with the targeted audience.	3.73
I check directly from my immediate superior for clarification on what I can share and what information I can provide.	3.63
The organisation has clear internal brand materials to help employees understand its brand story. A dedicated team (HR/Marcom) oversees the creation and dissemination of internal brand information. These materials also clarify what and how to communicate with external parties.	3.61
There is no official guideline that I am aware of. I prepare material for external parties based on my experience and past interactions.	2.93
Brand Experience – Which guidelines do you need to refer to ensure that the brand is presented correctly visually?	Mean
The company has clear brand identity guidelines and templates that detail the connection between the organisation's visual cues and the purpose of the company.	3.71
The company has a clear corporate brand identity and guidelines and there is a specific team that oversees corporate and brand communication matters.	3.70
I refer to previously produced materials to help prepare documents for external sharing and consumption.	3.35
There are no official guidelines that I'm aware of, so each department or office will create its own materials.	2.83

Other items featuring modest means also point to a gap that company managers could reflect upon when moving forward to enhance their customers' experience (Table 3). For instance, participants' level of agreement was higher with regard to:

- The consistency of the firm's branding/messaging (mean=3.68),
- A well organised brand portfolio (mean=3.68),
- Achieved loyalty among customers, who were also ambassadors of the firm (mean=3.66),

- Consistency in the customer's service experience (mean=3.65), and
- Consistency and rigour in the firm's visual brand communications (mean=3.65).

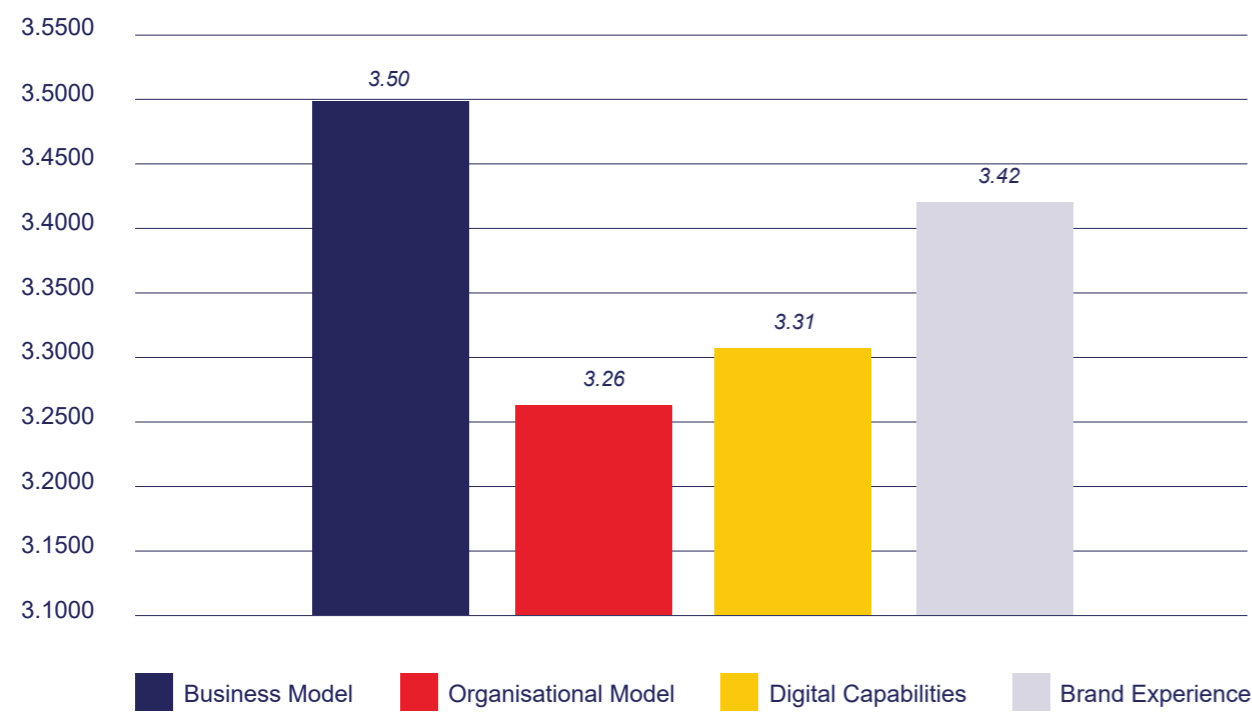
Table 3 - Brand Experience - How effective is your advertising and promotion activities?	Mean
Our branding and messaging is very consistent hence we are able to sustain the hype even after initiatives are over.	3.68
We measure the effectiveness and returns on our marketing spend. Over time many of our customers have become our brand activists because they buy into the brand message.	3.64
Our advertisement and promotion activities must include a discount component for them to be effective.	3.35
Consumers do not connect with our advertising and promotion activities.	3.04
Brand Experience - What do you think about the organisation of your brand portfolio? (including corporate brand, product brands, subsidiary brands).	Mean
Our brand portfolio is well designed and well-organised.	3.68
The organisation has a recognisable and identifiable portfolio of brands, products and services that resonates with customers and partners.	3.63
We have a wide range of brands or products and services that are not synergistically organised, customers might sometimes be confused or unaware of our offerings.	3.19
We have a disorganised brand portfolio, even internal staff may not be aware of the differences between our brands or product and service offerings.	2.99
Brand Experience - What is the relationship between your company and customers?	Mean
Our customers are loyal and have helped refer new customers to us through word of mouth.	3.66
Our customers are loyal.	3.58
Our interaction with our customers are purely commercial and driven by commercial considerations.	3.39
We have limited interaction with our customers.	2.67
Brand Experience - What do you think about the customer service experience of your company across all channels and platforms (online, offline)?	Mean
Our customer service experience has been consistent, given that information provided and collected from front-end touch-points (customer service/website) is well supported by the back end and technical staff. The company has clear service standards and generally meets expectations.	3.65
Our customer service experience is purposefully designed and engagement on the various platforms (online to offline) is seamless. The company has established clear service standards and consistently meets these expectations.	3.63
Provision of customer service is seen as a front-end service, and support from technical staff is not integrated. Hence there is no follow-through from the customer providing feedback/complaint to the actual resolution of matters raised. The company has no view of the overall resolution of customer complaints.	3.08
Our customer service experience is not consistent as service standards are not enforced diligently.	3.06
Brand Experience - Do you see any inconsistency in how the brand is presented?	Mean
Visual brand communications (internal and external) are consistent and rigorously vetted for standardisation.	3.65
Visual brand communications (external) are generally consistent.	3.64
Visual brand communications are managed separately by departments and may not be applied consistently.	3.10
I do not perceive consistent visual brand communication as an important aspect of how I deliver service to my customer.	3.01



Figure 4 provides an overview of the current state of progress and priorities of businesses in Vietnam, examining collectively the thematic areas of business model, organisational model, digital capabilities, and brand experience. Examining these areas, business model as a whole has greater levels of agreement and implementation followed by branding experiences. In terms of I4.0, while there is agreement in digital capabilities, there is still strong potential and avenues for growth in this spectrum. Likewise, it may require organisational model changes and greater focus placed here in order to create synergies across the different areas to enhance the adoption of I4.0. In this regard, several items that scored modest means suggest the need to be further reflected upon, including:

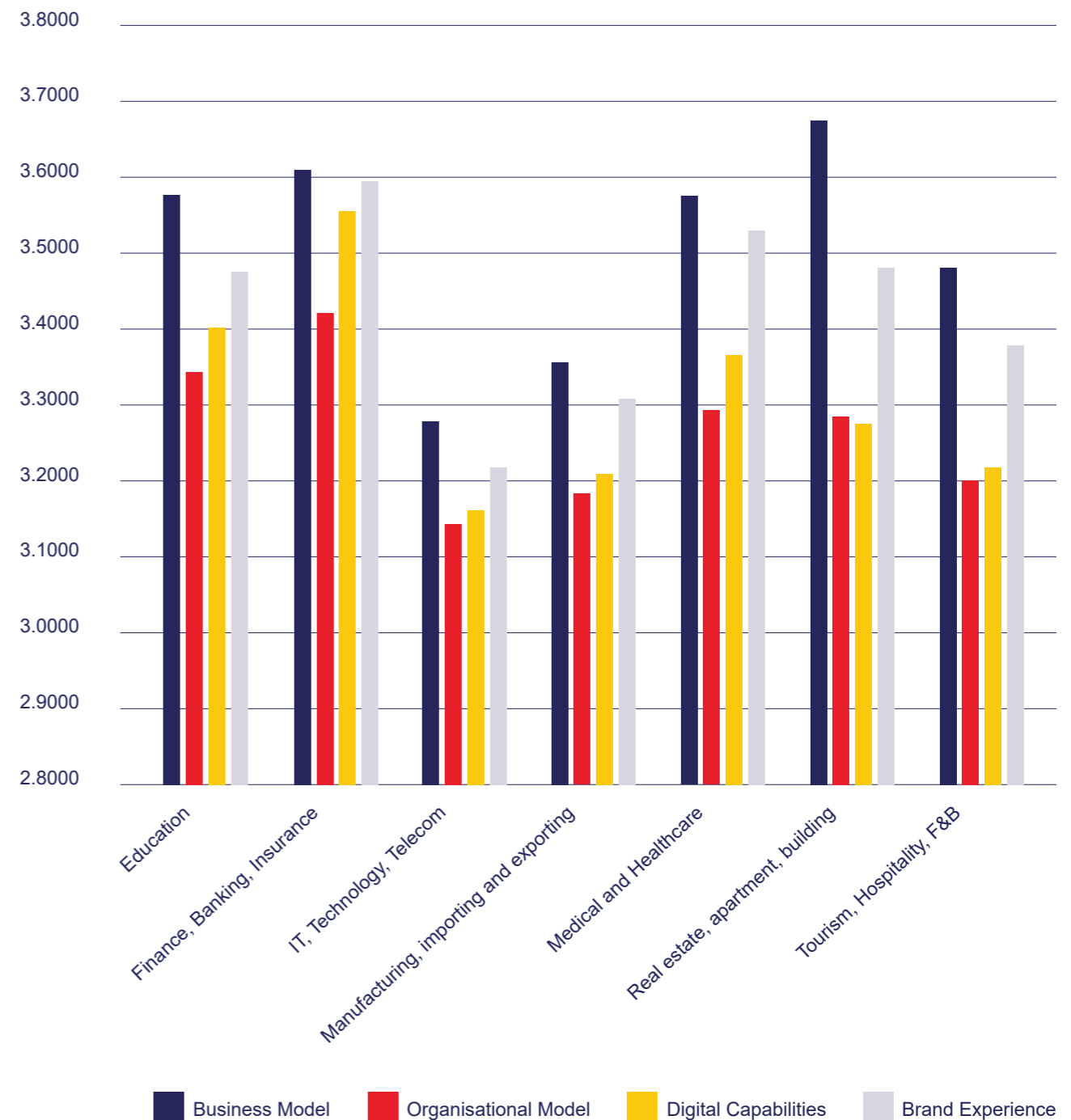
- My department has no problem working with/receiving support from other departments.
- The organisation has institutionalised channels/sessions scheduled annually to promote knowledge sharing.
- The top management of my organisation is open to changes/suggestions from different levels of the organisation; this approach is adopted to ensure that the company remains vigilant/relevant.
- My department has no problem accessing information from the other departments.

Figure 4 – Overview of SMEs’ focus in Vietnam



Segmenting these thematic areas against the different industries in Vietnam further provides an interesting perspective of which sectors are advancing on I4.0 and which may need further support and development (Figure 5). Education and ‘finance, banking and insurance’ are well ahead of the other industries, with a lean towards agreement of the 4 areas, where, interestingly, ‘IT, technology and telecommunications’ and ‘manufacturing, importing, and exporting’ display low levels. This finding suggests that, either difficulties in adaptation, or hurdles such as infrastructure or resourcing, could be inhibiting the development in these two industries.

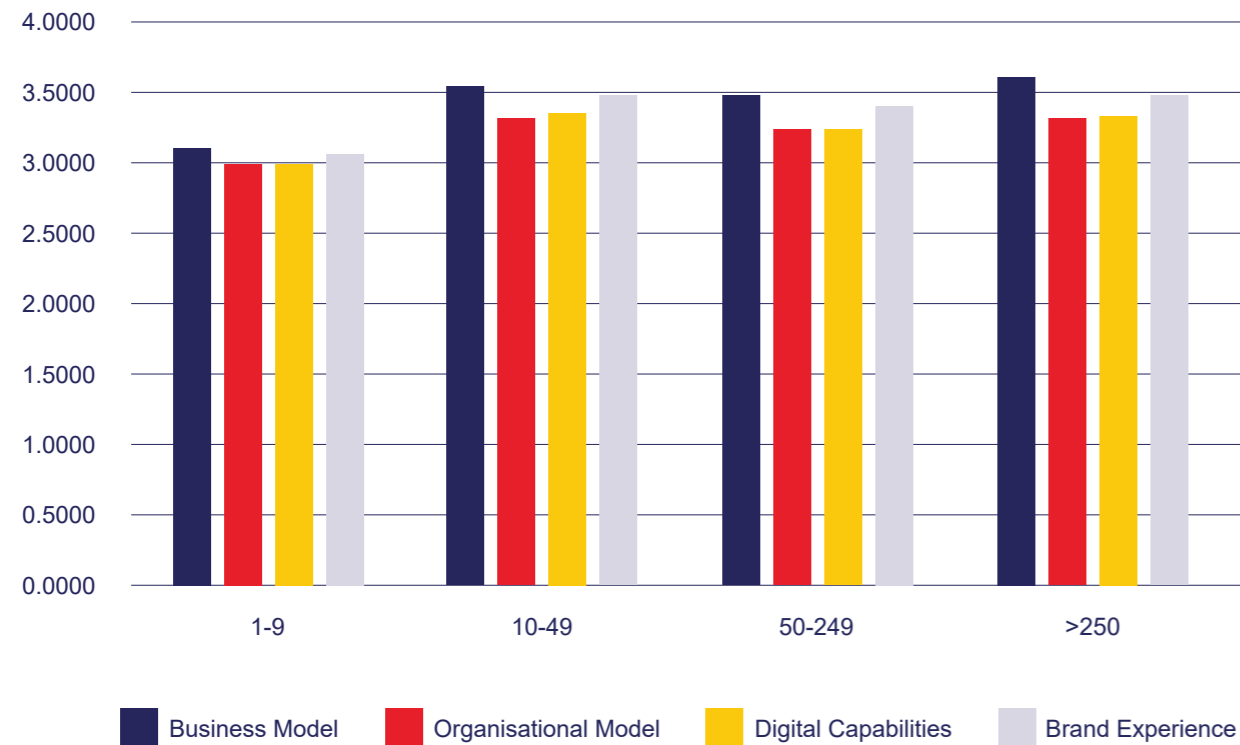
Figure 5 – Levels of agreement across the different industries





As Figure 6 illustrates, broadly, there is agreement across all the different sizes of organisations. In addition, there is strong consistency across the different thematic areas with micro firms (1-9 employees) displaying lower levels of agreement. As with the results segmented by industries, there is a potential hurdle in resourcing, financing, and infrastructure of micro firms, which may be aligned to the lower levels of agreement and I4.0 readiness. This finding suggests that further support is required to ensure that micro firms develop their industry capabilities for the future.

Figure 6 – Levels of agreement against organisation size



Qualitative data analysis

The qualitative data were gathered through face-to-face and online interviews during September of 2021 and March of 2022. Table 1 provides a snapshot of demographic characteristics of the 101 participants who agreed to be interviewed and those of their firms. Efforts were made to sample a similar number of participants involved in as many as nine industries.

Table 1 - Industry in which the firm operates	n=101	%
Education	11	10.9
Finance and banking	11	10.9
IT-Technology	11	10.9
Manufacturing	11	10.9
Medical/Health care	12	11.9
Real estate	11	10.9
Hospitality/Tourism	11	10.9
International business (exports, etc.)	11	10.9
Services (e.g., repair, transportation/logistics)	12	11.9
Size of the firm (in full-time employees)	n=101	%
10-49	15	14.9
50-249	30	29.7
250 and above	56	55.4
Whether the firm is involved in international business (e.g., exports, etc.)	n=101	%
Yes	70	69.3
No	31	30.7
Location of the firm	n=101	%
Hanoi	48	47.5
Ho Chi Minh City	34	33.7
Other (multiple regional locations)	19	18.8
Role of the participant	n=101	%
CEO	60	59.4
Manager/Director	41	40.6
Experience in the industry (years)	n=101	%
Between 2-5 years	27	26.7
Between 6-10 years	12	11.9
11 years or more	62	61.4
Gender of the participant	n=101	%
Male	70	69.3
Female	31	30.7

Note: Some percentages were rounded off.



- Opportunities and challenges to I4.0

1a) Opportunities from adopting I4.0

In the following sections, the participants will be deidentified using acronyms, where, for instance, Participant 1 is labelled 'P1', and Participant 2, 'P2'. Asked about the opportunities they perceived from I4.0 adoption, there was agreement concerning the positive outcomes that could be gained from such involvement. Selected elaborated comments provide different points and directions illustrating emerging opportunities:

P7 (manufacturing): 10 years ago, when I worked at [company name], Industry 4.0 became a hot issue and many companies have applied it in different ways and levels. People started building online systems, then more modern ones for their companies. We started to use technology to support from production to operation processes, to support store management, inventory, and human resource management. Those systems can link to each other, help to simplify work for the managers and the employees. For example, with designers, when applying technology, they can design faster on computers instead of drawings on papers, then switch to 3D, 4D, which makes it more intuitive and beautiful.

In addition, there are many marketing channels to help them reach more customers. Previously, the store sellers stayed in the store and waited for customers to come to buy goods, but now they can approach customers through online channels for their sales, and marketing ... So, I4.0 is an opportunity that helps businesses to increase sales, improve work speed and efficiency.

P17 (education): We held a workshop about I4.0 for Education 3 months ago when COVID-19 was not as complicated as it is now. Everyone just thought technology was a supporting factor; however, we forecast technology would be a potential one. Vietnamese people are quite afraid of change, people in the education industry often choose traditional and safe way because education activities involve many people such as teachers, parents, and students. They do not want to have much of an opinion; they are cautious with technology and digital transformation. During the workshop, we warned that technology was very necessary and very useful for education, especially it provided a flat world for learners. Students can choose their own teachers; they can study with abroad teachers and professors when they are in Vietnam without being abroad. Technology also helps build resources, learning tools, applications for everyone to access, or platforms designed in attractive forms through games, activities...

COVID-19 caused many negative effects, but I think that there is also a "push" for the education industry to be digitally transformed; COVID-19 required people to apply technology in schools. We all agreed on having an important strategy for schools to implement technology... we have transitioned completely to online classes for leadership, inspirational modules. At first, people protested that online learning was not effective; however, what is important is the need to exploit the online platforms and lead these instead of letting them lead us. After COVID-19, we still apply online activities for our classes.

1b) Challenges related to I4.0 adoption

While numerous opportunities stemming from the I4.0 phenomenon could be tapped into, similarly, there was agreement that it also posed various threats. The following observations provide some illuminating perspectives that highlight that the threats go beyond a firm's lack of resources. Instead, some arguments point to the missing opportunities and difficulties for companies from not embracing this phenomenon. Such is the argument of P8 (education):

The application of technology is no longer an advantage but a compulsory trend. Companies that do not update technology will soon be compelled by the market, where competition is increasing due to technology applications. Because geographical and information gaps are increasingly removed, technology helps international companies to enter the Vietnamese market quickly (Vietnamese customers also have complete access to services). Moreover, international investment funds in guest countries contribute to intensifying competition across sectors, thus, requiring enterprises to update themselves and diversify their service products.

P2 (real estate) referred to challenges due to scant knowledge, and the lack of an organisational culture conducive to spreading the I4.0 word:



People have heard a lot about Industry 4.0, but almost no one knows how to use it in their (job) area. It is vital to boost internal communication, answer questions, and guide the employees of various ages and levels on various levels of technology access and transformation comprehension when performing in the organization.

P21 (banking): Vietnam still has lots of policy gaps, as well as legal frameworks for e-commerce activities and digitization of financial services. Banks do not dare to accelerate digital transformation drastically because there is no clear legal framework to conform (fear of misleading the general requirements of the government, violating the law, wasting costs used for investment). When changing business models, all services, operational processes, and distribution channels need changing; to invest in activities requires enormous financial resources. The biggest challenge with digital transformation is the risk of cybersecurity and information security concerning customers' personal information.

Human resource competency: persuade staff that transformation now is compulsory rather than optional and prepare training programs for them.

Competition is getting fiercer in the financial sector. In the past, only banks competed against each other, but now there are more financial technology (FinTech) companies. Currently, FinTech companies are burning cash to collaborate with banks, but when they accumulate enough customer data, they will become banks' direct competitors.



• **Support required**

The purpose of this theme was to investigate perceptions of external and internal support, including support at government and industry levels. Numerous responses highlight the current need for different forms of support. For instance, P28 (medical industry) voiced concerns regarding slow government response in facilitating the utilisation of high-end equipment:

Policies from the Ministry of Health are needed to encourage and promote firms to develop more I4.0 technology application goods. For example, [company name] offers a portable eye disease screening device that is far more convenient to use at home or in places with poor medical conditions than the huge machines used in hospitals previously. However, in order to utilize it, it must first go through the Ministry of Health's licensing procedure, which is currently exceedingly lengthy and fraught with complications. Hence, thus far, it could not be used.

For P33 (exports industry), there are entities that already provide support; however, there appeared to be a disconnect between those holding a managerial or leadership position and the needs of stakeholders in the 'upstream' side of the supply chain:

“ Almost all industries in Vietnam already have associations, but the level of efficiency varies greatly depending on each association. This relies vastly on the mission they set as well as the direction of the leader of the association.

Association presidents need to be the ones who are also involved in the industry, so that they can set objectives for both general industry and for businesses to benefit. Those who do not engage with the industry will never understand the reality of the industry so as to present appropriate development directions but can only export very general, underutilized things...

• **The value of I4.0**

This theme sought to reveal the extent to which I4.0 could enhance a company's products/services while at the same time improving end consumers' experience. Many different forms of adding value were revealed, including the following:

P5 (hospitality): Our purchasing department focuses on using technology. Normally, when we want to buy something, we list out everything on a paper and give it to the purchasing team to look for and buy products from different suppliers. But now, we are using a system called Material control system where we put all products. When a department wants to order something, we only go there and search for it. The order is automatically sent to the purchasing team. Because we have built a good relationship with suppliers, we quickly get the quotation; thus, we can receive our ordering item in the afternoon when we order in the morning. In addition, the purchasing team and other departments know what they have in stock and can control it as well.

P10 (retail/services) emphasised some technological features that simplified customers' experience: For example, with the automatic parking system, instead of having to wait for a security guard to open and swipe the car card, when customers enter the system, it automatically recognizes them and even helps them pay for their parking. They can swipe their shop card or pay cash, and the system will pay back by itself. Another example is [company name], which caters for the young, dynamic customers who love such services. The company has developed Web applications to find the store's location and other information about the store. Furthermore, if the customers want to receive shopping voucher information, they can do so by running the store's application.

“ I4.0 helps improve management efficiency and improve labour capacity.

We take a lot of time to report, now it is gradually being replaced by technology. Everyone puts their result on a link, then it can report how much of the plan is completed or remind staff to complete their work. Or we have operation management software that can connect with rented booths. If they want to repair something or want to have a meeting, they will send their information on the software, which will be transferred to us. We will share feedback and update them on the progress. In addition, instead of doing 10 tasks per day, our staff can do 15 or 20 tasks by applying technology. And we have tools to check their productivity as well.

• **Employee insights**

One crucial component in implementing I4.0 in the workplace concerns the potential drawbacks through resistance and other challenges that arise at company level. Oreg (2006) explains that the term 'resistance to change' is often used in both practitioner and research literature to explain some of the potential consequences, including falling short of expectations, in introducing new managerial practices, compensation systems, or, as the case of this report, significant technological changes. Some of the comments provide support that,

“ When it comes to new technology uptake, a process of assimilation, adaptation, and even embracing is needed.

P37 (manufacturing): Employee reactions are separated into two groups: those who conform to the company's culture and those who do not. People are so inspired by nature that they occasionally refuse to use technology not because they can't afford it, but because they don't want to. We need solutions for workers that are out of scope, such as arranging for them to perform other more suited positions or even persuading them to leave the company.



- For those who truly lack the capacity to use technology, we will provide retraining activities, followed by time for them to try again with guidance from both the company and the supplier. Provide technical solutions, and then operate after the essential requirements have been satisfied.
- Those who remained, their mindset to skill set improved to a very different level than before.

P49 (exports): Basically, most employees had their reaction at first because their workload was increased when working method was switched (besides their normal jobs, they would have to sit down and put data into the system) and put pressure on them (the progress of their work is always shown on the system; they are compelled to complete deadline tasks set on a daily basis, not as flexible as before).

Managers need to be responsible in the transition in order to succeed. Prior to the transition, consultations from multiple parties should be studied to find a suitable technology solution that applies to the specific characteristics of the company and then applied to employees. During the progress, employees can comment and report incidents for better improvement instead of refusing to change to new operations.

- **Coping with COVID-19**

A final theme concerns two critical dimensions, one being the disruptive impacts of COVID-19, and the second how I4.0 might provide support in coping with the crisis. Managers operating in different industries pinpoint precise ways in which I4.0 can lend a hand in creating more agile and efficient ways of operating the business under the severe and unprecedented effects of a devastating event. However, as the following selected comments indicated,

”

I4.0 is not a panacea, and business managers need to have a more in-depth understanding of the additional facets that are involved when embracing this phenomenon.

Moreover, limitations in I4.0 do exist, and consequently managers must maintain realistic expectations as to what I4.0 can and cannot deliver:

P13 (exporting): Information Technology has helped businesses in maintaining a certain degree of operation throughout the COVID-19 period in certain ways. However, considering this to be a critical factor for businesses to overcome the COVID-19 period is impossible - When COVID-19 is completely controlled, the UK will still return to the traditional face-to-face model, unable to apply the current work-from-home model because providing orders for customers requires direct work between the parties involved, especially in the field of coffee and agricultural products, as is the case in the UK today.

P30 (manufacturing): In the last COVID-19 period, technology has demonstrated its role in helping some businesses in areas that still remain operational and even make the best growth. Many businesses in Vietnam are starting to run very fast to perform digital transformation for the time being. However, digital transformation is not simply about pushing figures online or building an online sales website, but it must be about building an enterprise operating system to optimize production resources. Many enterprises in Vietnam are being misdirected.

P102 (education): Without IT, the school would certainly not be able to guarantee training activities in the past time. Online teaching is only a part, but IT also helps in the management and administration of the school's training organization (the manager sitting at home can also check the progress of each lesson and record of the lesson. It is also still stored on the system even after it has taken place for inspection when necessary), providing in-time, synchronous, accurate and subjective activity data.

However, there are also different perceived challenges in implementing I4.0. P30, for instance, had reservations concerning the limitations of the I4.0 phenomenon: In a COVID-19 context, technology will play a different role in business operations depending on the different states of society. For example, it is clear that technology will play a vital role in helping businesses operate steadily, but if society had to completely close down like in the last three months, technology would not be able to support much regardless of any problem because it would not be able to produce or transport goods to sell to customers.

Similarly, and commenting from a medical industry perspective, P90's observations point to confidentiality and training issues that would need to be overcome: As a doctor, I am very skeptical about applying technology in healthcare, especially in consultation between patients and doctors. Because all documents, medical books, pathology are written in direct medical examination methods, now to reach a new stage, the training for doctors must change completely and this is a challenge for the medical profession. In that challenge, some people can go ahead and handle it very quickly, but there are also some who just can't handle it. In addition, this change is also related to the fact that hospitals will also need to have new recruitment standards for medical staff because if doctors are not natural and comfortable sitting and communicating with patients through video calls, how can I perform online medical examination? And the last story, everything goes back to training for medical staff, but currently, no training program has been launched to equip doctors with knowledge and skills for online medical examination. Currently, the materials from medical examinations and treatment knowledge are transferred directly to the online environment; no one can guarantee where the quality will go.



Conclusions



This report fulfilled several objectives. Primarily, the quantitative data gathered among 503 companies throughout Vietnam provides empirical evidence of various aspects related to I4.0 from company managers and CEOs, including companies' business model, and the state of digitalisation. These aspects are crucial in determining the state of I4.0 adoption, and potential shortcomings. The overall model mean scores suggest that while there is a tendency among participants to agree with the benefits, requirements, and the need for various forms of support in the implementation and maximisation of I4.0 strategies and procedures, various gaps are identified. In fact, the lack of full agreement (mean < 4.0) with many of the areas under examination underscores presents opportunities for companies' management to reflect upon how the uptake, stronger awareness, and a fuller commitment to I4.0 could be realised. This thought is supported and complemented by many of the verbatim comments (qualitative section), which underline the value of the I4.0 phenomenon in being applied at a company level.

As suggested by different participants, 'fulfilling the promise' of I4.0 requires facilitation of knowledge management, that is, knowledge of the benefits from rolling out I4.0-related principles across an organisation. These principles cannot simply be left to chance, or solely to the will and the involvement of government. Instead, companies first need to ascertain the value of embracing I4.0. Should such assessment be overall beneficial and advantageous, accordingly, companies' management should device hands-on initiatives to not only persuade their staff of the need to commit to I4.0, but also to disseminate knowledge and awareness that, together, would render adaptation and commitment to I4.0 a smooth and learning process.

Again, companies cannot leave the implementation of I4.0 to the government's leadership alone. As P23 (education industry) posited: "Digital transformation has now been included in one of the national action programs; businesses that do not update digital transformation will be left behind." Should companies' resources be scarce, the implementation of I4.0 could first be at a basic level, followed by a progressive scaffolding or intensification in involvement, whereby companies could assess the initial results, the needed resources, and their overall capability in building I4.0-related critical mass and knowledge. Nevertheless, the role of various stakeholders is critical in paving the way for a future I4.0 revolution and uptake. Among other potential partners triggering the development of I4.0 uptake, educational institutions could be significant in this process, preparing future professionals for a smoother transition into professional roles. This transition not only could be reinforced through teaching, but also from hands-on presentations by industry experts, as well as through real-world experiences (site visits) and activities (internships/ apprenticeships), where students can understand the actual value of implementing I4.0 principles.



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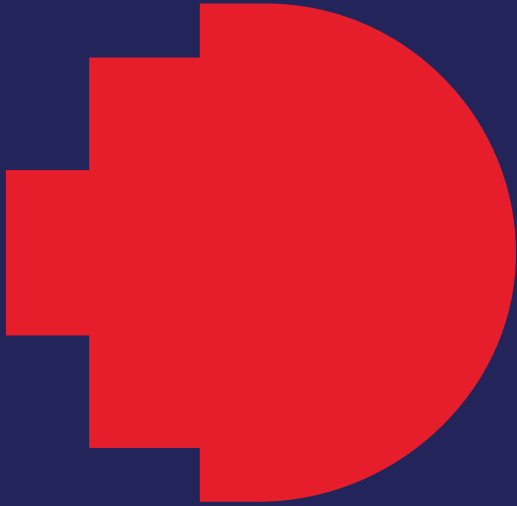


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