

Effects of Business Dashboards on Managerial Decision making: The Mediating Roles of Competitive Intelligence and Information Management Capabilities

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Abstract

As the volume and complexity of data continue to increase in the current digitalised business environments, most organisation are using IT-enabled decision support tools to inform their decision-making process. Despite the growing investments in IT-enabled support tools, some organisations have failed to attain the desired gaols. This study examines whether competitive intelligence and information management capabilities mediate the effects of business dashboard features on managerial decision making. Survey data of 350 organic food manufacturers indicate that business dashboard features directly affect managerial decision making. Information management capabilities mediated the link between functional dashboard features and managerial decision making. Whilst competitive intelligence and information management capabilities emerged as sequential mediators of the link between functional dashboard features and managerial decision-making, but not between visual dashboard features and decision making. Finally, the research highlights the role of competitive intelligence in facilitating the link between some business dashboard features and managerial decision making.

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1. Introduction

Faced with ever-increasing volumes of data as well as fast-changing consumer needs and environmental dynamism have resulted in organisations adopting IT-enabled decision support tools to inform the decision-making process (Shrestha, Krishna, & von Krogh, 2021). IT-enabled decision support tools enable managers to effectively manage of the fast-growing volume, velocity and variety of data that is continuously being produced in the current digital environment (Cao, Duan & Cadden, 2019; Bettis-Outland, 2012). Research suggests IT-enabled decision support tools such as business dashboards and other big data analytics tools can help organisations to effectively manage the complexity and volume of data they have to deal with (Tian, 2019; Mikalef & Pateli, 2017). Business dashboards are now one of the most used data IT-enabled decision support tools in organisations operating in different contexts such as health (Noonpakdee et al., 2018), urban planning (Lock et al., 2020) and manufacturing (Tyran, 2010). Business dashboards can capture large amounts of data required to inform managerial decision-making (Matheus, Janssen & Maheshwari, 2018). IT-enabled decision support tools such as business dashboards can facilitate data-driven decision-making (Wamba et al., 2017). Indeed, some scholars contend that data-driven decision are '*better decisions*' (McAfee et al., 2021).

Dashboards are visual displays of infographic or narrative visualizations of data used to monitor conditions and/or facilitate managers' interpretation of business trends (Wexler, Shaffer & Cotgreave, 2017). Dashboards can also summarize key performance metrics and indicate patterns, trends and inter-connections in real time for analytical operational and strategic purposes

(Vázquez-Ingelmo, García-Peñalvo & Therón, 2019; Côte-Real, Ruivo, Oliveira, & Popovič, 2019). Consequently, managers' ability to transform data into useful information and knowledge is affected by the managers' ability to access accurate, timely and appropriate amounts of information (Merendino, et al., 2018). Thus, to support decision-making, requires not only investment in IT-enabled tools but also in developing managerial capabilities that decision-makers require to effectively leverage and transform data into usable knowledge that can enable managers to sense, seize and shape opportunities required to enhance organizational performance and competitiveness (Côte-Real, Oliveira & Ruivo, 2017; Sánchez-Ferrer, Pérez-Mendoza & Shiguihara-Juárez, 2019).

However, whilst the popularity of business dashboards has increased limited attention has been paid to other factors that could facilitate the link between business dashboards and managerial decision-making. Some scholars contend that the potential of business dashboards to enhance managerial decision-making depends on implementing managers' experience as well as ability to exploit the available database to enhance knowledge generation and discovery (Sánchez-Ferrer et al., 2019). Extensive empirical research have investigated the effect of dashboards and webpages on strategy implementation and information management (Krush, Agnihotri, & Trainor, 2016), as well as performance management and productivity (Yigitbasioglu & Velcu, 2012), but limited attention has been paid to how business dashboards can facilitate managerial decision making and business performance (Ribeiro-Navarrete, Botella-Carrubi, Palacios-Marqués & Orero-Blat, 2021). Hence, there is a dearth of research investigating the link between dashboards and managerial decision-making (O'Sullivan & Abela, 2007; Pauwels, 2014).

Extant research suggests that in addition to investing in IT-enabled decision support tools for effective decision-making, organisations should also invest in other factors that can facilitate

effective utilisation of dashboards and knowledge generation required for more informed decision-making (Ghasemaghaei & Calic, 2020; Sánchez-Ferrer et al., 2019). Given the large capital outlays that have been made in IT-enabled decision support tools such as dashboards and the reported failures of such investments to drive business value there have been calls for more empirical research into factors that could facilitate the link of IT capabilities and organisational performance (Samdanis, & Lee, 2018). Indeed, some scholars contend that dashboards are not a panacea for effective managerial decision-making and organisational performance, as dashboards need to continuously change and adapt to different environmental conditions (Clark, 2021). Consequently, researchers are increasingly calling for more empirical research on potential mediators of the link between data analytics and IT-enabled decision support systems and performance (Wamba et al., 2017). Thus, the current study responds to these calls (Krush et al., 2016; Clark, 2020), by investigating whether competitive intelligence and information management capabilities mediate the link between business dashboards and managerial decision-making.

Thus, drawing from Dynamic Capability Theory (DCT), information capabilities are viewed as a dynamic capability that can be deployed in the reconfiguration, renewal and building of lower-level capabilities such as business dashboards. In line with dynamic capability theorists (Wamba et al., 2017) business dashboards can be viewed as an operational capability as they can only enable organisations to perform ongoing activities to support existing products and services. Consequently, there is need to develop higher-order dynamic capabilities such as competitive intelligence and information management capabilities that can enable the organisation to build and renew existing operational capabilities as well as seize emerging opportunities (Pavlou & ElSawy, 2006).

This paper responds to calls for more empirical work on the effects of business dashboards on decision-making (George et al., 2016). First we investigate the differential impact of visual and functional dashboard features as information management support tools on managerial decision-making processes. Some scholars have found that despite the high adoption of dashboards in industry, most managers are not satisfied with the current dashboards indicating the need for more empirical work into enhancing the contribution of dashboard on decision-making (Pauwels et al., 2009). Hence the second goal of the study is to examine how other capabilities, such as competitive intelligence and information management capabilities, can play a mitigating role in the link between dashboard features and managerial decision-making. At the empirical level our study results can inform managers on the design, development and utilisation of dashboards to inform decision-making.

The remainder of the paper is structured as follows. First, the literature is discussed culminating in the development of a conceptual model and associated hypotheses. This is followed by a discussion of the research methodology. The research findings and discussion of the results are then presented. The paper concludes by discussing the study implications, limitations and areas for further research.

2. Theoretical background and hypotheses

2.1 Dynamic Capability Theory

The DCT advocates the need for organisations to develop resources and dynamic capabilities that can enhance an organisation's ability to respond to fast-changing environments (Winter, 2003; Teece, Pisano & Shuen, 1997). Extensive research contends that dynamic capabilities can enable organisations to sense, seize and transform ordinary capabilities and resources (Teece, 2018).

Thus, business dashboards can be viewed as an organisational or operational capability as they are a collection of routines that when combined with their implementation flows can confer decision options on organisational management (Kapoor & Aggarwal, 2021). Additionally, some scholars point to the hierarchical ordering of dynamic capabilities, where higher-order capabilities as lower-order capabilities come above operational capabilities is a layer of higher-order dynamic capabilities (Grant, 1996; Winter, 2003). Thus, in line with dynamic capability theory, in this study business dashboards are viewed as operational capability as they can only enable organisations to perform ongoing activities to support existing products or services and make a living in the short-term. This is in line with prior research that has considered IT resources as a capability (Winter, 2000). Consequently, there is a need for development of higher-order dynamic capabilities that can enable the organisation to renew and transform existing operational capabilities and seize emerging opportunities (Pavlou & ElSawy, 2006). In this study we view competitive intelligence and information management capabilities as vehicles through which the impact of business dashboard on managerial decision-making is transferred. Therefore, dynamic capability theory provides a suitable framework to examine whether the link between business dashboard on managerial decision-making is sequentially mediated by competitive intelligence and information management capabilities.

2.2 Managerial decision-making

Decision-making is defined as a choice among alternatives (Li, Wu, Cao, & Wang, 2021) and is viewed as one of the most important activities that managers need to effectively undertake to ensure the attainment of espoused organisational goals (). The growth in ICT technology has resulted in increased interest of managers and researchers on how knowledge-based IT systems

can support managerial decision-making (Pappas, Caputo, Pellegrini, Marzi & Michopoulou, 2021). The ability of an organisation to make decisions quickly and accurately is viewed as a key organisational capability (Ghasemaghaei, Ebrahimi & Hassanein, 2018). However, other scholars contend that the quality of managerial decision-making depends on how the information and knowledge is managed and shared within the organization (Ghasemaghaei & Calic, 2020), as well as the availability of managerial skills and capabilities required to facilitate the value creation process (García-Peñalvo, & Conde, 2014) and the amount of resources allocated to IT (Shrestha et al., 2021). Incessant changes within the internal and external business environments have led to increased volume, complexity velocity, variety and veracity of data being produced, and this has complicated the decision-making process (Rapp, Agnihotri & Baker, 2011). Consequently, systematic decision-making calls for increased accuracy, consistency, confidence, and speed during the decision-making process (Yigitbasioglu & Velcu, 2012). Consequently, most organisations tend to adopt IT-enabled decision support systems tools such as dashboards to manage the complexity emerging from using big data and to streamline managerial decision-making. Research suggest that decision-making quality is enhanced when managers have more knowledge of the relationships across the factors being analysed (Merendino et al., 2018;) and these relationships are easier to identify when business dashboards are used. Indeed, shortfalls in managers' information management capabilities can negatively impact decision-making quality (Merendino et al., 2018).

2.3 Business dashboard and managerial decision-making

To survive in fast-changing dynamic environments, organisations need to develop dynamic capabilities that can be used in creating, extending and modifying the ways they make a living (

Helfat et al, 2009). As business dashboards require to be customised to specific users and contexts, they can therefore be regarded as a rare, valuable, imperfectly inimitable, and immobile organisational resource. In line with prior research, business dashboards can be considered as an organisational resource or IT capability (Byrd et al., 2008;). Increasing organisations are deploying IT capabilities to inform their decision-making and enhance performance outcomes (Li, Wu, Cao & Wang, 2021; Mikalef & Pateli, 2017). Indeed, a range of highly sophisticated IT-enabled decision support systems, such as balanced scorecards, enterprise resource planning and digital dashboards, are being used to synthesize information required to inform decision-making (Yigitbasioglu & Velcu, 2012). Ongoing breakthroughs in ICT have resulted in the development of new types of dashboards that can incorporate multiple sources of information as well as both visual and functional features that support decision-making processes (Krush et al., 2013). Due to their ability to link business and attribute-level metrics as well as financial data, BD can facilitate analytics-based decision-making by helping managers to capture, aggregate and synthesize data (Janssen, van der Voort, & Wahyudi, 2017). According to Berinato (2016), if properly designed and leveraged, dashboards are an extremely powerful tool that not only supports decision-making, but also motivates, persuades, and even makes data memorable.

Visual dashboard features focus on effective and efficient presentation of information to the user to enhance data visualisation (Yigitbasioglu & Velcu, 2012). Fast visualisation and consolidation of the most crucial information required to assess and monitor performance on a single screen (Few, 2006) facilitates sense-making, exploration, problem solving, and communication of complex ideas (Gonzalez, Gasco, & Llopis, 2016). When visual features are designed from a user perspective, they can enhance managers' comprehension of the information that is required for informed decision-making Data visualization also facilitates managerial learning and managers'

ability to garner more insights from available data without resorting to intricate analytical procedures (Krush et al., 2016). Hence:

H_{1a}: Visual business dashboard features positively influence managerial decision-making.

Literature suggests that visual business dashboards features do not provide the optimum information required for effective decision-making when organisations are operating in volatile and dynamic environments (Berinato, 2016; Rapp et al., 2011), as in such situations, data visualization only tends to lead to biases in the decision-making process (Bititci, Cocca, & Ates, 2015). Hence, some scholars have called for functional features to be added to business dashboards (Yigitbasioglu & Velcu, 2012). Functional dashboard features that are more interactive, easy to manipulate and can sort and bookmark data as well as monitor and update data have been found to be more useful in managerial decision-making (Pauwels et al., 2009). Functional features can provide customer insights and financial information to complement reports produced by visual features (Santiago & Shanks, 2015). The flexibility of functional dashboard enables managers to switch between alternative presentation formats thereby reducing the information overload encountered when managers only utilise visual features (Wexler et al., 2017). Hence, we hypothesize:

H_{1b}: Functional business dashboards features positively influence managerial decision-making.

2.4 Effect of business dashboards on competitive intelligence

Competitive intelligence focuses on monitoring the business environment and identifying the relevant competitor information required for managerial decision-making (Ranjan & Foropon, 2021). Effective competitive intelligence is crucial for organisations to attain meaningful and

actionable intelligence required to gain a competitive edge on the marketplace (Opait, Bleoju, Nistor, & Capatina, 2016). Business dashboards are a major source of information and data that can be used in intelligence and managerial decision-making (Vázquez-Ingelmo, García-Peñalvo, Therón & Conde, 2020). Whilst a range of different IT-enabled decision support tools are currently used in industry to facilitate competitive intelligence, few have the capabilities to automatically aggregate and analyse data, and also disseminate competitive intelligence throughout organisations as business dashboards (Gandomi & Haider, 2015). The new generation business dashboards can provide information that is required for garner the competitive intelligence required for various types and levels of decision-making (Vázquez-Ingelmo et al., 2020), thereby enhancing organisational capabilities to make fast and effective decisions (Hasford, Hardesty, & Kidwell, 2019). Thus, data visualization and structuring through business dashboards enhance competitive intelligence and also facilitate the automatic routing of right information, at the right time, to the right user (Rao, 2003). Thus, we hypothesize that:

H_{2a}: Business dashboards visual features positively influence competitive intelligence.

H_{2b}: Business dashboards functional features positively influence competitive intelligence.

2.5 Effect of business dashboards on information management capabilities

The way information is gathered, processed, and then diffused is continuously changing (Peltier, Dahl, & Swan, 2020). By combining various concepts into manageable data, business dashboards can help inform decision-making. However, knowledge generation can only be valuable if managers are equipped with the skills and capabilities required for value creation (Fareed et al., 2021). Thus, there is need for managers need the skills to effectively leverage big data to inform and shape strategy (George et al., 2016). Information management capabilities are one of the most

important skills managers need to enhance their organisations' competitive advantage as they facilitate proactive monitoring of the business environment and sense-making (Samdanis & Lee, 2018). In this study, information management capabilities are viewed as the ability of an organization to quickly provide decision-makers with information at the most suitable level of consistency, reliability, accuracy, confidentiality, timeliness, connectivity, and security to enable an organization to change its strategic direction in a rapidly changing environment (Samdanis & Lee, 2018). Managers can use information management capabilities to analyze causal relationships between business factors, as well as manage customer and competitor reactions). Thus, the effect of business dashboards on managerial decision-making can be optimised if and when managers have information management capabilities required to leverage the available information (Krush et al., 2013). Consequently, an organization's stock of knowledge interacts with the functional characteristics of the organization's dashboard to enhance information management capabilities (Krush et al., 2016). Indeed, managerial IT resources are required to effectively leverage IT technological resources. Thus:

H_{3a}: Business dashboards visual features positively influence information management capabilities.

H_{3b}: Business dashboards functional features positively influence information management capabilities.

2.6 Mediating role of competitive intelligence

Competitive intelligence facilitates the assimilation and leveraging of external information on competitors (Mouzas & Ford, 2012) as well as fast identification of potential risks and opportunities emanating from the business environment, and fast response to these (du Toit, 2015). Thus, competitive intelligence is not only about monitoring competitor moves, but also making

recommendations that arise from analysing the available information that affects organisational competitiveness. Thus, IT-enabled information support systems such as dashboards can enhance competitive intelligence (McLeana & Woodsb, 2019). During complex decision-making processes, insights garnered on competitors and environment are combined with visual and structured knowledge from business dashboards to enhance an organisation's strategic response capabilities (Di Vaio, Palladino, Pezzi, & Kalisz, 2021; Grant, 1996). Thus, competitive intelligence is a high order dynamic capability that can be used to modify and transform operational capacities such as business dashboards. According to McLeana & Woodsb (2019), competitive intelligence is required to reconfigure an organization's vital internal processes and enhance decision-making. A study of 82% of large American enterprises found that 90% of Forbes 500 global companies use competitive intelligence for decision-making processes and risk management (Xu, Liao, Li, & Song, 2011). Thus, competitive intelligence mediates the relationship between business dashboard functional and visual features and managerial decision-making. Hence:

H_{4a}: Competitive intelligence mediates the relationship between visual business dashboard features and managerial decision-making.

H_{4b}: Competitive intelligence mediates the relationship between functional business dashboard features and managerial decision-making.

2.7 Mediating role of information management capability

IT-enabled decision support tools offer a wide range of opportunities for organisations to collect, automate, produce, and share knowledge (Rahimi, Møller, & Hvam, 2016). As a dynamic capability, information management capabilities enable managers to utilise such IT-enabled tools to assess competitors' capabilities and decide on the strategic moves that are required to enhance

competitiveness (Krush et al., 2016). Thus, information management capabilities are knowledge integrative mechanisms that can be deployed to enable managers to leverage IT-enabled resources such as dashboards during managerial decision-making. Thus, there is need for decision-makers to determine not only the type of information required for informed managerial decision-making, but also have the capabilities to decide how such information is collected and disseminated (Yasmin, Tatoglu, Kilic, Zaim, & Delen, 2020). As such, information management capabilities are crucial for the exploration and exploitation of various IT-enabled decision support and information management systems required for effective decision-making (Al-Emran, Mezhuyev, Kamaludin & Shaalan, 2018). As a dynamic capability, information management capabilities facilitate the transformation of diverse and complex information that can be used to reconfigure, redeploy, and create other capabilities. Hence, we hypothesize:

H_{5a}: Information management capabilities mediate the relationship between visual business dashboard features and managerial decision-making.

H_{5b}: Information management capabilities mediate the relationship between functional business dashboard features and managerial decision-making.

2.8 Sequential mediating effects of competitive intelligence and then information management capabilities

While extant literature has identified a direct link between business dashboards and decision-making, some scholars argue that the relationship is amplified by other factors such as personal characteristics of the managers as well as their IFMC, strategy implementation speed and/or the ability of the organization to undertake competitive intelligence (Krush et al., 2016). However, there is limited empirical work linking competitive intelligence and information management

capabilities (Cao, Duan & Cadden, 2019). Thus, in line with prior research that contends a hierarchical ordering of capabilities study we posit that the relationship between business dashboards and decision-making is sequentially mediated by competitive intelligence and then information management capabilities. This approach also emphasises a systematic planning approach that is designed to achieve the best fit between the organisational strategy and its environment (Bell, Dean, & Gottschalk, 2010). Ghannay & Zeineb (2012), contend that the synergistic effects of competitive intelligence and information management capabilities can facilitate managerial decision-making.

Some scholars even view information management capabilities and competitive intelligence as two sides of the same coin that at times have a convergent relationship, as both can be sources of competitive advantage for organisations in dynamic environments (Bartes, 2015). Whilst there are some similarities, such as the use of structured data, competitive intelligence and information management capabilities are in fact distinct constructs (Krush et al., 2016). Competitive intelligence is a key building block of knowledge management (Liebowitz, 2001), whilst information management is a subset of knowledge management (Al-Hawamdeh, 2002). Thus, competitive intelligence facilitates information management capabilities, as well as the analysis and dissemination of findings that can be used to enhance an organisation's strategic response capability and performance (Ranja & Fropon, 2021). Consequently, competitive intelligence and information management capabilities can be deployed sequentially or simultaneously to facilitate decision-making (Cenamor, 2021). Hence, we hypothesize:

H_{6a}: The relationship between visual business dashboard features and managerial decision-making is sequentially mediated by competitive intelligence and then information management capabilities.

H_{6b}: The relationship between functional business dashboard features and managerial decision-making is sequentially mediated by competitive intelligence and then information management capabilities.

From the above discussion, the conceptual model shown in Fig. 1 emerged, illustrating that whilst the effect of business dashboard visual and functional features (X) on managerial decision-making (Y) is direct, this link can also be sequentially mediated by competitive intelligence (M1), and then information management capabilities (M2). Mediators (M1 and M2) facilitate causal linkages between the independent variable (X) and a dependent variable (Y) and both direct and indirect effects can be interpreted (MacKinnon, Fairchild & Fritz, 2007). Thus, whilst the direct effects ($X \rightarrow Y$) and ($M1$ or $M2 \rightarrow Y$) are important, the indirect effects ($X \rightarrow M1 \rightarrow M2 \rightarrow Y$), through the mediator/s are also important outcomes (Hayes, 2018).

[Insert Figure 1 about here]

3. Methodology

3.1. Sampling and data collection

To empirically test the relationships hypothesized in this study, a quantitative research design using a questionnaire-based survey was utilized. A questionnaire was initially prepared in English as all the measures were adapted from Western literature. To enhance face validity, four experts (two professors and two senior managers in the manufacturing sector) reviewed the questionnaire. To enhance language equivalence the questionnaire was translated and then back translated from Persian to English by two independent translators. When both versions of the questionnaires were

the same, then the Persian version was used to collect data from the Iranian organic food manufacturing sector. As over the past decade, Iran has been transitioning from a centrally planned economy to a privatized market economy (Soltani & Wilkinson, 2012). to succeed in this highly regulated and competitive industry, managers are increasingly adopting IT-enabled decision support systems to facilitate effective managerial decision-making.

Using simple random sampling technique, a sample of 350 organisations were randomly sampled industry database of over 4,000 organic food manufactures. To increase response rates, email imitations were sent to senior executives of organisations in the study sample and then the drop-off and pick-up method was used to collect data from managers who agreed to participate to increase the response rate. 193 responses were received with a six-week period and an additional 27 were received after sending follow-up emails, resulting in a usable sample of 220 and a 62.8% response rate. Key informants that responded included were chief executive officers and general managers (73%) and IT, manufacturing and operations managers (27%). Respondent organisations had been operating in the industry for 10 to 50 years and employed between 12 and 310 people.

3.2. Measures

The measures for all study constructs were adapted from literature and were measured on a 7-point Likert-type scale anchored on '1' = strongly disagree to '7' = strongly agree. BD was measured as a bi-dimensional construct using measures adapted from O'Sullivan and Abela (2007). Five measurement items from Saayman et al., (2008) were used to measure *competitive intelligence*. We adapted six items from Vorhies and Morgan (2005) to measure *information management capabilities* and those for *managerial decision-making* were from Yigitbasioglu & Velcu (2012). Literature indicates that organizational size and age can affect managerial decision-making. Thus,

in this study, we focused on parsimony to the detriment of comprehensiveness and used organizational size and age as control variables. Following Zaefarian, Henneberg, & Naudé's (2013) study, organization size was measured by the logarithm of the number of full-time employees, and organization age by the logarithm of the total numbers of years an organization had been operating in the industry.

4. Data analysis and results

4.1. Measurement purification

We used SPSS, AMOS, and the PROCESS macro to analyse the data. As recommended by Anderson and Gerbing (1988), the two-step approach was used to assess reliability and validity. First exploratory factor analysis (EFA) and then confirmatory factor analysis (CFA) were used to assess the internal and external consistency of the measures. A 5-factor CFA model was estimated, and the model had acceptable fit indices ($\chi^2 = 2822.50$; $df = 131$; GFI = .90; NFI = .91; NFI = .90), suggesting the model fits the data sufficiently. The GFI, TLI and NFI were all equal to or $>.90$ cut-off, and the RMSEA was .06 and thus equal to the threshold. The standardized factor loadings of all the measurement items were above the .50 threshold and significant at the $p \leq .01$, indicating convergent validity.

To assess discriminant validity, we used Fornell and Larcker's (1981) criterion through calculating all the constructs' square roots of AVEs. As shown in Table 1, discriminant validity is achieved as square roots of AVEs were all greater than the correlations between the individual constructs. The descriptive statistics are also shown in Table 1.

[Insert Table 2 about here]

4.2. Hypotheses testing and results

To investigate the direct effects as well as sequential mediation relationships sequential mediation analysis was performed using Model 6 in the PROCESS macro in SPSS. A bootstrapping regression method model was specified to estimate both direct and indirect effects (Hayes, 2018).

The results of in Table 2 indicate support for nine out of the twelve study hypotheses.

Significant direct effects emerged between managerial decision-making and visual and functional dashboard featured emerged as significant predictors of managerial decision-making providing support for H1a and H1b, respectively. As predicted in H2a and H2b, positive direct significant effects emerged between competitive intelligence and visual and functional business dashboards features. Whilst visual business dashboards features positively influenced information management capabilities, negative but non-significant effects emerged between functional business dashboards features and information management capabilities providing support for H3a and disproving H3b. The results supported a mediating effect of competitive intelligence on the effects of visual and functional business dashboards features on managerial decision-making, providing support for H4a and H4b, respectively, as none of the CIs straddled a zero. Significant negative mediating effects of information management capabilities emerged on the relationship between business dashboards functional features and managerial decision-making, disproving H5a. Contrary to H5b, information management capabilities did not mediate the link between visual BD features and managerial decision-making, as the CIs straddled a zero.

[Insert Table 2 about here]

H6a and H6b predicted indirect sequential mediating effects of competitive intelligence and then information management capabilities on the relationship between business dashboard visual and functional features and managerial decision-making. Contrary to H6a, no sequential mediating effects of competitive intelligence and then IFMC on the link between business dashboard visual features and managerial decision-making emerged. Contrary to H6B, significant positive sequential mediating effects of competitive intelligence and then information management capabilities on the relationship between business dashboards functional features and managerial decision-making. Finally, none of the control variables had significant effects on the mediators and dependent variable.

5. Discussion

With the general aim of understanding the determinants of effective decision-making, the current study investigated whether visual and functional business dashboards features influence managerial DC processes. Additionally, the study examined whether these relationships were serially mediated by competitive intelligence and IFMC. In line with prior research (Krush, Agnihotri, & Trainor, 2016), the results indicated that both visual and functional features of business dashboards enhance managerial decision-making. and the relationship is facilitated by competitive intelligence as suggested in extant research (Bartes, 2015). The results also demonstrated that information management capabilities mediate the link between business dashboards functional features and decision-making. Surprisingly, information management capabilities had negative mediating effects on the effects of visual business dashboards features and managerial decision-making. The finding emphasizes the importance of functional features of business dashboards as predictors of managerial decision-making and affirms prior research that

contend that the link between visual dashboard features and decision-making are mediated by competitive intelligence and managers' information management capabilities

5.1. Theoretical implications

Our findings have implications for theory and knowledge in information management and managerial decision-making. First, this study contributes to knowledge in information systems management and builds on Few's (2006) study by operationalising business dashboards as a bi-dimensional construct composed of visual and functional features. Second, the study results point to the important role competitive intelligence and information management capabilities play in enhancing the link between functional features of business dashboards and managerial decision-making. Third, the negative mediating effects of information management capabilities on the link between business dashboards visual features and managerial decision-making suggest that this relationship could be more complex than identified in extant literature (Krush et al., 2016). From a Dynamic Capability theoretical perspective, this study showed how competitive intelligence and information management capabilities as how higher-order dynamic capabilities (higher-order dynamic capabilities) can facilitate the deployment and enhance the effects of lower-order capabilities on managerial decision-making. Fourth, the study extends Yigitbasioglu and Velcu's work (2012) on the effects of business dashboards on managerial decision-making by investigating the effect of contextual factors that can facilitate this relationship. The study results suggest other dynamic capabilities such as information management capabilities and ability to undertake competitive intelligence are required to enhance managerial decision-making. These findings support Krush et al.'s (2016) contention that in addition to information management and IT-enabled support tools, other factors may be required to inform managerial decision-making.

Finally, in response to calls for more empirical work on factors that can enhance the effectiveness of business dashboards in organisations (Merendino et al., 2018) this study empirically examined a model that points to the valuable role that sequential mechanisms could play in smoothing the path between IT-enabled decision support tools such as business dashboards and managerial decision-making.

5.2. Practical Implications

From a practical perspective the current study has important implications for information systems managers and other executives in the food manufacturing sector. The first implication points to the need for managers to realise the critical role of IT-enabled decision support systems such as business dashboards play in facilitating the aggregation and dissemination of data required to effectively exploit existing market knowledge and inform managerial decision-making. Second, the study points to the for business dashboards that incorporate both functional and visual features, as visual features on their own cannot guarantee effective managerial decision-making. Thus, as suggested by Yigitbasioglu & Velco (2012), organisations need to adopt the new generation of business dashboards that embody both visual and functional features to enhance managerial decision-making. Third, managers need to have a clear idea on the decisions being made so as to categorise the information requirements so as to be able to pinpoint the specific dashboard features that are required to support the specific decisions they will be making. Indeed, as articulated by Vázquez-Ingelmo et al., (2019), dashboards cannot be optimal for every user and situation. Thus, there is need to customise and personalise business dashboards to produce tailored displays and information. Fourth, managers should ensure that competitive intelligence is incorporated into the decision-making process as it plays a crucial role in enhancing the quality of decisions made. Fifth

there is need for organisation to invest in the development of information management capabilities that are necessary for effective information systems management and managerial decision-making (Gandomi & Haider, 2015). Finally, given that individual managers have finite memories, which may lead to important information being overlooked during the decision-making process, business dashboards are an important decision support tool that can minimize information overload and information asymmetry, thereby enabling managers to streamline data and focus on the information required for effective managerial decision-making in specific context.

5.3. Limitations and future directions

The contributions of the current study should be viewed in the light of the study's strengths and limitations. First, our study was a cross-sectional study and as such does not support causal relationship between the variables in our conceptual model. It is advisable that future research could use an experimental or longitudinal research designs to prove causality. Second, this study examined how competitive intelligence and information management capabilities facilitate the link between business dashboards features and managerial decision-making. Literature indicates that the link between information technology support tools and managerial decision-making is complex and points to the need for more research on other factors that could play a mitigating role on this link. Third, some scholars have pointed out that IT is only a tool that facilitates decision-making, and does not guarantee knowledge creation, deployment and utilisation (Ruiz, Mercader & Cerdar, 2006; Rust & Espinoza, 2006). Indeed, some scholars have called for more research on the link between information strategy and decision making (Martinez-Simarro, Devece, & Llopis-Albert, 2015), as limited information management capabilities can inhibit decision making (Merendino et al., 2018). Thus, future studies may focus on possible moderators and mediators of the link

between information and managerial decision-making. Fourth, given that knowledge management is a facilitator of managerial decision-making process, future research could investigate whether knowledge management capabilities facilitate from the link between business dashboards and other organizational goals and objectives. Fifth, future research could also to investigate whether organisational learning and absorptive capacity mediate or moderate the link between business dashboards and decision-making. Finally, whilst we conceptualised decision-making as an independent variable in this study, future studies could examine how other marketing, financial and operational organizational performance are impacted by business dashboards.

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