

# Achieving Decision-Making Quality and Organisational Agility in Innovation Portfolio Management in Telecommunication 4.0

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Innovation portfolio management (IPM) decision-making capability has become one of the most important organisational competencies to survive and be sustained in the hyper-competitive market of the telecommunications equipment industry. As Telecommunication 4.0 brings up new challenges and complexities created by open innovation and integrated hardware and software, there is a necessity to further demonstrate how organisations leverage networking with partners and exploit internal organisational structural flexibility to fully gain IPM decision-making quality and organisational agility. This study aims to explore how IPM decision-making quality and organisational agility are influenced by a business intelligence system with the capability of providing profound market knowledge and orchestrating the organisations' networking capabilities in leveraging external capabilities with internal factors embedded in a nimble organisational structure that subsequently influences decision-making accuracy. Furthermore, the relationship of antecedents—a business intelligence system, networking capability, and nimble organisational structure—is elaborated in our conceptual research model. Exploratory case studies with four telecommunication equipment companies in Indonesia and a literature review are used to examine the relationship between IPM decision-making quality antecedents. Deriving from information processing theory, dynamic capability, and resource-based theory, the originality of this study lies in how organisations exploit not only internal resources and flexible organisational structure, but also in how it accesses, configures, and leverages external network resources embedded in business partners to come up with full access to IPM decision-making quality in an open innovation era.

**Key words:** *Innovation portfolio management, decision-making, agility, business intelligence, networking capability, nimble organisational structure.*

## Introduction

The telecommunication landscape is changing faster than ever before, ranging from infrastructure and components to operator and subscriber coverage, to new technologies and players. The increasing challenge of competition, rapid change in demand, technology, and regulation require organisations to be able to respond and adapt quickly. Staying agile in an ever-changing telecommunication environment becomes mandatory (IHS Markit, 2018). Agile innovation portfolio management (IPM) that brings organisational agility becomes one of the key characteristics and development requirements of Telecommunication 4.0 (Li, 2018) characterised by smart and connected technologies of cloud, internet of things (IoT), mobile, artificial intelligence (AI), wearables, nanotechnology, quantum computing, robotics, and 3D printing (Hupfer et al., 2018; Deloitte and Forbes Insight, 2018). Furthermore, Telecommunication 4.0 also brings new challenges for the players to address integrated hardware and software, open system, and virtualisation issues (Li, 2018).

IPM decision-making, as one of the most important organisational competencies to survive and be sustained in a competitive market, is receiving more interest of late (Behrens & Ernst, 2014; Behrens et al., 2014; Christiansen & Varnes, 2008; Kester et al., 2009; Kester et al., 2011; Kester et al., 2014; Kock & Georg Gemünden, 2016; Kawakami et al., 2015; McNally et al., 2013; McNally et al., 2009). For example, McNally et al. (2013) quantitatively examine how new product portfolio management (NPPM) decisions impact performance and the role of managerial dispositions. It highlights three managerial dispositions—directive leadership style, need for cognition, and risk perceptions—influence NPPM dimensions—value maximisation, balance, and strategic fit—which subsequently impact NPD and firm performance. Another study by Gutiérrez & Magnusson (2014) finds that rational and formal decision-making processes are experienced as more legitimate than informal and non-rational ones. Behrens et al. (2014) find that managers vary in their decision policies regarding the exploitation of innovation projects and that experience impacts the decision policies of middle managers but has little impact on senior managers. Furthermore, middle managers place less emphasis on the level of uncertainty surrounding the project (technology and demand) and more emphasis on the strategic context (the project relative to competitors' offerings and other products in the firm's portfolio). Jonas et al. (2013) conceptualise and empirically validate management quality—a multidimensional construct consisting of information quality, allocation quality, and cooperation quality—on project portfolio success. A two-year longitudinal study shows that there is a strong positive causal link between management quality and portfolio success. Alexander Kock & Georg Gemünden (2016) investigate the quality of the decision-making

process and its impact on agility. The study shows the structural components including (1) clarity of strategic goals, (2) formality of the IPM processes, and (3) controlling intensity serve a coordinating function, while the cultural components including (4) innovation climate and (5) risk climate serves a motivating function in IPM. All components positively influence portfolio decision-making quality, which in turn positively influences agility.

Existing research on IPM decision-making describes the impact of effective decision-making on performance and how the decision-making is influenced by internal organisational factors such as managers' roles and perceptions on innovation, rationality, and formality of decision-making processes, managers' experience, and innovation culture and climate. We still lack understanding about the role of information processing as a crucial activity in distributing information widely within an organisation, as well as that regarding the promoting of the coordination and collaboration required to attain decision-making quality and organisational agility. In addition, the organisations' capacity to integrate external resource capabilities owned by partners into IPM decision-making processes has not been investigated thoroughly.

This study aims to contribute to IPM research by exploring the information processing capability of a business intelligence system to orchestrate organisations' networking capabilities in leveraging an external capability with internal factors embedded in a nimble organisational structure. This would enable organisations to achieve high-quality IPM decisions and agility to suit the changing customer needs and competitive conditions. This study is based on exploratory case studies and a literature review with the aim of investigating the relationship among antecedents of IPM decision-making quality and organisational agility. It aims to furthermore develop a framework that can be further tested using a quantitative survey. The conceptualisation and investigation of the autonomous and joint effect of the business intelligence system, networking capability, and nimble organisational structure on organisational agility highlights the importance of complementarities among antecedents and adds to the cumulative body of knowledge in this important research area.

## **Conceptual Development**

### ***Decision-Making Quality in IPM and Organisational Agility***

Innovation portfolio management (IPM) is a dynamic decision-making process that evaluates and selects projects, as well as allocating related resources (Jonas et al., 2013; Cooper et al., 1999). In order to successfully develop an innovation portfolio, firms must coordinate and strategically align a portfolio of innovation projects, leverage synergies, capture portfolio value, and reduce risks at the portfolio level (Kester et al., 2011; Kester et al., 2014).

Most prior research has concentrated on success factors and ignored the decision-making processes underlying IPM. However recently, research interest in IPM decision-making has been flourishing. It has been qualitatively shown that rational and formal decision-making processes experience higher acceptability than informal ones (Gutiérrez and Magnusson, 2014). Portfolio success is determined by the actors' interaction process in portfolio decision-making where it is positively influenced by information availability, allocation of resources, and mutual collaboration (Jonas et al., 2013. Kester et al. (2011) identify that portfolio mindset, agility, and focus influence decision-making effectiveness.

Decision-making quality becomes one of the most important variables in managing innovation portfolio as the accuracy of project selection, resource allocation, alignment of innovation portfolio to strategy, and the choice of incremental or radical innovation implementation are determined by the way decisions are made (Kock and Georg Gemünden, 2016). Cooper et al. (2001) emphasise that portfolio management is aimed toward “doing the right things” which is opposite to what project management wants to achieve in “doing things right”. In this study, decision-making quality is defined as the degree by which portfolio management decisions—such as the initiation, (re)prioritisation, or even termination of projects—are made in a transparent, stable, comprehensible, and rigorous manner (Behrens and Ernst, 2014; Behrens et al., 2014; Kester et al., 2009; Kester et al., 2014; Kock and Georg Gemünden, 2016; Unger et al., 2012).

The positive empirical relationship between decision-making quality and organisational agility has been studied before (Kock and Georg Gemünden, 2016) and the conclusions show that the ability to respond appropriately to a dynamic changing environment is essential to firm survival (Dove 2001). A highly dynamic business environment requires organisations to adapt to a market environment with an ease that thereafter contributes to the achievement of cost economies (Chen et al., 2014) enabling organisations to exploit opportunities for innovation and competitive actions (Sambamurthy et al., 2003).

### ***Networking Capability***

The root of networking capability can be traced to dynamic capability theory (Teece et al., 1997), the resource-based view (Barney, 1991), literature on organisational learning and the knowledge-based view of the firm (Grant, 1996), and social network theory (Dyer and Nobeoka, 2000; Lorenzoni and Lipparini, 1999; Dyer and Singh, 1998; Capaldo, 2007). In line with dynamic capability theory, it is suggested that firms not only have capabilities that allow them to exploit internal resources, but also that they are permitted to access, configure, and leverage external network resources embedded in business partners (Teece, 2007). The capability of each firm in developing and managing networks can be different from one firm to another, and a firm can outperform other firms in this area (Dyer and Nobeoka, 2000).



Jifeng Mu and Anthony Di Benedetto define networking capability as the competency of a firm to purposefully search and find network partners and manage and leverage network relationships for value creation (Mu and Di Benedetto, 2012). By optimising networking capability, firms have the opportunity to leverage strategic network resources from network partners and make it possible for firms to integrate, combine, and optimise various expertise, capability, and knowledge that are considered strategic for the firms (Dyer and Singh, 1998; Mu and Di Benedetto, 2012; Mu, 2013; Vesalainen and Hakala, 2014; Mu et al., 2016; Lin, 2004; Mu, 2014). The previous research literature suggests that networking capability is a composite capability for finding networking partners, managing networking relationships, and leveraging networking relationships (Mu and Di Benedetto, 2012; Mu et al., 2016).

A Deloitte report states that to become a technology, media, and telecommunications frontrunner in the Industry 4.0 era, organisations must be able to amplify their technical and business capabilities through partnering. In an era of rapidly changing technology and complexity involved in designing technology platforms, organisations cannot go it alone and must be capable of mobilising a diverse ecosystem to deliver value to customers (Hupfer et al., 2018). Partnerships enable organisations to develop end-to-end solutions effectively which becomes the key for unlocking competitive advantages, as it enables organisations to determine cost position or differentiation (Hupfer et al., 2018; Porter, 1985; Cho and Moon, 2013; Porter, 1990).

### ***Business Intelligence System***

An organisation is required to effectively handle the dynamic information from diverse sources regarding changes in customers, competitors, and technologies and develop it into a business intelligence system. This system provides enterprise-wide, integrated, consistent data for managers in order to be able to filter out unimportant events related to customers, competitive actions, and technology and support what-if analysis (Park and El Sawy, 2017; Chen et al., 2012; Roberts and Grover, 2012; Tallon et al., 2013; Wixom and Watson, 2001). The excellence in this information technology processing capability enables organisations to respond to market change quickly and accurately (Park and El Sawy, 2017).

Firstly, the market-oriented organisation needs to deeply understand useful information about trends and players in the market, including customer analysis, competitor analysis, and other important influencers such as suppliers, socioeconomic conditions, and technological change (Slater et al., 2010). However, information, generated from what customers can articulate using traditional market research, is usually not enough to create distinguished and sustainable customer value. Customers may have difficulty in clearly articulating their needs, and future plans, and may not have the capability to exploit current technologies and explore expectations regarding future technologies (Slater et al., 2010); (Kohli and Jaworski, 1990). Intelligence

dissemination is the second important business intelligence system element. The information gathered during intelligence generation will become useful information if it is shared across the organisation and combined with other related information. The information value will be improved by effective dissemination of intelligence information so that organisational players are able to see it in a wider context, use this information, and supplement it with other complementary information (Slater et al., 2010). Thirdly, the market-oriented organisation must later integrate the intelligence to create knowledge assets and achieve a shared belief system, defined as a shared interpretation of the intelligent information, with details of how it can be properly exploited to improve firm business performance (Slater et al., 2010). Finally, the shared interpretation of the information must be manifested into coordinated action for implementing decisions.

### ***Nimble Organisational Structure***

Industry 4.0 is characterised by the presence of an agile network structure. The agile and flat hierarchy will accelerate decision-making as it reduces the communication layers. Nimble project teams are encouraged to work more independently and make necessary adjustment and adaptation based on the project requirements (Sivathanu and Pillai, 2018). In a nimble organisational structure, the whole organisation functions as an interactive network, where agile teams are integrated. It is not a top-down bureaucracy with just only a few teams working with IT or agile tools and processes (Denning, 2018). Agility at the team level or unit level will not be useful if senior managers themselves are still trying to comprehend and actualise the agile paradigm.

In a nimble organisational structure, everyone in the organisation is given a clear view of customer interactions, and the opportunity to work in small teams and short cycles. By implementing this sort of process, continuous product and solution enhancement can be achieved (Denning, 2017). Nimble structure is characterised by flat structure and accountable roles, and fosters hands-on governance where cross-team performance management and decision rights are pushed to the edge of boundaries to create active partnerships, as well as an ecosystem that extends internal networks and meaningful relationships within an extensive external network. Small, fit-for-purpose performance cells can then be used for designing and creating open physical and virtual environments that empower people to do their jobs effectively and in a more conducive environment (Aghina et al., 2018).

In this study, the decision-making quality in IPM and the organisational agility framework is developed and the relationship among the antecedents is elaborated. The dimensions and indicators of all constructs used in the framework are presented in Table 1.

**Table 1:** Variable, Definition, and Dimension

Variable	Definition	Dimension	Reference
Organisational Agility	Responsiveness to changes in demand, new product development, changes in product mix, product pricing, market expansion, supplier selection, IT adoption and diffusion.		(Sibony et al., 2017; Tallon, 2008; Tallon and Pinsonneault, 2011)
IPM Decision-Making Quality	The degree to which portfolio management decisions—such as the initiation, (re)prioritisation or even termination of projects—are made in a transparent, stable, comprehensible, and rigorous manner.		(Kock and Georg Gemünden, 2016)
Networking Capability	The competency of a firm to purposefully search and find network partners, manage and leverage network relationships for value creation.	<ul style="list-style-type: none"> <li>• Finding network partners</li> <li>• Managing network relationship</li> <li>• Leveraging network relationship</li> </ul>	(Mu and Di Benedetto, 2012; Mu et al., 2016)
Business Intelligence (BI) System	Information systems that support the acquisition of information about changes in customers, competitors, and technologies; disseminate it in a timely manner, and provide enterprise-wide integrated and consistent data	<ul style="list-style-type: none"> <li>• Information acquisition</li> <li>• Intelligence dissemination</li> <li>• Intelligence integration and coordinated action</li> </ul>	Adapted from (Park and El Sawy, 2017)

Variable	Definition	Dimension	Reference
Nimble Organisational Structure	An organisational structure built from the integration of nimble teams where the whole organisation embraces the nimble mindset and functions as an interactive network, not a top-down bureaucracy with just a few teams implementing nimble tools and processes	• Nimble Project Cycle	Adapted from (Denning, 2017; Denning, 2018)
		• Nimble Project Management	

## Research Study and Development of Conceptual Framework

### *Research Design*

Exploratory case studies are conducted in the early phase of conceptual framework development to obtain state-of-the-art insight from practitioners of important antecedents influencing IPM decision-making quality and agility (especially recent antecedents which are not yet extensively discussed in the literature). Case studies will help clarify the relationship between various IPM decision-making quality antecedents, and their relationship to agility. The case study is relevant and appropriate when the environment being studied is complex and disordered (Harrison, 2002). Therefore, the framework in this study is developed from both existing literature and contextual field data from exploratory case studies (Parasuraman et al., 2004).

Four large telecommunication equipment companies in Indonesia were selected for a semi-structured interview. They are multinational companies from the United States, Finland, Sweden, and China. These companies were selected because they are categorised as large companies having more than one product line and multiple project teams that allows us to explore how they manage nimbleness inside the organisation. The definition of a large company follows the Indonesian Central Bureau of Statistics (BPS Indonesia) classification whereby the size of the business is defined as a company with more than 100 employees ([www.bps.co.id](http://www.bps.co.id)).

The exploratory case studies are based on thirty minutes to one hour semi-structured interviews with members of the senior leadership in each company. The respondents were at management level within the company, such as the CEO, CTO, Sales or Marketing Head, or Director, who

were believed to have sufficient knowledge of both company strategy as well as the business processes of the company.

### *Developing the Conceptual Framework*

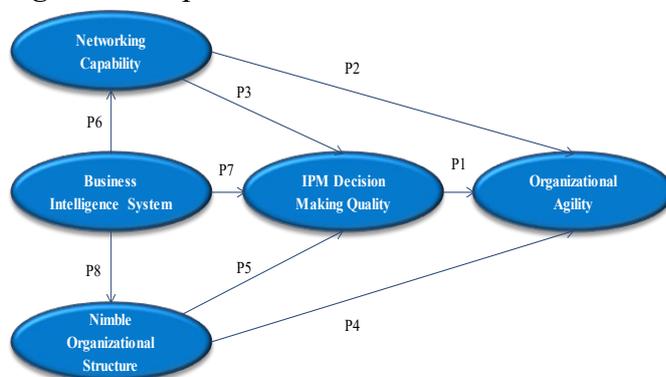
The selection of variables for the conceptual framework is guided by an extensive literature review, identifying dominant antecedents that are considered to be key in shaping IPM decision-making quality and agility, and was developed through exploratory case studies. The relationship among variables will be examined in detail in this part, and the conceptual research model is developed, as shown in Figure 1.

### *Decision-Making Quality and Organisational Agility*

A study by Alexander Kock and Hans Georg Gemünden (2016) provides empirical evidence that a high decision-making quality allows for better organisational agility. Decision-making quality includes not only a decision to invest in a certain project but also to terminate an innovation project in order to attain a better portfolio strategic and swiftly reconfigure resources and respond to market dynamics (Behrens and Ernst, 2014; Unger et al., 2012). Kester et al. (2011) state that agility as the component of portfolio decision-making effectiveness is a consequence of portfolio decision-making processes. Previous research by Floricel and Ibanescu (2008) and Petit (2012) argue that IPM is considered a dynamic capability with the capacity to re-orchestrate organisational resources so that an organisation is able to respond to market dynamics. High quality organisational IPM decision-making is associated with high organisational responsiveness concerning environmental changes. It is, therefore, proposed that:

P1: IPM Decision-Making Quality has a positive and direct impact on Organisational Agility.

**Fig. 1.** Conceptual Model



### ***Networking Capability and Organisational Agility***

Networking capability makes it possible for firms to gain, create, and share knowledge, and establish partnerships with key stakeholders, in order to consolidate strategic partnerships. This capability allows firms to gain flexibility in the leveraging of key resources and business partners and work across boundaries to reach strategic agility (Battistella et al., 2017). Networking capability enables firms to obtain information and achieve competencies reliably and rapidly which consequently allows firms to become strategically agile due to being well-positioned in the strategic network core. By virtue of this positioning, firms are able to gain better and faster opportunities and deal with potential competition and threats (Battistella et al., 2017).

Another study by (Rezazadeh and Nobari, 2018) on cooperative entrepreneurship emphasises that by way of cooperation with partners, a synergy can be achieved that accelerates the decision-making process. Collaboration with partners enables firms to leverage partners' resources and knowledge during joint project implementation and is a worthwhile strategy for firms' agility (Sanchez and Nagi, 2001). Partnership with agile firms stimulates partners to achieve an equivalent level of capabilities, competencies, and flexibilities in their enterprise to conform to rapidly-changing customer and market demands (Yusuf et al., 2014). It is, therefore, proposed that:

P2: Networking Capability has a positive and direct impact on Organisational Agility.

### ***Networking Capability and Decision-Making Quality***

Inter-firm networking capability has been recognised in the literature as a mean that can produce or improve value in relation to product development and innovation (Mu et al., 2008; Dhanaraj and Parkhe, 2001; Peng and Mu, 2011; Soh and Roberts, 2005; Stuart and Sorenson, 2007). By leveraging network relationships, both parties will be able to generate differential returns that are beneficial for both as a totality (Dyer and Singh, 1998; Capaldo, 2007; Mu and Di Benedetto, 2012; Dhanaraj and Parkhe, 2001). Superior performance can be achieved by cooperating with partners as the development risk can be reduced, time-to-market can be shortened, defect rate can be reduced, product stock can be reduced, and flexibility and innovation can be enhanced (Dyer and Nobeoka, 2000). While Capaldo mentions that by leveraging network ties, superior innovation can be achieved (Capaldo, 2007).

Jifeng Mu and Anthony Di Benedetto argue theoretically, and demonstrate empirically, that networking capability is a reliable predictor of new product development performance (Mu and Di Benedetto, 2012). In a later study, it was also found that networking capability drives and exerts its impact on network structural relationships, which in turn affects new product

development (NPD) performance; and that strong ties and bridge ties positively affect NPD performance when firms have adequate networking capabilities (Mu, 2014). The empirical results also indicate that firms' sufficient networking capability to manage network dynamics is an important variable that positively moderates market orientation and entrepreneurial orientation with NPD performance (Mu et al., 2016).

As the Sales Head of a European company stated:

Telecommunication operators' requirements are becoming more complex. They demand telecommunication equipment companies provide an end-to-end solution and try to avoid being involved with the complexity of being engaged with multiple solution suppliers. Because of this, telecommunication equipment companies are required to have the ability to create partnerships and leverage a partner's specific capability to gain an advantage of having fast and comprehensive innovation.

A study by Choi and Contractor (2017) adds a complementary finding that moderately involved and moderately complex alliance agreements with diverse organisational partners are better for performance (due to the likelihood of R&D progress), in relation to the four decision points of the R&D process. In this partnership model, alliance partners can maximise the benefits of sharing valuable resources for R&D while at the same time mitigating the costs of interaction and complex task coordination, and are then able to be more nimble in responding to unexpected events (e.g. R&D failure). It is, therefore, proposed that:

P3: Networking Capability has a positive and direct impact on Decision-Making Quality.

### ***Nimble Organisational Structure and Organisational Agility***

Enterprise-wide agility is shaped from nimble teams integrated into a nimble network and should be freed from top-down bureaucracy. It is not merely a few teams or unit levels working with IT tools or processes under senior managers who are still learning to embrace and embody the agile mindset. The whole organisation needs to act and function as an interactive network (Denning, 2018). Organisational agility is greatly impacted by organisational structure. When there is a rapid change in the business environment, the hierarchy will experience difficulties that are usually caused by distorted information from the bottom. The highly bureaucratic nature of hierarchical organisations requires considered decision-making, which cannot be made within a short period of time (Teece et al., 2016).

Nimble organisational structures allows teams within an organisation to collaborate interactively and transparently in order to achieve a singular vision in the delivery of accurate products and solutions to customers (Denning, 2017). The nimble network promotes

innovation as it stimulates active partnership and the emergence of constructive ideas which may come from any competent team members throughout the organisation (Denning, 2018; Denning, 2017). A nimble network contributes to organisational-wide agility. It is, therefore, proposed that:

P4: A Nimble Organisational Structure has a positive and direct impact on Organisational Agility.

### ***Nimble Organisational Structure and Decision-Making Quality***

An appropriate organisational structure has been considered a prominent enabler of successful product innovation management. Organic structures and decentralisation enable faster and more effective decision-making in dynamic and rich information environments (Cormican and Sullivan, 2004) as they promote learning and knowledge generation (Cumming, 1999; Baets, 1998; Davenport and Prusak, 1998). In order to have successful communication in a portfolio decision-making process, effective organisational structure and leadership motives are required (Hepworth et al., 2017). In a dynamic market, an organisation's proficiency in establishing new organisational structures which address complex and customs requirements is crucial to coping with risks and uncertainties (Gemünden et al., 2018).

An organisation with multidivisional structures is able to become more responsive and flexible in seizing by allowing decentralisation. With this structure, new product development can be assigned to particular divisions with divisional resources, making it possible for the organisation to orchestrate the resources necessary to develop products required by the market (Teece et al., 2016).

The Solution Sales Head of a European company stated that:

The problem with most of the European telecommunication companies is that they are still experiencing a strong vertical structure and reporting lines based on product lines, or functional departments, with a non-flexible hierarchical decision-making process.

In order to be agile, it's best if there is a higher number of small customer-facing teams, with more independent decision-making capabilities.

Working in these small, nimble teams, and in short cycles, with a sound knowledge of customer positioning and expectations, allows nimble structure teams to make enhancements to existing products or solutions regarding the production of new products over a short time period (Denning, 2017). A flexible and organic structure offers advantages over an excessively rigid systematic approach to developing an innovation portfolio as it enables the leverage of

the full spectrum of organisational competencies while harnessing the unique skills of individuals (Rubin and Abramson, 2018). It is, therefore, proposed that:

P5: A Nimble Organisational Structure has a positive and direct impact on Decision-Making Quality

### ***Business Intelligence Systems and Networking Capability***

Information technology (IT) enables parties in partnership to accelerate the exchange of information which subsequently promotes the availability and quality of critical and relevant information necessary to improve firm performance (Tippins and Sohi, 2003). As IT improves information exchange in the form of knowledge sharing between partners, it helps improve networking efficiency by acquiring, interpreting, and storing accurate and necessary knowledge (Madhok and Tallman, 1998; Selnes and Sallis, 2003).

Activity integration with international subcontracting partners will be possible if the aligned information system is available (Seggie et al., 2006). Furthermore, activity coordination between members of a partnership is enhanced by fast and accurate information exchange that promotes joint actions (Selnes and Sallis, 2003); (Kim et al., 2006). The information system will promote the networking and collaborative capability between all business partners involved (Chang et al., 2014).

IT investments, in the form of dedicated IT assets and IT alignment, positively influence information exchange, relationship-specific knowledge (RSK) stores and joint actions, which are major components of partnership dynamic capabilities, and can be defined as the ability of partners to coordinate actions in pursuit of market opportunities, or in response to threats (Chang et al., 2014). Even though the effect of dedicated IT assets and IT alignment toward relationship-specific knowledge (RSK) stores is not significant, this effect is mediated through information exchange. Through this IT investment, partnership performance will be enhanced through product development platform synergy and effective information sharing of a market, operational data, and end-user records (Chang et al., 2014). It is, therefore, proposed that:

P6: A Business Intelligence System has a positive and direct impact on Networking Capability

### ***Business Intelligence System and Decision-Making Quality***

Innovation decision-making requires information processing as a crucial activity as it mitigates environmental uncertainty (Galbraith, 1974) and promotes organisation-wide information distribution (Daft and Lengel, 1986). Information systems intensifies organisations' information processing capabilities by enhancing the amount of information that the



organisations are able to administer (Ben-ariéh and Pollatscheck, 2002). In order to achieve successful innovation, support in the form of coordination, collaboration, and communication through IT is increasingly important (Kawakami et al., 2015; Peng and Heim, 2014; Saldanha et al., 2017). A business intelligence system provides profound knowledge regarding the market, and subsequently influences decision-making accuracy regarding which innovation portfolio to pursue (Kroh et al., 2018).

As stated by a Sales Head of a company from the United States:

In order to win the market over, an organisation needs to be innovative and agile and maintain a customer-centric vision. The organisation must be able to capture customer ‘pain points’ and requirements, disseminate this intelligence within the organisation and subsequently perform coordinated action to arrive at accurate decisions and solutions that fit the requirements of suitable price and feature. There is nothing more important. Solutions can be developed in-house or by collaborating with other solution providers.

A Sales Head of a Chinese telecommunication company stated:

We have to understand the technology trend, both today and in the near future, and customers’ plans and requirements. The customer is primary. By aligning with both, an organisation will be able to make the correct innovation decision. When adaptation in product development is required, our organisation shares technical expertise groups and set up “bridges” between different product lines in an integrated communication platform to support fast, coordinated, and documented decision-making.

It has been shown that project portfolio management information systems bring positive impacts to portfolio management success (Kock et al., 2015) as mediated by project portfolio management quality. The project management process can be defined better with the use of an information system, while at the same time information quality can be accentuated (Gemünden et al., 2018).

Other research empirically demonstrates that intensive IT use positively influences organisation-wide market knowledge, which in turn has a positive impact on a firm’s innovation program performance, since IT intensifies information exchange with internal and external stakeholders (Kock et al., 2015). It is, therefore, proposed that:

**P7: A Business Intelligence System has a positive and direct impact on IPM Decision-Making Quality**



### ***Business Intelligence Systems and Nimble Organisational Structure***

The development of a nimble organisational structure should be supported by a business intelligence system that intensifies communications and strengthens effective knowledge dissemination (Hamranova et al., 2014). Information systems allow multiple project teams to obtain and share useful information residing in other operating units (Dewett and Jones, 2001). Information technology has dramatically expanded access by individuals or teams to various sources of information that subsequently promote their level of participation in various information networks (Yan and Louis, 1999).

A business intelligence system uses data sources that span the departmental and functional boundaries which enable cross-functional data integration and reporting (Chaudhuri et al., 2011). Business intelligence also promotes the integration of organisational data with external market and customer data (Forsgren and Sabherwal, 2015). The capacity for obtaining information and making an analysis that spans organisational departments supports business decisions that go beyond the single control activities, such as balanced scorecards (Elbashir et al., 2011). With these capabilities, organisations will be able to leverage the resources they have to achieve new resource configurations as markets dynamics (Kogut and Zander, 1992; Eisenhardt and Martin, 2000). It is, therefore, proposed that:

P8: A Business Intelligence System has a positive and direct impact on Nimble Organisational Structure

### **DISCUSSION**

In this study, we theorised that closely coordinated IPM can increase decision-making quality and enhance the organisational responsiveness in satisfying market demand. Successful innovation decision-making is produced by intensive internal and external information processing, coordination, and collaboration of resources under a business intelligence system (Ben-ariéh and Pollatscheck, 2002; Kawakami et al., 2015; Peng and Heim, 2014).

However, this study also emphasises that as the customer requirement complexity increases in today's open innovation era, the capability of organisations to leverage networking with partners (Mu et al., 2016; Mu and Di Benedetto, 2012) and to exploit internal organisational structure flexibility (Denning, 2017) becomes more important for the success of product development and organisation responsiveness when offering solutions to customers. This study provides an integrated perspective, centred upon business intelligence capabilities, which positively influence organisation networking and collaborative capability between all business partners involved (Chang et al., 2014). From this integrated perspective multiple project teams may obtain and share useful information (Dewett and Jones, 2001) and improve the level of

participation in various information networks (Yan and Louis, 1999). This study, therefore, adds to the growing body of research aimed at understanding the mechanisms through which the three antecedents influence organisational agility and subsequent business performance.

## CONCLUSION

Exploratory case studies and a systematic literature review proved that decision-making quality in IPM and organisational agility is decisive for business success when an organisation is facing intense market pressure (Kester et al., 2009; Kester et al., 2014). Decision-making quality and agility are determined by appropriate investments in ongoing product renewal and extensions, as well as investments in products for new market spaces (Kester et al., 2009). Therefore, the quality of innovation portfolio decision-making is central to strategic decision-making capability, especially when the innovation complexity increases (Killen, 2017; Jonas, 2010).

This study develops a conceptual framework which links networking capability, nimble organisational structure, and a business intelligence system and examines their effect on decision-making quality. It employs information processing theory to propose and examine the antecedents and consequences of decision-making quality in IPM. The study diverges from the previous studies on IPM decision-making by investigating networking capability in leveraging external capability and organisational structure flexibility in order to enable organisations to achieve high-quality IPM decisions and agility. This study therefore adds to the cumulative body of knowledge in this important research area. The conceptualisation and investigation of the autonomous and joint effects of the market-orientation of the business intelligence system, networking capability, and nimble structure on organisational agility, highlights the importance of complementarities between antecedents and sets a standard for future research.

### *Future Research*

This study has a limitation in that it is solely conducted in relation to telecommunication equipment companies in Indonesia. As the antecedents of IPM decision-making quality have been identified and their relationship is presented, a large-scale quantitative survey may be further undertaken to test the conceptual framework and more extensively explore the role of each variable. Future research may be extended to consider international implications of the research and wider industry coverage.

### *Management Implications*

From a managerial perspective, this research gives managers a comprehensive view of how to enhance organisational IPM effectiveness and consecutive responsiveness in providing solutions to customers, and consider which important factors influence this effectiveness and



its relationships. It is suggested that portfolio managers intensify the use of the information system, as it positively impacts an organisation's innovation program performance, by intensifying the information exchange between internal and external stakeholders.

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