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Enhancing resilience in digital multi-sided platform start-ups: An exploration of entrepreneurial logic and open innovation strategies

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ABSTRACT

Objective: The article aims to examine the strategic fit between two distinguishable types of entrepreneurial logic (effectuation and causation) and different types of innovation approaches (radical and innovative).

Research Design & Methods: We employed a self-administered questionnaire-based quantitative study and the partial least squares structural equation modelling (PLS-SEM) to test the hypothesis. The sample comprises 70 Indonesian digital multi-sided platform (MSP) start-ups that have been operating for at least three years.

Findings: The empirical results suggest that effectuation can contribute to digital MSP start-ups' resilience after they succeed in providing radical innovation. On the other hand, causation directly contributes to their resilience. Meanwhile, incremental innovation does not contribute to digital MSP start-ups' resilience.

Implications & Recommendations: The empirical results suggest that effectuation can contribute to the resilience of digital MSP start-ups after they succeed in providing radical innovation. On the other hand, causation directly contributes to their resilience. Meanwhile, incremental innovation does not contribute significantly to the resilience of digital MSP start-ups.

Contribution & Value Added: This study explores how the entrepreneurial logic in digital MSP start-up models can improve the survival rates of emerging market start-ups. It focuses on Indonesia, where the survival rate is comparatively lower than in other Asian countries. Moreover, this research is crucial for comprehending the phenomenon underlying the resource-based theory paradox, because it involves implementing innovation strategies within the constraints of limited initial resources and capabilities.

Article type: research article

Keywords: effectuation; radical innovation; incremental innovation; resilience; multi-sided platform

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INTRODUCTION

Digital entrepreneurship through multi-sided platforms (MSPs), a business model involving multiple user roles that interact within the enterprise's digital ecosystem, has become a common approach for young entrepreneurs to innovate and address inefficiencies or institutional voids in the market (Soluk *et al.,* 2021; Khanal *et al*., 2021; McAdam *et al*., 2021). Driven by two key reasons, scholars have started to focus more on MSPs (McIntyre *et al*., 2017). Firstly, platforms play a crucial role in the broader economy by reducing transaction costs among market sides (*e.g.* Hagiu, 2015). Secondly, multi-sided platforms (MSPs) stand out as highly promising business models in the digital economy because of their flexibility, capacity to handle complexity, rapid scalability, and value capture (Abdelkafi *et al*., 2019). Multi-sided platforms offer the same benefits to entities engaging in larger-scale transactions

as technology platforms do, enabling companies to achieve economies of scale and scope. The effects of platforms extend to diverse sectors such as the food industry, credit card processing, and textbook publication, highlighting their relevance beyond technological advancement (McIntyre *et al*., 2021).

Employing an MSP serves as a common indicator of an innovative firm. Through harnessing platform economics and the potential of networks, numerous early-stage businesses have evolved from modest beginnings into global leaders. Furthermore, established enterprises have turned to the platform paradigm to break free from their routines and explore innovative avenues (Libert *et al*., 2016). According to the research by Krisharyanto and Purwadi (2021), more than 1000 digital MSP start-ups had been registered as legal entities by 2019. These entrepreneurs initiate digital MSP start-ups with a nascent business model, despite having limited resources and experience. Many of them achieve remarkable success, growing into unicorn-stage start-ups or publicly listed companies (Fauzi & Daryanto, 2019; Santoso *et al*., 2018). Nevertheless, the Indonesian context also witnessed the failure of numerous digital MSP start-ups due to their inability to establish market-accepted business models and adapt to shifting business dynamics (Santoso *et al*., 2020b; Sucahyo *et al*., 2018).

Recent research in the entrepreneurship field mentions that the resilience of start-ups largely hinges on innovation (*e.g.* Sadeh & Dvir, 2020; Eftekhari & Bogers, 2015) and entrepreneurial logic (*e.g.* Long *et al*., 2021; Laine & Galkina, 2017). Two types of technological innovations, *i.e.* radical and incremental, still pose challenges in identifying their determinants in the market (Coccia, 2017). Interestingly, some studies also suggest that innovation might not significantly contribute to start-up resilience (Shan *et al*., 2016; Hyytinen *et al*., 2015). Regarding entrepreneurial logic, Sarasvathy (2001) elucidated decision-making processes at the firm level, especially when leaders must make choices in situations when information and resources are insufficient. Traditionally, causation logic is employed when contemplating intended outcomes and selecting available resources. In the case of resource scarcity, firms adopt effectuation logic to proactively seize opportunities. Given that firms can concurrently engage in radical and incremental innovation (Coccia, 2017), these two logic can also apply to technological innovation. However, studies delving into the strategic alignment between entrepreneurial logic and open innovation approaches for start-up survival remain relatively limited.

To bridge this gap, we aimed to examine the strategic alignment between two distinct types of entrepreneurial logic (effectuation and causation) and various innovation approaches (radical and incremental) that contribute to start-up resilience. These endeavours align with the notion put forth by West and Bogers (2017) to encompass and integrate our comprehension of innovation, particularly within innovative phenomena and perspectives, focusing on new venture development and the innovation process within the MSP firm context. This study focused on the paradox presented by the resource-based theory, wherein innovation strategies are employed amidst limited initial resources and capabilities. Furthermore, this research is pivotal in comprehending the entrepreneurial logic embedded in the business model of digital MSP start-ups. Its significance lies in enhancing the survival rate of Indonesian start-ups, which remains comparatively lower than that of other Asian countries (Maulana *et al*., 2018).

The structure of this article is as follows. Firstly, we will present the conceptual framework and hypotheses, providing an explanation of the theoretical underpinning. Secondly, we will present the research methodology. Thirdly, we will elaborate on the result of the empirical research and discussion. Finally, we will highlight the significance of the findings and their implications for theoretical, managerial, and future research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Effectuation and Causation in Digital MSP Start-ups Innovation

Effectuation is characterized as a logic of 'organized improvisation' and non-predictive control that accepts a set of means as provided and concentrates on picking amongst various results that may be generated with that set of means. Meanwhile, causation begins with the intended outcomes and the selection of the most appropriate means to produce such outcomes (Sarasvathy, 2001). Effectuation and causation, either separately or jointly, are aspects of entrepreneurs' logic that are crucial in governing the firms' innovation or strategy to attain noble performance (Paweta, 2016; Roach *et al.*, 2016; Yu *et al.*, 2018).

In the context of digital multi-sided platform (MSP) start-ups, innovation is best understood in terms of novel substances. Concerns regarding the MSP's impact on innovation are logically linked to concerns about competition (Marty & Warin, 2022). They present a straightforward theoretical model that emphasizes the importance of an MSP in promoting open innovation. This model aims to assess the consequences of organizing sectors around an MSP on open innovation dynamics, with particular attention to the influence of cross-platform competition. In relation to competition policy, it illustrates how to encourage cross-platform competition. The resulting outcomes are threefold. Firstly, an MSP's presence is pivotal for fostering market innovation. Secondly, it suggests that the MSP's disproportionate market power could impede open innovation in this realm, even if the negative impact on the industry's pace of open innovation is not immediately evident. Finally, the data reveals that industries with multiple MSPs tend to innovate at a higher rate.

Trabucchi and Buganza (2019) differentiate three strategies that can be observed from multiple open innovation perspectives, offering broader insights. Supply (side) extension and data trading are grounded in the potential to augment the fundamental transactional two-sided structure by introducing a new side, effectively reshaping the system around the platform provider. This transformation takes place not only because the participants within it exchange value in diverse manners but also because it evolves as a dynamic, growing ecosystem. They coined the term 'ecosystem innovation' for these two tactics, aiming to expand the network's entities (Trabucchi & Buganza, 2019). In this context, incremental innovation performance is achieved by initially exploring novel insights, followed by the transformation of existing activities using these insights, and ultimately leading to the creation of fresh offerings such as content or features. On the other hand, radical innovation can be realized by reinforcing crowd or community management practices through co-creation initiatives involving ecosystem platform members, potentially leading to the development of new business models (Subramaniam & Youndt, 2005; Solesvik, 2019).

The question of which logic (effectuation or causality) contributes to specific forms of innovation (radical or incremental) is intriguing. According to Tushman and Anderson (1986), firms implementing radical innovations experience faster expansion than those adopting incremental ones. Similarly, Chandy and Tellis (2000) concluded that new firms are the origins of radical innovation, whereas incumbents lean towards incremental innovation. In cases of resource constraints, open innovations in new ventures or start-up environments usually emerge based on effectuation logic. As these firms progress beyond their initial stages, they tend to innovate employing causation logic.

As per Arroteia and Hafeez (2020), earlier studies based on the resource-based view both endorse and indicate that firm and individual resource levels constrain the development of capabilities required for identifying new market opportunities. The existence of social networks and experiential knowledge leads to a fusion of effectual and causal relationships. Furthermore, Pérez Sigüenza *et al*. (2022) discovered that effectuation surpasses the resource-based theory when effectuation employs networking strategies for expansion. Effectuation is also recognized as a tool for enhancing creativity.

A previous study revealed that small start-ups with limited resources employ effectuation reasoning early in the open innovation process, while causation logic becomes more prevalent as the firms progress through their life cycle (Linglebach *et al*., 2015). Under conditions of uncertainty, the resource-based view perspective suggests that entrepreneurial networking leads to the non-predictive control of effectuation (Galkina & Jack, 2022). In this context, non-predictive control involves abstaining from using available information to predict specific situations. Instead, start-ups tend to base their decision-making on interactions and negotiations with their stakeholders (Dew *et al*., 2009). Guo (2019) discovered that effectuation strongly influences open innovation and is often associated with emergent strategies for exploring new possibilities. As a result, effectuation logic fosters radical innovation. Conversely, the resource-based view also suggests that in more stable situations, relationships with external stakeholders through entrepreneurial networking are forged using goal-driven decision-making of causation (Galkina & Jack, 2022). Unlike the non-predictive control of effectuation, which shapes open innovation through external interactions, goal-driven decision-making of causation relies on available information such as market research or feasibility studies (Dew *et al*., 2009). The prominence of causation logic increases in the open innovation process as the firm's resource constraints diminish.

Sarasvathy and Venkataraman (2011) argue that we can perceive entrepreneurship as a method akin to the scientific method. They suggest that teaching entrepreneurship as a skill can improve reasoning about the world. Rathakrishnan *et al*. (2021) discovered that the right combination of people (those open to change or self-transcendent) and process (effectuation) positively predicts innovative behaviour and firm performance. Guo (2019) establishes a connection between effectuation and innovation strategy, highlighting the favourable impact of effectuation on innovation strategy and opportunity shaping. Moreover, Guo (2019) suggests that opportunity shaping plays a mediating role in the link between effectuation and innovation strategy. This implies that effectuation can shape the identification and creation of opportunities, which in turn can lead to radical innovation. Moreover, Rathakrishnan *et al*. (2021) emphasize that incorporating effectuation logic into decision-making processes can activate implementation-oriented behaviour, resulting in elevated firm performance. Furthermore, Liu and Isaak (2016) argue that effectuation can drive radical, disruptive innovation, while causation logic is more likely to yield iterative, incremental innovation. These studies collectively imply that effectuation can enhance innovative behaviour, firm performance, and the identification and creation of opportunities, ultimately culminating in radical innovation. Hence, we hypothesised:

H1: Effectuation has a positive association with radical innovation performance.

Forés and Camisón (2016) discovered that internal knowledge creation capability positively influences incremental innovation performance. This finding supports the notion that a deliberate and planned approach, characteristic of causation, can contribute to incremental innovation performance. Furthermore, Ritala *et al*. (2022) examined the connection between renewal capital, knowledge protection, and innovation performance. Their findings reveal that firms' renewal capital is positively linked to the extent of incremental innovation. This implies that the capacity to refresh and enhance the firm's knowledge base, aligning with the principles of causation, can contribute to incremental innovation performance (Ritala *et al*., 2022). Moreover, Prokop *et al*. (2022) investigated the relationship between owner gender diversity, energy management, and the degree of innovation radicalness within firms. They affirmed the correlation between firms' implementation of energy management and the generation of both radical and incremental innovations. This further bolsters the hypothesis that causation is positively associated with incremental innovation performance (Prokop *et al*., 2022). These studies collectively indicate that external environmental factors, internal knowledge creation capability, renewal capital, and energy management are positively linked to incremental innovation performance. These findings underscore that a methodical and planned approach characteristic of causation can contribute to incremental innovation performance. Hence, the above conditions are formulated as hypothesis as follows:

H2: Causation has a positive association with incremental innovation performance.

Digital MSP Start-ups' Innovation in the Resilience Aspect

Our research focused on how digital MSP start-ups can evolve into resilient organizations. Organizational resilience signifies an organization's ability to adapt to and thrive within its evolving environment (Chaharbaghi *et al*., 2005). Chaharbaghi *et al*. (2005) and Mafabi *et al*. (2012) provide evidence that innovation is the fundamental route to establishing organizational resilience. Their findings, grounded in knowledge management research, underscore the significant role of innovation in fostering company resilience. Moreover, Borda-Rodrigue and Vicari (2015) demonstrated the connection between innovation and cooperative resilience. As per Sabahi and Parast (2020), firms operating within a more innovative environment exhibit greater robustness against disruptions. Innovation, both directly and indirectly, helps firms reinforce competencies that positively impact their risk management capacity.

A symbiotic connection appears to exist between the two. A resilient firm acquires knowledge from its environment to implement the necessary open innovations for enhancing resilience (García-Morales *et al*., 2006). Buliga *et al*. (2016) claim that business model innovation (*i.e.* radical innovation) serves as a robust response to environmental turbulence and it emanates from resilient companies. Consequently, a firm's resilience is closely linked to its capacity for generating radical innovation (Buliga *et al*., 2016; Rampa & Agogué, 2021). However, in certain contexts, such as the

manufacturing sector within developed countries, emphasizing extensive or incremental innovation enhances firms' resilience (Wojan *et al*., 2018).

Thus, we hypothesised:

H3: Radical innovation performance has a positive association with start-up resilience.

H4: Incremental innovation has a positive association with start-up resilience.

Entrepreneurial Path for Start-up Resilience

Prior research has substantiated that effectuation and causation stand as pivotal components of firms' open innovation (Linglebach *et al*., 2015; Roach *et al*., 2016; and Yu *et al*., 2018). Numerous additional studies have further affirmed the role of open innovation in fostering business resilience (Chahrabaghi *et al*., 2005; Garcia-Morales *et al*., 2006; Mafabi *et al*., 2012; Buliga *et al*., 2016). To gain a more comprehensive understanding of how entrepreneurial logic (effectuation and causation) are adapted to cultivate resilient companies, there is a need to test the mediating impacts of open innovation. This endeavour is essential given our primary objective of constructing firm resilience based on entrepreneurs' logic.

While delving into knowledge management, McManus *et al*. (2008) discovered that innovation serves as a bridge to establish organizational resilience. Knowledge management, as detailed by Mafabi *et al*. (2012), encompasses the acquisition, development, and utilization of information for change, leading to innovation and ultimately firm resilience. Ferreira *et al*. (2021) examined the mediating roles of open innovation in achieving firm performance within their study on how managerial capability generates competitive advantages. They emphasized that dynamic capability may directly and indirectly influence competitive advantage, but innovation is essential to connect this capability with outcomes.

In certain instances, radical innovation and incremental innovation assume distinct mediating roles between antecedents such as entrepreneurial logic or market orientation and firm performance, ultimately influencing resilience. Although both radical innovation and incremental innovation stem from market orientation, these two types of innovation serve as antecedents for varying firm performance outcomes. Radical innovation operates as a direct antecedent of firm performance. In contrast, incremental innovation indirectly contributes to firm performance by means of new product performance (Chang *et al*., 2014).

Gruber *et al*. (2008) explored market opportunity identification in emerging technology firms and underscored the concept of multiple opportunity identification prior to entry. Serial entrepreneurs, who possess prior start-up experience, formulate a 'choice set' of alternative market opportunities before determining which one to pursue. This implies that effectuation, as a decision-making approach, can lead to the identification of multiple market opportunities, including those necessitating radical innovations. Furthermore, Gruber *et al*. (2008) support the notion that entrepreneurs who identify a 'choice set' of market opportunities prior to their initial entry attain performance advantages. This indicates that start-ups engaging in effectuation and identifying multiple market opportunities have the potential to attain superior performance outcomes, including resilience. Therefore, we hypothesised that radical innovation performance mediates the relationship between effectuation and start-up resilience. Effectuation, as a decision-making approach, can lead to the identification of multiple market opportunities and the creation of radical innovations, which subsequently contribute to the resilience of start-ups.

H5: Radical innovation performance mediates the relationship between effectuation and start-up resilience.

Zahra and George (2002) discuss the concept of absorptive capacity, which pertains to a firm's ability to acquire, assimilate, and apply external knowledge. The article underscores the distinction between a firm's potential and realized capacity and how they can influence the establishment and maintenance of competitive advantage. This implies that causation, involving the leveraging of existing resources and capabilities, can contribute to a firm's absorptive capacity. Consequently, absorptive capacity can facilitate incremental innovation performance, potentially mediating the relationship between causation and start-up resilience. Furthermore, Zahra and George (2002) extend the concept of absorptive capacity by delineating the circumstances in which a firm's potential and realized capacities

can differentially impact its performance. By proficiently harnessing and applying external knowledge, start-ups can enhance their innovation capabilities and ultimately enhance their resilience in the face of challenges. As a resource-based approach, causation can contribute to a firm's absorptive capacity, subsequently fostering incremental innovation performance. This performance in incremental innovation can then mediate the link between causation and start-up resilience. Hence, we hypothesised:

H6: Incremental innovation performance mediates the relationship between causation and start-up resilience.

RESEARCH METHODOLOGY

Sample and Data Collection

This research employed samples from Indonesian digital MSP start-ups that implement open innovation practices involving crowd, community, or complementary approaches. These start-ups have been operational for a minimum of three years. Most of these digital start-ups are user-generated content platforms (UGC) relying on multiple individuals or communities to co-create content (Rayna & Striukova, 2015; Schweisfurth *et al*., 2011). Moreover, MSP firms can capture value from the crowd or the platform ecosystem using an open strategy perspective (Chesbrough, 2007).

In our research, we focused on the founding team personnel of Internet-based MSP start-ups, aiming to scrutinize the implementation process within new businesses engaged in open innovation procedures. The members of the founding team were generally young individuals with relatively limited absorptive capacity and little experience in establishing or managing a company, given that internet ventures are typically no more than a decade old (Guo *et al*., 2016; Milanov & Fernhaber, 2009). This background aligns with the principles of effectuation, particularly for novel and unproven business models (Fisher, 2012; Sarasvathy, 2001), and is especially relevant for developing countries (Cai *et al*., 2017). This type of business demonstrates exceptionally high market growth and a notable level of uncertainty due to environmental dynamism. Consequently, we confronted these challenges through exploratory learning.

The respondents representing digital MSP start-ups as entrepreneurial organizations are founders or executives. Given the relatively nascent nature of these businesses and the fragmented company data available in Indonesia, we employed a judgmental sampling method (Malhotra & Birks, 2007). To address these challenges, we collected data from diverse sources, including recommendations from interviewees (snowball sampling). Not all contacts were willing to provide information about potential respondents. We managed to accumulate around 151 lists of potential respondents. Out of these, 78 questionnaires were distributed and fully completed. Among these distributions, 47 were submitted online, and 31 questionnaires were collected through face-to-face interactions. Out of the 78 collected datasets, eight did not meet the screening criteria and thus we excluded them from data processing. Therefore, the total number of responses comprised 70 data samples. Apart from the screening results, no data were lost due to the researcher's direct contact and respondents' monitoring.

Measures and Statistical Methods

We employed a self-administered questionnaire-based quantitative study that utilized a 6-point Likert scale for hypothesis testing. We adapted the measurements of the latent variables from previous studies with relevant contexts to uphold content and construct validity, as outlined in Table 1. In this context, effectuation comprises five lower-order constructs: means, affordable loss, leverage contingencies, partnerships, and non-predictive control. This measures the entrepreneurial decision-making approach that emphasizes leveraging existing resources and constraints to generate new opportunities and outcomes (Sarasvathy & Dew, 2008). Conversely, causation measures a process that concentrates on selecting means to create a particular effect, assuming the effect as given (Chandler *et al*., 2011). Radical innovation performance gauges the development and execution of new and notably distinct business models that induce substantial changes and disruptions within the market (Tien & Cheng, 2017). On the other hand, incremental innovation performance assesses the process of refining, enhancing, and exploiting

existing products, services, or processes without introducing significant changes to the underlying technical trajectory (Tien & Cheng, 2017). Lastly, start-up resilience measures the start-up's ability to anticipate, respond, adapt, and rebound from disruptive events or challenging circumstances, enabling the maintenance of operations and the achievement of long-term success (Matos *et al*., 2022).

Table 1. Measurement indicators

Questionnaire items	AVE	CR	SLF	Mean	Std. Dev
Effectual logic (Chandler *et al.*, 2011; Guo *et al.*, 2016; Laskovaia *et al.*, 2017; Roach *et al.*, 2016)					
- *Means*	**0.639**	**0.839**			
1. Network contribution to innovation ability **(MNS1)**			0.877	4.690	1.040
2. Network helps to strengthen innovation concept **(MNS2)**			0.857	4.800	1.040
3. Network assists to improve innovation concepts **(MNS3)**			0.644	4.470	1.150
- *Affordable Loss*	**0.676**	**0.861**			
1. Careful not to commit unaffordable resources **(AFL1)**			0.756	4.090	1.160
2. Careful not to risk more money **(AFL2)**			0.802	3.930	1.290
3. Careful not to exceed financial capacity for unsuccessful innovation projects **(AFL3)**			0.900	4.380	1.100
- *Partnerships*	**0.607**	**0.822**			
1. Use a number of agreements **(PCS2)**			0.788	4.430	1.160
2. Use pre-commitments as often as possible **(PCS3)**			0.766	3.840	1.400
3. Risk reduction by approaching potential partners or customers **(PCS4)**			0.783	4.400	1.090
- *Leverage Contingencies*	**0.557**	**0.833**			
1. Experiment with different products, services, or business models **(LVC1)**			0.807	4.730	1.020
2. Experiment with different innovation concepts **(LVC2)**			0.637	4.640	0.890
3. Flexible and took advantage of opportunities **(LVC4)**			0.803	4.840	0.880
4. Adapt activities based on resources availability **(LVC5)**			0.724	4.740	1.030
- *Non-predictive control*	**0.576**	**0.799**			
1. Talk with people to enlist their support **(NPC1)**			0.840	4.530	0.900
2. Measure the success of product development based on our and our partner's perspectives **(NPC4)**			0.833	4.730	0.900
3. Base strategy on what we are capable of **(NPC5)**			0.575	4.530	1.090
Causation (Chandler *et al.*, 2011)	**0.619**	**0.919**			
1. Analyzed long-run opportunities and selected the best return **(CAU1)**			0.802	4.867	0.945
2. Developed a strategy to best take advantage of resources and capabilities (**CAU2**)			0.827	5.059	0.862
3. Researched and selected target markets and did meaningful competitive analysis **(CAU3)**			0.829	4.868	1.006
4. Designed and planned business strategies (CAU4)			0.785	4.838	1.002
5. Organized and implemented control processes to meet objectives (CAU5)			0.744	4.588	1.136
6. Had a clear and consistent vision (CAU6)			0.735	5.118	0.890
7. Designed and planned production and marketing efforts (CAU7)			0.779	4.824	1.010
Radical innovation performance (Tien & Cheng, 2017; Crossan & Apaydin, 2010)	**0.586**	**0.804**			
1. Growth ratio from radical innovation in the last three years **(RAD1)**			0.553	3.890	1.310
2. Introduce more new business models than major competitors in the last three years **(RAD2)**			0.869	4.670	1.220
3. Frequently introduced new business models into markets that were totally new to the firm in the last three years **(RAD3)**			0.834	4.530	1.140
Incremental innovation performance (Tien & Cheng, 2017; Crossan & Apaydin, 2010)	**0.498**	**0.745**			
1. Growth ratio from incremental innovation in the last three years **(INC1)**			0.638	5.130	0.900
2. Frequently introduce incremental new features into new markets in the last three years (**INC2**)			0.640	5.090	0.990
3. Introduce more new features than competitors in the last three years **(INC3)**			0.822	5.010	0.860

Questionnaire items	AVE	CR	SLF	Mean	Std. Dev
Start-up resilience (Branicki *et al.*, 2018; Pal *et al.*, 2014; Sheffi & Rice, 2005)	**0.518**	**0.806**			
1. Have strong support from business partners **(RES1)**			0.733	4.911	0.860
2. Have easy access to funding and other resources for any situation (**RES2**)			0.485	4.015	1.344
3. Have firm principles and self-confidence in running a business **(RES3)**			0.767	5.338	0.704
4. Able to find a way out when faced with various difficulties (RES4)			0.837	5.310	0.758

Source: own study.

The inferential statistics utilize the partial least squares structural equation modelling (PLS-SEM) method to analyse the relationships between constructs within the research context as outlined in the hypotheses. The PLS-SEM method is a causal modelling approach that emphasizes maximizing the explained variance of constructs' latent variables. It is commonly employed when the research involves a small sample size (Sosik *et al*., 2009), utilizing the bootstrap technique with 5000 samples (Hair *et al*., 2016). Moreover, PLS-SEM is frequently employed in research within the social sciences, including strategic management research (Hair *et al*., 2012). Data processing with PLS-SEM involves several procedures (Hair *et al*., 2011; 2012). Firstly, the measurement model is evaluated to analyse items' validity (average variance extracted) and the reliability of constructs (construct reliability) in constructing latent variables (constructs). Secondly, the structural model is evaluated to explore the relationships among latent variables based on the conceptual framework. Thirdly, a fit assessment model is employed to gauge how well the data aligns with the research model. Finally, hypotheses are tested by evaluating t-values and p-values.

RESULTS AND DISCUSSION

We collected data from 70 respondents as the sample, with demographic information regarding the duration of business operations and the number of employees presented in Table 2. This sample represented 46.36% of the relevant population (151) and met the PLS-SEM standard for three endogenous variables, which indicated that the minimum required sample size was 65. This aligns with the theory of Hair *et al*. (2014), which suggests that the sample size should be at least the number of endogenous variables multiplied by 10. Furthermore, this study achieved an R2 value of 0.44 and observed four inward arrows pointing towards firm resilience. According to Hair *et al*. (2014), when there is a maximum of four arrows pointing at a construct and a minimum R-square value of 0.25, the sample size should be a minimum of 65. Therefore, considering these factors and the total population of 151, a sample size of 70 was sufficient.

Table 2. Demographic data

Duration of business operation	Frequencies	Number of employees	Frequencies
3rd Year	33 (47.14%)	< 15	16 (23.86%)
4th Year	17 (24.29%)	15-49	29 (41.43%)
Above 4th Year	20 (28.57%)	50-100	18 (25.71%)
		> 100	7 (10%)

Source: own study.

Measurement Models

As presented in Table 1 above, the measurement model assessed convergent validity through the loading factor value, discriminant validity through the average variance extracted (AVE) value, and construct reliability through the composite reliability (CR) value. A standardized loading factor (SLF) is a number that indicates the correlation between the score of a question item and the indicator score of the indicator measuring the construct. According to Hair *et al*. (2016), a loading factor greater than 0.50 is generally considered sufficient for an initial examination of the loading factor matrix. The measurement results indicate that most of the factor loading values for the research indicators are sufficient, with values above 0.50, except for RES2 (0.495), which is still close to the threshold value.

The subsequent evaluation involved comparing the square root of the AVE with the correlation between the constructs. Discriminant validity was achieved when the square root of the AVE for each construct was greater than the correlation between the two constructs within the model. An AVE value greater than 0.50 was desired. The measurement results demonstrated that the AVE values of the dimensions and variables exceeded the minimum value of 0.50. These values were as follows: means with 0.639, affordable loss with 0.676, partnership with 0.607, leverage contingencies with 0.557, and non-predictive control with 0.576 for effectuation. The AVE values for the remaining variables were causation with 0.619, radical innovation with 0.586, and firm resilience with 0.518. The exception was the incremental innovation variable with a value of 0.498, which was close to the AVE threshold.

Lastly, for the CR value, a construct was considered reliable if the composite reliability was above 0.7. The measurement results show that all variables had values above 0.7, with the lowest value for incremental innovation (0.745) and the highest reliability value for causation (0.919).

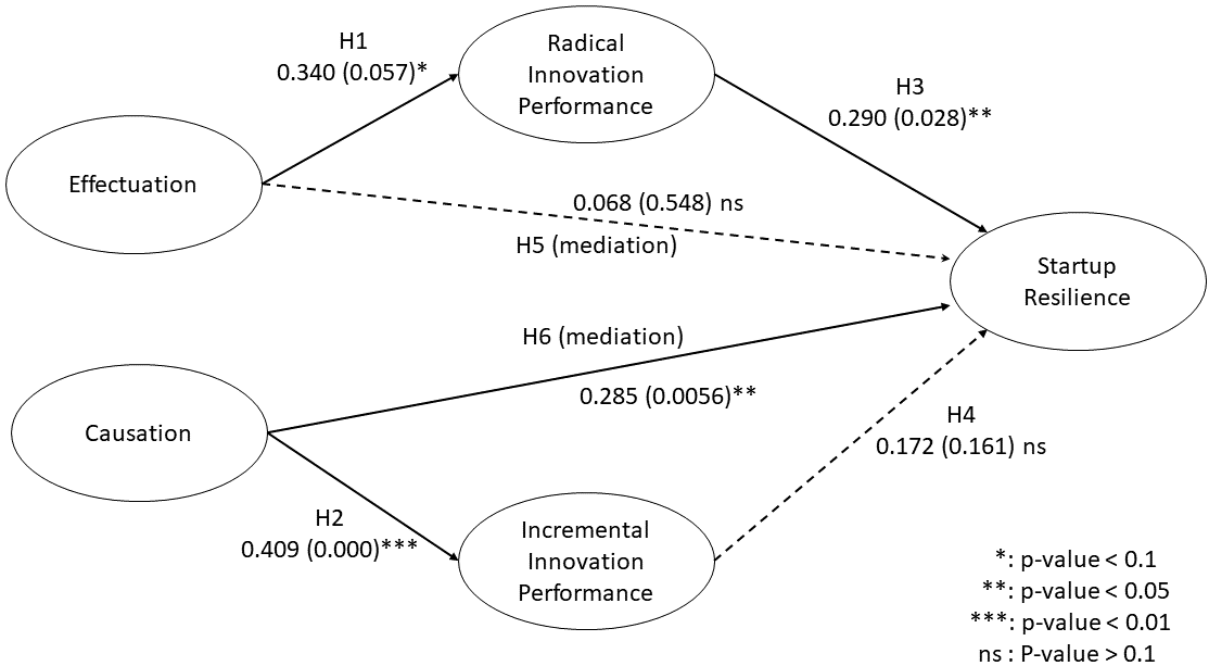

Figure 1. Structural model testing with path coefficient and p-values (in bracket)
Source: own elaboration.

Figure 1 shows the results of the structural model. Firstly, hypothesis 1 was supported, indicating that effectuation had a positive relationship with radical innovation performance. These findings were statistically significant with a coefficient value of 0.340 (p-value 0.057). The second hypothesis, involving causation, also demonstrated a positive relationship with radical innovation performance, having a coefficient value of 0.409 (p-value 0.000). The third hypothesis was corroborated with a coefficient value of 0.290 (p-value 0.028), establishing that radical innovation performance positively affected the resilience of digital MSP start-ups. In contrast, hypothesis four was not substantiated, as evidenced by a coefficient value of 0.172 (p-value 0.161). Thus, incremental innovation performance did not impact the resilience of digital MSP start-ups.

Using the VAF (Variance accounted for) value, we could determine whether a model was fully mediating, partially mediating, or exhibiting no mediation. According to Hair *et al*. (2014), a model is classified as fully mediating if its VAF value exceeds 0.8, as partially mediating if it falls between 0.2 and 0.8, and as having no mediation if the value is below 0.2. The VAF value is obtained by dividing the indirect effect by the total effect. Based on this theory, hypothesis five was supported, and radical innovation performance partially mediates the influence of effectuation on start-up resilience. The direct effect was 0.068 (p-value 0.548), and the indirect effect was 0.09, yielding a total effect of 0.166. The VAF value, calculated as 0.596 (0.09/0.166 = 0.596), fell within the category of partial mediation (VAF between 0.2-0.8). The

final sixth hypothesis was not supported. It demonstrated a direct effect of 0.285 (p-value 0.056), an indirect effect of 0.07, and a total effect of 0.355. Consequently, the VAF value was 0.197 (0.07/0.355 = 0.197), placing it in the category of no mediation. In other words, incremental innovation performance did not mediate the impact of causation on the resilience of digital MSP start-ups.

Effectuation And Causation As The Driver of The Open Innovation Process

This study found that effectuation and causation have distinct positive associations with innovation performance. Effectuation is associated with radical innovation performance, while causation is associated with incremental innovation performance. This finding is in line with Tushman and Anderson's (1986) statement that firms implementing radical innovations expand faster than those adopting incremental ones, and with Chandy and Tellis (2000), who found that new firms are sources of radical innovation, while incumbents lean towards incremental innovation. Linglebach *et al*. (2015) also contribute by noting that small start-ups with limited resources tend to employ effectuation reasoning early in the innovation process, while causation logic becomes more prevalent later in a firm's life cycle. Additionally, Guo (2019) supports the idea that effectuation strongly influences innovation and results in radical innovation.

Within the effectuation context, open innovation is a multi-actor process, in which negotiations and interactions guide innovation strategy (Yoho *et al*., 2018). Effectual processes and behaviours contribute to improving open innovation within start-ups (Nytch, 2012). Effectuation impacts start-up-level innovativeness (Roach *et al*., 2016). Furthermore, both causation and innovation performance have a positive effect on industry growth (Futterer *et al*., 2018). Both effectuation and causation can lead to innovation performance, but their effectiveness depends on the uncertainty level (Harms *et al*., 2021).

Effectuation and causation can be effective pathways for entrepreneurial innovation in business model performance. Futterer *et al*. (2018) also indicate that in moderately growing industries, entrepreneurial paths are comparably effective, while effectuation is more advantageous for developing innovation performance in high-growth industry situations. Conversely, causation is more effective in generating innovation performance in low-growth industry contexts. Effectuation and causation serve as decision-making frameworks that can guide open innovation and help start-ups navigate uncertainty. These concepts also contribute to start-up performance, particularly concerning business model innovation (Harms *et al*., 2021).

Different Innovation Process as The Driver of Digital MSP Start-up Resilience

The findings reveal that radical innovation performance is positively associated with start-up resilience, while incremental innovation has no significant effect on start-up resilience. These findings are consistent with previous studies (Chaharbaghi *et al*., 2005; Mafabi *et al*., 2012), which provide evidence that innovation is a primary avenue for creating organizational resilience and underscore the significant role of innovation in start-up resilience.

Furthermore, Borda-Rodrigue and Vicari (2015) have also demonstrated the relationship between innovation and cooperative resilience. According to Sabahi and Parast (2020), start-ups with a more innovative atmosphere are more resilient to disruptions. A resilient start-up gathers knowledge from its environment to implement the innovations necessary to enhance resilience (Garcia-Morales *et al*., 2006). Buliga *et al*. (2016) suggest that business model innovation (*i.e.* radical innovation) is a robust response to environmental turbulence and often originates from resilient companies. Consequently, firm's resilience is strongly influenced by its capacity to generate radical innovation (Buliga *et al*., 2016; Rampa & Agogué, 2021).

Mafabi *et al*. (2015) discovered that open innovation partially mediates the effect of creative climate on organizational resilience. Open innovation plays a pivotal role in building organizational resilience by fostering dynamic capabilities through adjustments in work processes and structures. Successful diffusion of open innovation practices can lead to resilience behaviours such as competitiveness, adaptability, and value creation. However, Harms *et al*. (2021) found that incremental innovation might not be sufficient to deliver customer value, aligning with the insignificant findings of this study.

High-tech industries tend to exhibit greater resilience to shocks through their open innovation activities compared to low-tech entities (Wziątek-Kubiak & Pęczkowski, 2021). Innovative resilience results

from persistent innovation efforts, enabling the creation of new knowledge and fostering learning. Resilient organizations manifest their open innovation strategy, processes, and routines (Lv *et al*., 2018).

Resilience emphasizes the ongoing pursuit of product differentiation based on innovation (Herrera-Reyes *et al*., 2015). Resilience encourages innovation by reducing negative emotional and psychological responses, thereby promoting creative thinking. The impact of resilience on performance varies with the start-ups' years of experience (Hallak *et al*., 2018).

The Path of Digital MSP Start-ups Journey Toward Resilience

The findings of this study indicate that radical innovation performance significantly mediates the relationship between effectuation and start-up resilience. This study aligns with the works of Buliga *et al*. (2016), Chahrabaghi *et al*. (2005), Garcia-Morales *et al*. (2006), and Mafabi *et al*. (2012), all of which highlight how innovation drives business resilience. Particularly, companies with technological capabilities strive to enhance their resilience through innovative methods, often resulting in the discovery of new capabilities and the creation of new business models as a manifestation of radical innovation. Such companies enhance their innovation by leveraging their new open innovation-oriented businesses (Aldianto *et al*., 2021). Open innovation serves as a bridge to establish organizational resilience (McManus, 2008). Additionally, Ferreira *et al*. (2020) explore the mediating role of open innovation in achieving firm performance by examining how managerial competencies contribute to competitive advantages. Open innovation is instrumental in connecting capabilities to outcomes, especially for start-ups with standalone company status; radical innovation proves more advantageous for start-up resilience (Wojan *et al*., 2018).

Being innovative is a prerequisite for being resilient, as innovative businesses tend to continually anticipate and adapt to specific conditions (Kuckertz *et al*., 2020). However, in this research, incremental innovation performance does not mediate the relationship between causation and start-up resilience. This finding contrasts with Roca *et al*. (2021), who demonstrate the significance of incremental innovation for resilience. Companies focused on generating profits often prioritize incremental innovation in their production processes, rather than engaging in immature strategies. In the context of digital MSP start-ups, incremental innovation alone cannot guarantee resilience since these start-ups often implement unproven business models (Santoso *et al*., 2020a). Some business models may only work under specific environmental conditions, making the addition of content or features through incremental innovation in different environments inefficient as a solution. The results of the mediation test also indicate that the resilience of digital MSP start-ups is achieved through well-planned strategies and execution driven by causation logic, rather than incremental innovation.

Small businesses have the potential to contribute to the national economy. However, the majority of them encounter significant challenges when initiating and expanding their operations. With the advent of digital technology, particularly in technology-based enterprises, small businesses have recently gained opportunities to grow and expand. Despite limited financial and human resources, they can thrive and grow. Various studies suggest that small and medium-sized enterprises (SMEs) can leverage digital platforms, including multi-sided e-commerce platforms, to overcome resource constraints and capitalize on platform-generated opportunities (Asadullah, 2021).

CONCLUSIONS

The research findings imply that there are two routes to achieving resilience in digital MSP start-ups. The first route achieves resilience through the development of radical innovation based on effectuation logic. The second route involves developing resilience directly based on causation logic. In their research, Ruiz-Jimenez *et al.* (2020) mention that the performance of expert technology-based new ventures relies on both effectuation and causation, whereas the performance of novice start-ups relies solely on effectuation. This research provides theoretical implications, suggesting that both expert and novice digital MSP start-ups utilize effectuation to generate radical innovation performance for their resilience. Moreover, expert start-ups employ causation logic for resilience. Thus, the findings fill the gap in the strategic entrepreneurship literature concerning the strategic fit between entrepreneurial logic and the open innovation approach for start-up resilience.

For practical implications within the context of expert digital MSP start-ups, aside from employing radical innovation through effectual logic, these start-ups can also achieve resilience through causation logic. This can be achieved by preparing well-planned strategies and executions, similar to established firms. They should consider alternative strategic responses such as retrenchment, preservation, innovation, or even pivoting to something new for various scenarios and act accordingly (Wenzel *et al.*, 2020). Ultimately, the efforts to achieve resilience, whether through effectual logic via radical innovation or directly through causal logic, are valuable not only for surviving crises but also for ensuring the sustainable growth of the digital MSP start-ups themselves. Conversely, novice digital MSP start-ups commonly struggle to flexibly navigate between effectuation and causation due to limited resources and experience, leading them to adopt effectuation logic. Consequently, they can achieve resilience by exploring radical innovation through a business model pivot based on relevant stakeholders. This also sheds light on why early-stage start-ups often pivot their business models until they discover a suitable model that drives their growth.

These findings and implications demonstrate that the survival of digital MSP start-ups can be achieved through both radical and incremental innovation. However, these types of innovation stem from different entrepreneurial logic. This underscores the need for entrepreneurship education to encompass both entrepreneurial logic approaches: effectuation and causation. While conventional business schools often emphasize causation logic through activities like developing business plans, making return-based decisions, and conducting market research (Towers *et al.*, 2020), incorporating opportunity-based entrepreneurship education becomes crucial. This can trigger effectuation logic by encouraging students to identify business opportunities, transform them into new ventures, manage dynamic organizations, and cultivate growth-oriented enterprises. Notably, early graduate entrepreneurs, constrained by limited experience and resources, tend to adopt effectuation logic (Ruiz-Jimenez *et al.*, 2020). Given the study's findings, where the path to start-up resilience through effectuation logic involves pursuing radical innovation, entrepreneurship education should include content that equips students to pivot business models and engage in experimentation.

This study significantly contributes to the understanding of how entrepreneurial logic and open innovation techniques might enhance resilience for digital multi-sided platform businesses. However, it is crucial to recognize the limitations of its breadth and the potential challenges in generalizing the findings. This study specifically examines digital multi-sided platform companies within a single industry or setting, which may not provide a comprehensive representation of the wide range of businesses across other industries. Moreover, it is important to consider that the outcomes of this research could have been impacted by the particular temporal context and technical environment in which the data was gathered. The dynamic and ever-changing landscape of digital platforms and innovation initiatives may result in fluctuations in outcomes as time progresses. Hence, it is advisable to exercise prudence when endeavouring to extrapolate the outcomes to alternative beginning scenarios or to prognosticate enduring patterns. Subsequent studies may endeavour to broaden the investigative parameters by incorporating a more extensive array of industries, geographic locations, and temporal intervals. By incorporating a broader range of circumstances, the study's conclusions can be strengthened, as it would yield a more thorough comprehension of the interplay between entrepreneurial logic, open innovation, and start-up resilience. This would enhance the findings' application and robustness.

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