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Open Innovation Strategy in Indonesia ICT Industries

Rivira Yuana[1], Eko Agus Prasetio[2], Rizal Syarief[1], Yandra Arkeman[1], Arif Imam Suroso[1]

1. School of Business, IPB University, Jl. Raya Pajajaran, RT.03/RW.06, Babakan, Kecamatan Bogor Tengah, Kota Bogor, Jawa Barat 16128, Indonesia
2. School of Business Management, Bandung Institute of Technology, Jl. Ganesa No.10, Lb. Siliwangi, Kecamatan Coblong, Kota Bandung, Jawa Barat 40132, Indonesia

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ABSTRACT

The research objective is establishing the relationship between business model, open innovation, and a firm's performance in a context-based corporate accelerator program held by Indonesia ICT industries. The crucial relationships between startup and industry collaboration that were identified in the literature study are: (1) co-creation; (2) the need for IP-sharing; (3) reducing R&D costs; (4) the need for risk sharing; and (5) the primary driver of companies' sustainability growth. The result shows that "co-creation" represented by business models becomes the most reliable driver in the issue of the importance of collaboration, and it leads to an independent factor that should be firstly developed and continuously improved. The IP-sharing and risk-sharing factors are both reliable drivers but medium dependent; thus, the relation is in a linkage zone, which means that these two factors are unstable or sensitive for both sides. The startups and industries must have a proper contractual agreement once they decide to share the IP and risk. The integrity factor will be necessary for mutual benefit. Reducing R&D costs and the main driver of the company's sustainability growth are the dependent variables or outcomes of the collaboration between startups and leading industries.

Corresponding author:
rivierayuana@gmail.com

SARI PATI

Tujuan penelitian adalah membangun hubungan antara model bisnis, inovasi terbuka, dan kinerja perusahaan dalam program akselerator perusahaan berbasis konteks yang diadakan oleh industri ICT Indonesia. Hubungan penting antara startup dan kolaborasi industri yang diidentifikasi dalam studi literatur adalah: (1) co-creation; (2) kebutuhan untuk berbagi IP; (3) mengurangi biaya R&D; (4) kebutuhan akan pembagian risiko; dan (5) pendorong utama pertumbuhan keberlanjutan perusahaan. Hasil penelitian menunjukkan bahwa "co-creation" yang diwakili oleh model bisnis menjadi pendorong paling andal dalam isu pentingnya kolaborasi, dan itu mengarah pada faktor independen yang harus terlebih dahulu dikembangkan dan terus ditingkatkan. Faktor berbagi-IP dan berbagi-risiko keduanya merupakan penggerak yang andal tetapi bergantung sedang; dengan demikian, hubungan berada dalam zona keterkaitan, yang berarti bahwa kedua faktor ini tidak

	stabil atau sensitif untuk kedua belah pihak. Startup dan industri harus memiliki perjanjian kontrak yang tepat setelah mereka memutuskan untuk berbagi IP dan risiko. Faktor integritas akan diperlukan untuk saling menguntungkan. Mengurangi biaya R&D dan pendorong utama pertumbuhan keberlanjutan perusahaan adalah variabel dependen atau hasil kolaborasi antara startup dan industri terkemuka

INTRODUCTION

Because of the 4.0 industrial revolution era in Germany in 2011, developed countries especially United States noticed the importance of adopting cutting-edge technological innovation for boosting the economy. Currently, the same method has been noticed by developing countries, including Indonesia. The most critical factor in this era is an innovation capability that drives economic growth. Industries realize that innovation is a complex and multi-factorial challenge, and it depends on the industrial environment to obtain more potent competitive advantages (Sivam et al., 2019).

In the ICT industry, technological turbulence is high, and the pressure to be innovative, unique, and first to market becomes stronger (Pile, 2018); thus, it would be harder for large companies to keep pace with the rapid of a nascent company or startup velocity (Kohler, 2016). ICT industries have been facing a very turbulent environment, and they should be more adaptive and innovative. Otherwise, they will be getting substantial risks of decline (Wikhamn & Styhre, 2017). The advancement of digital economy in ICT industries has transformed the concept of growth crossover in nations and firms both involving input and output. It has been confronting an ambiguous between input increases and output decreases. Excessive increase in input could result in decreased productivity. To solve this dilemma, firms have to use the power of soft innovation resources that lead to neo open innovation (OI) concept in the digital economy (Tou et al., 2019).

There is a paradigm shift from closed innovation to OI applied for several companies' collaboration (Moschner & Herstatt, 2017), either between small and big companies or companies with research or other institutions. Further, nascent company innovation activities are more distributed, multidisciplinary, cross-border, cross-institutional, and inter-temporal processes (Kratzer et al., 2017). In other words, the emergence of OI should be based on principles of integrated multidisciplinary collaboration, co-created shared value, cultivated innovation ecosystems, unleashed exponential technologies, and focused on innovation adoption (Curley, 2015). The other issue that originates from OI is crowdsourcing, which becomes a tool to integrate users into the innovation process. Crowdsourcing is the practice of engaging a crowd for a specific task, and they work for solving a project with community-based co-creation. The problem is found that how to find the right crowd to minimize the uncertainty result (Koivisto, 2012). Co-creation with complementary partners that have particular skills and capabilities will be effective as the starting point of startup–industry collaboration (Aquilani et al., 2017).

The telecommunication industry has transformed people's way of living at a big scale. The main driver came from the fourth-industry revolution that introduced the internet of things. Virtual reality, artificial intelligence, big data analytics, and the new generation of machine learning were used in the context of digitalization. As a consequence, the bandwidth requirement became higher, and the communication network should become more intelligent. The telecommunication companies should fastly adapt to this radical change and prepare to be the backbone of digitalization. The companies

will have to shift their BM (BA) from communication services to data package distributors, and their revenues from traditional services will soon become obsolete. At this stage, mobile operators are on the process of connecting the customers with the new digital lifestyle (Mihailovic, 2019).

In Indonesia, OI activities are dominated by big firms. The telecommunication industries and the banking sector have been the most critical sectors during the disruption era. Incumbent telcos find themselves in the middle of a paradox. Recently, the communication activity has grown through 'over the top" services provided by social platforms, such as Facebook, WhatsApp, Zoom meeting, Fintech apps, etc. Hence, there is a shift in consumer behavior and traditional communication, which ultimately led to the decline in the demand for conventional banking services. The millennial generation found itself convenient with the new patterns of communication and prefers online financial transactions (cashless). Fintech companies have disrupted banks' traditional payment and lending services by delivering innovative digital services, such as mobile payment, crowdfunding, cryptocurrency, and robo-advising (Utoyo et al., 2020).

ICT companies, such as mobile operators, must renew their BMs to expand their portfolios by responding to market changes. OI is one of the cheapest strategies to accelerate internal innovation and could be utilized to expand the company's target market. A partnership model form that is commonly used by ICT industries and startups is called the corporate accelerator (CA). In this model, a unique platform is provided to sustain the company's long-term growth and renewal of the company's BM. An appropriate partnership could reduce the risk for industries in adopting new technological innovations in their production lines. This phenomenon happens because a startup tends to have more flexible and agile structures compare with big companies in the related industry. Therefore, big firms have to pay more attention to the drivers of innovations, such as the global availability of knowledge, technology fusion, and shorter innovation cycles (Inauen & Schenker-Wicki, 2012).

Today, Indonesian businesses are in the early stage of their digital journey. They have to start moving away from ad-hoc solutions toward coherent digital BMs. The disruptive environments push the ICT companies to be agile, adopt rapid technological change by sharing the risks and knowledge through OI collaboration. Hence, the objective of this research is to identify the important factors influencing the OI collaboration between startup and leading ICT companies, and the relationship between BM, OI, and the firm's performance in a CA context-based program, held by Indonesia's ICT industries.

LITERATURE REVIEW

Open Innovation (OI)

OI has been known since the early 2000s; this model was utilized by various organizations to develop strategic partnerships and to create "win-win" scenarios. Globalization became the key driver of this new concept of innovation, it is the logical way to maintain a company's competitive advantage (Abulrub & Lee, 2012; Ozkan, 2015). If appropriately implemented, the OI model can generate better products and services (Pile, 2018). The OI term was first popularized by Chesbrough (2004). It was a theory that explains how organizations can be more efficient if they utilize external input to innovate. OI has encouraged organizations to acquire intellectual property and values beyond their internal limitation. What makes OI distinguishable is the challenge faced to revamp the organizations' traditional R&D model that has a closed innovation system (Pile, 2018).

Due to the challenge mentioned above, OI has become a paradigm that forces companies to seek external ideas as much as internal ones and as a means to market development by adopting cutting-edge technology. With this definition, collaboration with external partners results in three OI strategies. The first one is the "outside-in"

approach, which hons the company's knowledge based on innovation from external sources. The second is the "inside-out" approach, where an internal knowledge source exploits external knowledge. The last process is a merge of both the "outside-in" and "inside-out" approaches (Moschner & Herstatt, 2017). On one hand, by funding a startup company, the well-established industry will gain insights into new technological developments and emerging markets. On the other hand, startups will gain funding and access to administrative resources in exchange for the ideas they generated (Moschner & Herstatt, 2017).

Several studies have found that OI has a significant impact on the organization's performance. A study involving five major European markets in 2008–2013 resulted in three dimensions as measurable outcomes, namely: (1) economic performance, measured by the firm's turnover; (2) financial performance, measured by shares value; and (3) human resources performance, measured as the level of employment. Internal development and external acquisition affect the inbound OI positively and significantly for all mentioned dimensions (Moretti & Biancardi, 2020). The relationship between OI practices and the firm's innovation performance is measured by some variables with inbound OI and outbound OI as independent variables and the firm's innovation performance as the dependent variable (Rangus & Drnovšek, 2013).

Other research also found how OI affected the firm and innovation performance of the firm. The inbound and outbound OIs are treated as independent variables, while both the firm and innovation performances are dependent variables. Inbound consists of external technology, external knowledge acquisition, while outbound consists of internal technology and knowledge exploitation. Reliable performance could be measured by sales growth, market share, profitability, financial indicators, customer performance, and turnover, while new products, R&D, intellectual property, and turnover are indicators of innovation performance (Lopes & de Carvalho, 2018). Another striking thing from this study is that there involved quite many contingent variables stated as control and moderating variables. Firm size, firm age, type of industry, and country are control variables, while competitive intensity, number of partners, and technological and market uncertainties are moderating variables.

Previous studies mostly examined the implementation of OI in the form of a strategic partnership between big firms and a newly established company to create a mutually beneficial situation from the merge of their resources. On one hand, by funding a startup company, the well-established industry will gain insights at new technological development and emerging markets. On the other hand, a startup will increase funding and access to administration resources in exchange for the ideas they generated (Moschner & Herstatt, 2017). Moreover, the turbulent environment in industries will be solved by introducing OI, which involves knowledge flow across the firm's boundaries as a complex co-creation process. The innovation could no longer be defined as the result of the isolated activities. From a societal point of view, the openness culture will foster entrepreneurship and expand the existing market with various BMs, products, and services (Sivam et al., 2019).

Liao et al. (2020) discovered that OI would have a better performance if firms paid more attention to market searching and technology scouting at the same time, and if they actively managed the collaboration during their innovation process through market exploitation, testing, or customer analysis. Furthermore, Liao et al. (2020) suggested how to enhance the firm's performance regarding its OI activities by implementing two specific capabilities, namely technological capability and market information management capability. Technological capability deals with a capacity that serves its technical function through the use of "state-of-the-art" technologies to benefit from

external technology resources and to influence the process of external resource acquisition and exploitation. In contrast, market information management capability refers to the firm's ability to manage knowledge obtained from customers and competitors' activities.

OI and BM

Since it becomes necessary to produce, innovations are generally conceived in unrelated fields across the company's boundaries. Afterward, the company's management needs to be assertive in seeking external sources. One common way is to utilize emerging entrepreneurs from both formal education institutions such as universities and informal institutions such as incubators and co-working space (Kohler, 2016). A big company that collaborates with startups should firstly identify critical organizational practices to achieve a sustainability-oriented innovation as its growth driver (Kennedy et al., 2017). Nowadays, startups have started to initiate innovations to replace existing technology with a new BM. Therefore, the leading industry has to prepare its R&D division to attract startups by offering various kinds of BMs that are possible to generate disruptive innovations (de S. Fabrício Jr. et al., 2015). As a consequence, big firms need to reorganize their current BMs and organizational structures to succeed the collaborating with startups. The R&D projects that do not fit with their current BMs might be commercialized elsewhere (Durst & Ståhle, 2013).

In a previous study, it was mentioned that the concept of a BM was not included in the definition of OI, although they were closely related. In OI, external and internal ideas are combined in a system that will be used in a BM. A BM, whether from an internal or external idea, generates values and defines an internal mechanism to determine the value itself (Vanhaverbeke & Chesbrough, 2014). The new development of OI is mainly in the area of BM innovation and the area of shifting the BM from products to services. The hardest challenge is how to link the front end of OI to the back end of the BM that must bring these inputs to the market (Chesbrough, 2017).

IBM-Linux is one of the success stories of combining OI and the BM, where the internal knowledge is accessible to others and generates a new BM. Firms with an abundance of expertise could profit from licensing out their platforms where other firms could develop proprietary applications and generate a broader range of applications from the original one. Another success story comes from the collaboration of iPod and Apple iTunes store, where one firm uses other's knowledge to develop a new BM (Vanhaverbeke & Chesbrough, 2014). The OI model supports firms and governments to create sustainable products and services, contributing to the overall global business growth. In developing countries, the OI model adoption might generate continuous development by achieving sustainable values (Hossain, 2013).

The impact of various research outcomes concludes that the OI model is vital for all big companies in increasing their competitive edge globally. Furthermore, this model will raise the funds needed for research and shorten the product cycle. Hence, they will no longer be able to solely depend on internal knowledge. Most big companies are now also relying on external sources (Saebi & Foss, 2015). The hardest challenge is how to link the front end of OI to the back-end business that must bring these inputs to the market. Developing a BM innovation in an organization will underpin to identify the useful knowledge inflow for innovation and knowledge outflow or knowledge released to the outside (Chesbrough, 2017).

The main idea of the OI model focuses on interactive processes through which knowledge and technologies flow across firm boundaries without great effort. The underlying assumption is that invention and innovation do not require the same place to develop. Internet use is ubiquitous, and it causes the ease of global knowledge and technology to create collaboration rapidly. The use

of crowd-funding will reduce fixed costs for R&D due to its risk-sharing cooperation between partners (Inauen & Schenker-Wicki, 2012).

The business development model requires the particular ability to face challenges. There was research on Dutch State Mining, one of the big companies establishing OI practice. It was found that the managers must dare to decide, gather the right people or team, manage assumptions, ensure the knowledge flows, balance financial and strategic objectives, effectively manage business portfolios, and convince the sustainability of corporate venturing. Most importantly, the manager should be able to put OI in practice (Kirschbaum, 2005). Furthermore, Chesbrough (2017) found that the BM should be agile, be innovated, capture, and create values from various knowledge inflows and outflows. It is defined as "an open BM." Linking technological innovation and BM innovation will augment each value, and firms should not separate R&D division from the design of their BMs.

Zhu et al. (2019) supported this theory by stating the importance of aligning the BM with OI strategy. The OI impact can significantly differ among firms referring to ways of implementing OI and the ignorance of the BM specific role. A BM could turn from either totally or partly closed to open. It depends on value creation and value capture. If both values are open, then the BM will be fully accessible. The BM has also a limited life cycle; thus, it will reach the time when it should be changed overtime to keep the business survive.

West and Bogers (2014) suggested the alignment between OI and the firm's BM to leverage the use of external innovation. Many studies focused on sourcing innovations but neglect how to make a profit from them. Therefore, external innovations, as part of OI implementations, should mention the existing BM to be aligned. The success of the BM depends on both value creation and value capture. In other words, OI and BMs integrate the two forces to enhance the innovation ecosystem enabling disruptive innovations (de S. Fabrício Jr. et al., 2015).

Corporate Accelerator (CA)

It was found that the "accelerator" partnership model between a startup and big industry, in fact, differed from the once-popular "incubator" model. This model is an upgrade version from the incubator model, where the focus lies on intangible assets (e.g., knowledge and skills). The accelerator is an organization that accelerates the creation of a startup. Accelerators are usually funded by more prominent companies and are used to create technology-based startup companies due to the lower cost of research in the technological field (Pauwels et al., 2015). Big firms, as established organizations, cannot wait for the internal development of technology. Instead, they should immediately access what they require by buying or licensing-in external intellectual properties (Rangus et al., 2016).

Another study revealed internal and external motives that affect larger companies in creating a CA program and how it was implemented in a new partnership with a startup firm. The research shows that the idea of creating a CA was mainly proposed by the company's CEO (Moschner & Herstatt, 2017). This is due to the fact that CEOs mostly understand the importance of OI as an instrument to gather external opportunities to ensure the company's long-term abilities to innovate. The role of dynamic innovation capabilities and OI activities should be a central focus in order to produce a breakthrough innovation, in this case, OI proposed to be a moderating variable (Cheng & Chen, 2013). CAs, as the rapid business incubation, moves startups from ideas to commercialization. By doing this, big firms actually drive the survival and growth of their business enterprises (Jackson & Richter, 2017).

CA's program is meant to support newly-established companies in forms of infrastructure, mentoring, training, and networking. It has been shown that the most effective model for a company

to adopt startups technology through CA is by involving start-up-related parties in routine meetings and workshops for the duration of three months. According to Kohler (2016), there are four dimensions in designing a CA program as a link between a company and startups as follows: proposition (programs offered), process (how the program is run), people (parties involved), and place (where the program is located). According to another study, there are eight dimensions of CA's focus configuration, which are the following: (1) locus of opportunity (internal vs external); (2) strategic logic (exploration vs exploitation); (3) industry focus (tight vs broad); (4) equity involvement (yes vs no); (5) venture stage (early vs later); (6) external partner (yes vs no); (7) connection to parent (integrated vs independent); and (8) leadership experience (internal vs external) (Kanbach & Stubner, 2016).

Shankar and Shepherd (2019) discovered five dimensions that may determine the success of CA programs, and those are corporate nurturing through CA (ecosystem vs. innovations), identifying potential venture to accelerate (inbound vs. outbound), strategic posture (reserve vs. adapt), investment time horizon (long term vs. short term), and CA stages (access to customers vs. access to business units). In Indonesia, CA held by ICT companies is known in various conditions, but mostly near to the advanced incubator. OI practices observed are licensing-in/technology purchase and partnering/R&D alliances/co-patent between the leading company and the startup community. The technology assessment and different cultures become new challenges, and the critical project leader should be strong enough to succeed in the partnership. As a leading company, it has to provide absorptive and integrative capacities and develop a common language, shared values, and the exact measurement of success with startups (Santoro et al., 2019).

Another issue originating from CA is the asymmetric partnership between big firms and startups during collaboration. Different motives will be risky for both parties. A study indicates that there should be three stages to accomplish the ideal collaboration as follows: partnership, strategic alignment, and relational alignment for compatible cultures, a propensity to change, and long-term orientation. The key factor solving this challenge is the selection of startups, which consists of building a selection team, identifying partnering needs, defining objectives, creating a partner list, negotiating with the chosen partners, and contractual agreement (de Groote & Backmann, 2020). However, big firms focusing on OI are more likely to create radical innovations and tend to sell greater numbers of new products. The problems of OI implementation are that it might increase cost, absorbing heterogeneous knowledge and technologies, and the risk of R&D decentralization (Masucci et al., 2020).

Collaborating with startups is more beneficial for big firms or incumbents that have excellent absorptive capacities. Startups should have an entrepreneurial mindset, the dependence of innovation ecosystem, the use of external knowledge flows, and the role of networks to collaborate successfully with big firms. The most important benefit for big firms is the flexibility and openness of startups to generate new opportunities for disruptive innovations. Big firms will also obtain gap resources and assets cheaply to keep their innovation engine running. The CA benefits for startups are solving a lack of resources, lack of legitimacy within the market, funding constraints, and getting a more competitive business environment (de Groote & Backmann, 2020; Usman & Vanhaverbeke, 2017).

METHODS

Interpretive Structural Modelling (ISM)

ISM is a qualitative analysis tool for studying and analyzing the complicated relationship between interdependent variables to transform the entangled system into visible, well-defined models with graphical representation. The device is based on best practice and expert knowledge, examining each element pair to identify their direct

relationships recorded in an interaction matrix. Thus, ISM modelers could map the hierarchy structure for an entangled system efficiently and effectively through matrix transformation and decomposition (Li et al., 2019). In other words, ISM is one of the effective methodologies for determining relationships among specific factors showing a problem overview.

Researchers have been using this approach to find relationships among variables referred to as the problem. There are some advantages to using this methodology, such as the following: (1) the systematic process due to considering all possible pair-wise relations of all system elements; (2) no knowledge needed by the participants except they understand the relationship among the system objects; (3) it records the complex issues efficiently and systematically; (4) the structured model generated is easy to communicate with others; and (5) the participants will focus on one specific question at a time to enhance the quality of interpersonal communication within the problem context (Attri et al., 2013)s. In other words, ISM is an interactive learning process where a set of different related components are structured into a comprehensive systemic model. ISM technique covers a system model by generating a comprehensive understanding of the domain under discussion.

Jain and Banwet (2013) simplified the ISM steps to generate model development. Firstly, with the brainstorming technique with the expert focus group, the result would be some components that were related to the purposive model. This activity would also lead to a contextual relationship testing between the key components. The pair-wise relationships were arranged in a matrix form by the issues of the problem to find the relationship between elements in a row with the ones in a column.

Generally, ISM starts with variable identification related to the problem issues. The second stage of the ISM approach is building a structural self-interaction matrix (SSIM) from a pair-wise comparison of variables, building a contextual relation such as "leads to," "depends on," "increases," "decreases," etc. Four symbols are used to define the relation between two sub-factors (i and j). The V symbol indicates that factor *i* leads to factor *j*, the A symbol that factor *j* leads to factor *i*, the X symbol indicates that factor *i* leads to factor *j* and factor *j* leads to factor *i*, and O means there is no relationship between factor *i* and factor *j*. The third stage is converting SSIM into a reachability matrix (RM) and checking the transitivity. The relational indicators from SSIM will change into binary digits 0 and 1. The sum of column and row will define the dependence power and driving power. After the transitivity is fixed, then the matrix model is obtained, and the ISM structural model is split into the following four quadrants: driver (high driver power and low dependent power).

The four quadrants are defined as MICMAC analysis or driving power and dependence power matrix, which indicates how strong each factor is, and clusters them into dominant, relay, dominated, and autonomous. The objective of MICMAC analysis is to determine the driver power and dependence power of each component. High dependence and low driver power indicate dependent factors, lower dependence and higher driver power indicate independent factors, respectively. Low dependence and low driver power indicate autonomous factors, while high dependence and high driver power indicate linked factors (Chidambaranathan et al., 2009).

The autonomous quadrant consists of components with weak dependence and weak driver power. The property of those components is relatively less connected to the system. The other clusters consist of components with low driver power and high dependence, high driver power, and high dependence, high driver power, and low dependence (Jain & Banwet, 2013). Components with high driver power and high dependence are called "linkages." These factors are unstable, and

any action on them creates a significant impact on the goal development process. They also have feedback effects on themselves (Chidambaranathan et al., 2009).

ISM is mostly used at a high level of abstraction either for long-range planning or a more concrete level (Figure 1). It has become a problem solver for process design, career planning, strategic planning, engineering problems, financial decision making, human resources, competitive analysis, and electronic commerce (Chidambaranathan et al., 2009).

Hypotheses of Start-up and Industry Collaboration
Since large corporations in developing countries, such as Indonesia, cannot afford high internal R&D expenses and also learn from global trends, they started to establish startup ecosystem fostering their business growth. BM and OI strategy from both startup and corporation will be the key success of constructing a CA. The OI type, whether inbound or outbound, would vary due to the maturity level of the existing internal R&D of the corporation (Inauen & Schenker-Wicki, 2012; Rangus & Drnovšek, 2013).

A previous study also found that value proposition is the main component of BM to pivot the strategic partnership between startup and corporation (Vanhaverbeke & Chesbrough, 2014). It was also found that innovation performance could be measured from general indicators such as profitability, growth, market share, and sales (Moretti & Biancardi, 2020). The hypotheses are as follows:

H1: OI strategy will be suitable for startup–corporation partnership in ICT industries

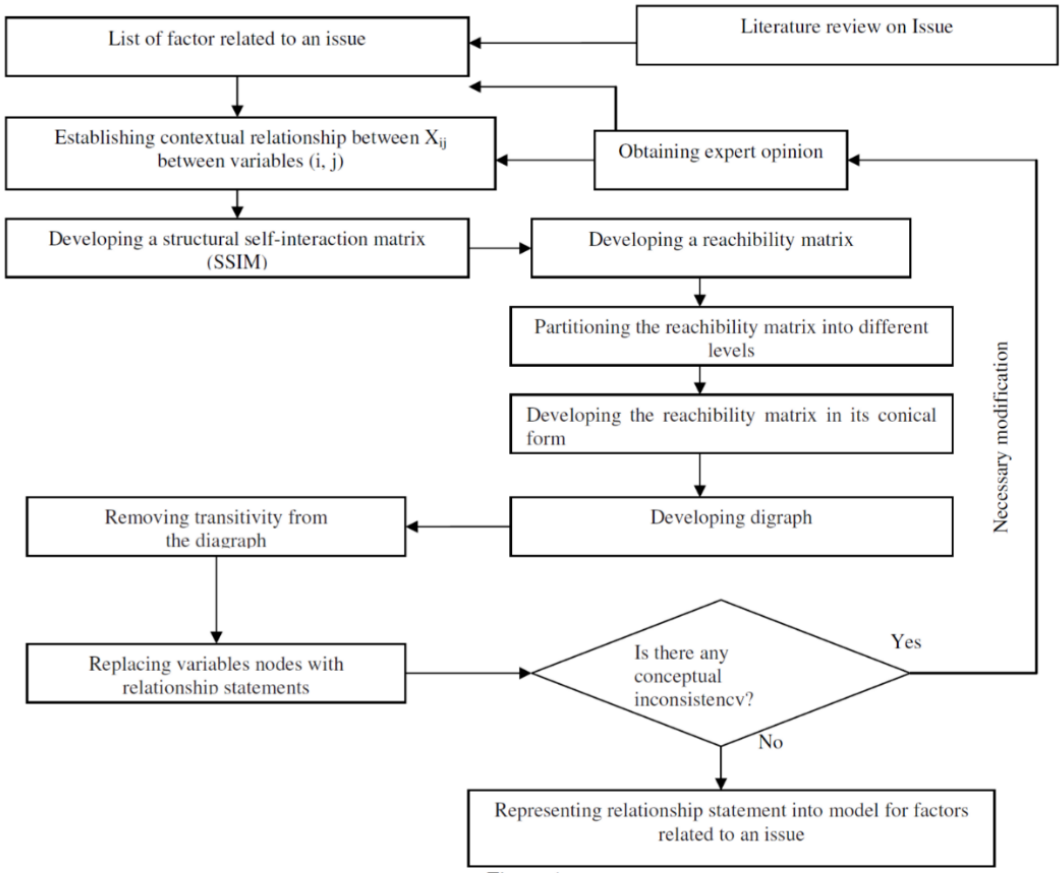

Figure 1. ISM flow diagram (adopted from Attri et al., 2013)

H2: Startup–corporation should align their BM in succeeding partnership

H3: Startup–corporation collaboration has a positive relationship with the company performance

The following is the diagram that shows the hypothesis for the startup–corporate partnership in Indonesia, especially for ICT industries (see Figure 2).

The research will be a qualitative study involving three top management levels from Indonesia ICT industries to be interviewed. We conducted a semi-structured interview either face to face or by telecommunication media. The variables derived from the literature study focusing on the importance of startup–industry collaboration. The ISM is utilized to find the relationship among variables. The hypotheses are determined and tested to refine the conceptual model. Since the data came from the ICT companies running a CA program, then the derived model will be valid for a context-based CA.

Table 1 describes factors that reveal the importance of startup–industry collaboration in previous studies.

From the conceptual model (Figure 2), BMs are defined by co-creation between startup and industry as their primary function is to generate value creation and value capture. The OI activities are represented by IP sharing and risk sharing, either outbound OI (licensing-out IP) or inbound OI (licensing-in IP). The collaboration goals are reducing R&D costs and increasing the company's growth indicated by profitability, size growth, market share, and sales. All hypotheses will be examined to determine the relationship between factors and which factors depend on others. The research scope is limited only to three ICT companies in Indonesia.

Data Collection

The three experts are interviewed one by one to verify the variables from the literature study, and the SSIM matrix is cross-checked. If there is a difference in any sub-factor relation, then the modus will be the final SSIM matrix. The experts have at least 15 years of experience, and the companies' profiles are described in Table 2.

The following is the SSIM matrix (see Table 3) compiled from three experts which are given four possible answers. The factor in a row is called factor *i*, and factor in a column is called factor *j*. The experts are given four possible answers, namely "V" if factor *i* influences factor *j*; "A" if factor in column *j* influences factor *i*; "X" if both factors influence each other; and "O" if both factors are unrelated. The possible answers could be one of four choices, but it is possible that there is an unchosen letter.

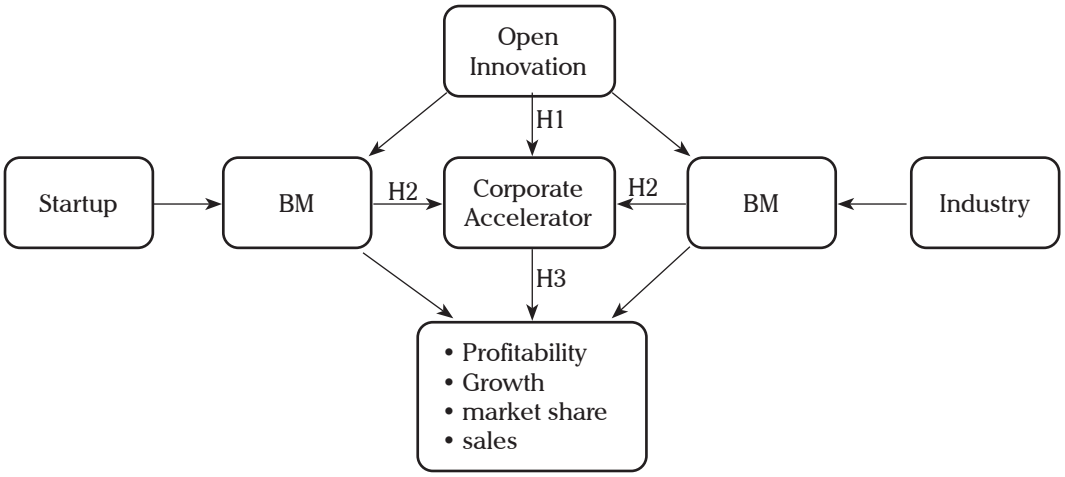

Figure 2. Conceptual model of CA in ICT industries

Table 1. Importance of Startup–Industry Collaboration Factors

Importance factor	Previous studies
Co-creation	Sivam et al. (2019); Curley (2015); Aquilani et al. (2017); Inauen & Schenker-Wicki (2012); Ozkan (2015); Teplov et al. (2017); Chesbrough (2004); Pile (2018); Oltra et al. (2018)
Intellectual Property (IP) sharing	Pile (2018); Cheng & Chen (2013); Vanhaverbeke (2013); Parthasarathy et al. (2011)
Reducing R&D costs	Aquilani et al. (2017); Inauen & Schenker-Wicki (2012); Cheng & Chen (2013); Bogers et al. (2019)
Risk sharing	Inauen & Schenker-Wicki (2012)
As the main driver for companies' sustainability growth	Sivam et al. (2019); Kanbach & Stubner (2016); Vanhaverbeke (2013); Bogers et al. (2019)

Table 2. Expert Profile

	Expert-1	Expert-2	Expert-3
Company ownership	State-owned enterprise	Private, multinational	Private
Specific field	Telecommunication	Mobile operator	IT infrastructure
Position	VP human capital	VP digital business	Operational director

Table 3. SSIM Matrix

No.	Factor Description	Factor No				
		5	4	3	2	1
1	Co-creation	√	√	√	√	×
2	IP sharing	√	×	√	×	
3	Reducing R&D cost	A	A	×		
4	Risk sharing	√	×			
5	The main driver of company's sustainable growth	×				

The second stage is transforming the SSIM matrix into the initial RM (see Table 4).

Table 4. Final RM

Factor no.	1	2	3	4	5	Driving Power
1	1	1	1	1	1	5
2	0	1	1	1	1	4
3	0	0	1	0	0	1
4	0	1	1	1	1	4
5	0	0	1	0	1	2
Dependence Power	1	3	5	3	4	

Since there is no transitivity, the initial RM becomes the final RM, and the next step is describing the factor position in driving power and dependence power matrix dividing into four quadrants. Each quadrant describes the strength of the driving and dependence powers of each factor. The row and column are summed and resulting in a number that determines the position in the driving

power and dependence power matrix. The matrix consists of four quadrants: the driver quadrant, the linkage quadrant, the dependent quadrant, and the autonomous quadrant. As mentioned in ISM theory, each quadrant describes the strength of the driving and dependence powers of each factor, as described below.

The next step is getting the factor level to ensure the position in the final digraph model. From the final RM, the reachability set and antecedent set for each factor is determined. The reachability set consists of the element itself and other elements to which it may reach, whereas the antecedent set consists of the element itself and the other elements, which may reach to it. Then, the intersection of these sets is found out for all elements as shown in Table 5.

The factors for which the reachability and intersection sets are the same occupy the top-level position. Then, the same step is repeated to obtain the factor for the next level. The step is repeated until the level of each factor is obtained, as seen in the last column of Table 5. The final stage is drawing an ISM digraph model based on the factor level from Table 5 and the relationship between factor from Figure 3. The arrow direction indicates the relationship between factors. The linkage factors should be found in the linkage arrow, such as factor 2 and factor 4 in Figure 4.

RESULTS AND DISCUSSION

The driving power and dependence power matrix in Figure 3 shows that all five factors are related to the importance of startup and industry collaboration since they fulfill the driver, linkage, and dependent quadrants. The IP-sharing and risk-sharing factors are in the linkage quadrant; it means that they are unstable, and a small change will lead to a significant impact on two dependent factors—reducing R&D cost and the main driver of the company's growth sustainability. IP sharing and risk sharing are also influenced by each other and have feedback to themselves. Co-creation is the only factor locating at the driving quadrant because it has the highest driving power and lowest dependence.

From the ISM digraph model, it is evident that "co-creation" becomes the strongest driver in the issue of the importance of collaboration between startup

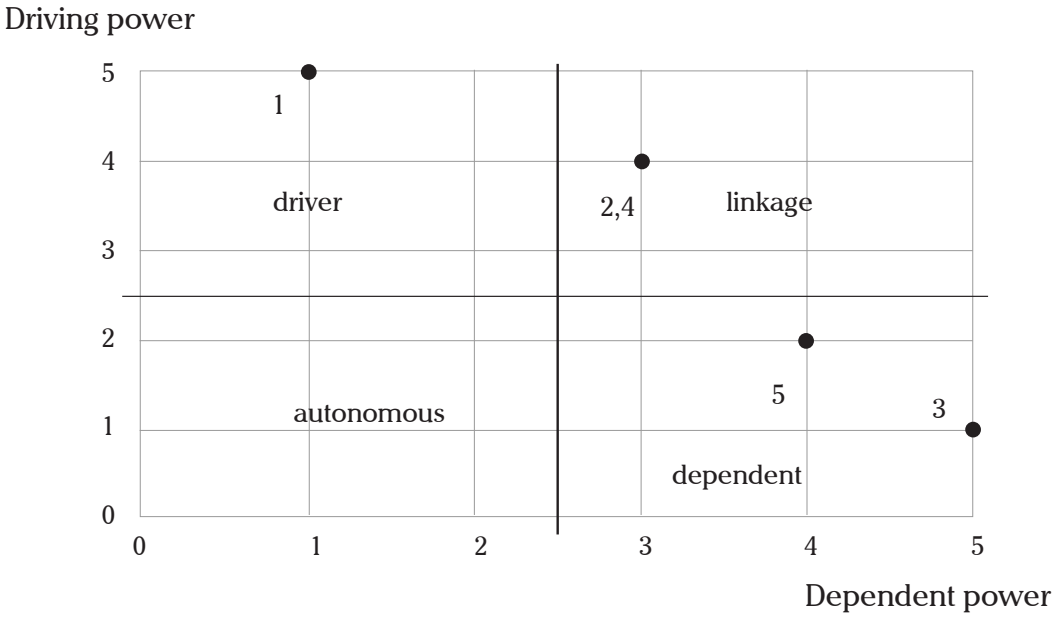

Figure 3. Driving power and dependence power matrix for "the importance factors in startup–industry collaboration"

Table 5. The Factor Level

Factor no.	Reachability Set	Antecedent Set	Intersection	Level
1	1, 2, 3, 4, 5	1	1	IV
2	2, 3, 4, 5	1, 2, 4	2, 4	III
3	3	1, 2, 3, 4, 5	3	I
4	2, 3, 4, 5	1, 2, 4	2, 4	III
5	3, 5	1, 2, 4, 5	5	II

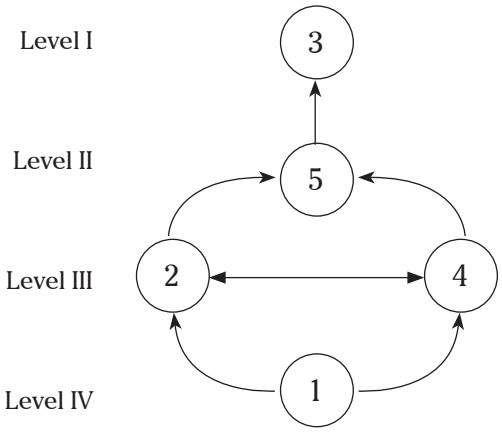

Figure 4. ISM digraph model of "the importance of startups-industries collaboration"

and industry, and it leads to an independent factor. As consequences, when both leading industry and startup run a partnership, then this factor should be firstly developed and continuously improved. In the conceptual model, the co-creation factor is represented at H2 as a part of BMs, either from startups or industries. Accordingly, ISM is agreed to H2, where co-creation represents the value proposition activity consisting of value creation and capturing of the company's BM.

However, the co-creation process is not that easy due to the need of linking human resources policies to OI activities. It requires big firms to renew their capabilities to acquire knowledge, know-how, and new ideas that are not part of their ordinary capabilities. Firms in the same industry that acquire the same resources might not combine resources in the same way, and it causes the uniqueness of the resources mixture. The human resources division plays a significant role in OI activities to prepare all employees incorporating external knowledge into the organizational learning capability (Peris-Ortiz et al., 2018). Innovation culture and innovation openness are the two crucial factors that have been concerned about the co-creation process. The major challenge in constructing and developing innovation culture is how to change the organization's mindset to mobilize teams to deliver new products and services to the market promptly (Kratzer et al., 2017).

The ISM result supports a previous study. West and Bogers (2014) suggested a co-creation between firms and external partners as communities and value networks for sourcing external innovation. Co-creation is a tool to expand the firm's innovation and value creation. An example of an OI model that has been successfully implemented is the Apple company with its signature product, iPod. By utilizing the structure of the OI model, Apple manages to focus on its' dynamic capability by

creating a strategic partnership with Wolfson, Toshiba, and Texas Instruments to create their designed products (Pile, 2018).

The IP-sharing and risk-sharing factors are both reliable drivers with medium dependent. Since both factors are in the linkage quadrant, they become sensitive factors. The IP management has been the key issue to succeed in OI collaborations due to the existence of information asymmetry defined as hidden information and hidden characteristics between companies. Hence, startups and industries must have a proper contractual agreement once they decide to share the IP and risk either with good corporate governance or an adequate legal understanding for both sides. Since the IP sharing and risk sharing are classified into OI activities, either inbound or outbound OI, then H1 is accepted where OI will lead to CA as the startup–industry collaboration. The culture and integrity factors will be necessary for both to succeed, for they generate mutual trust and benefit.

The two last factors, reducing R&D cost and the main driver of the company's sustainability growth, are the dependent variables or outcomes of the collaboration between startups and industries. These factors have a strong dependence and less driving power; thus, they lead to the collaboration performance measured by profitability, the company's growth, market share, and total sales (H3). The OI is part of BM from its co-creation process, and BM indicates the collaboration performance in revenue streams. The conceptual model in Figure 2 could be simplified into the relationship between independent and dependent variables in the context-based CA, as described in Figure 5.

The result in Figure 5 is supported by previous studies. Companies that adopt OI must manage both technical and market uncertainties through a co-creation journey so that they can achieve the successful commercialization of new technology. Furthermore, technological progress and innovation are believed to be business success factors in developed economies, and innovation is an enabler to obtaining sustained growth for many companies (Sivam et al., 2019; Teplov et al., 2017). Most problems are coming from the poor capability and understanding of the latest technology adoption, such as how technology might be applied by customers and benefits from the customer's point of view. As a result, both false positives and false negatives of measurement errors are unavoidable (Chesbrough, 2004). Therefore, OI could be the best strategy choice in which both companies will share IP and risk to shorten the time to market and reduce the overall innovation cost.

Figure 5 also describes how OI activities relate to a firm's performance. OI activities allow ideas and knowledge in the innovation process to flow across organizational boundaries in line with their BMs. It is realized that OI is complex and heterogeneous activities which mostly integrate R&D with external partners, such as startups, suppliers, customers, competitors, research institutes, etc. Organizational mechanisms will contribute to OI's effectiveness on firms' performance. A previous study stated that

Figure 5. BM, OI, and firm's performance relationship in CA

the participation in clusters or innovation networks with two-way collaboration (coupled OI) had the highest impact on firm performance. Collaborative networks with various partners enhance innovation by increasing the amount of knowledge sharing (Oltra et al., 2018).

A BM and OI-based strategy will ally the two forces of startups and large corporations, as shown by Figure 5. Hence, large corporations become a kind of "business catalysts" and keep looking for more initiatives to improve the innovation system. Vanhaverbeke (2013) found that OI must be embedded in the corporate strategy to understand the real value of OI initiatives. One of OI implementations could be defined as selling or buying IP of other companies to succeed in new products or services development (Rangus et al., 2016). The active collaboration between different firms includes IP sharing, while a co-creation process will create values by collecting all stakeholder's contributions (Pile, 2018).

MANAGERIAL IMPLICATION

The previous study agreed that co-creation is an independent factor driving OI as a good firm strategy. The notion of co-creation with complementary partners arises in the ICT sectors. This idea stresses diverse types of cooperation with external stakeholders from various industries, each with its own set of skills and competencies. Co-creation means that organizations build their knowledge bases through external ideas, knowledge, and resources. It highlights the critical role of interconnected innovation networks, the mode of customer integration (e.g., crowdsourcing), and the intermediation activity of third parties that facilitate and support interactions and collaboration between heterogeneous participants.

However, co-creation is not easy since human resource policies must be integrated into OI processes. It needs those huge organizations to update their capabilities for collecting information, expertise and innovative ideas that are not part of their core competencies. Companies in the same industry that receive the same resources may not combine them in the same way, so adding to the uniqueness of the combination. The department of human resources is essential to organizational intelligence operations because it prepares all employees by incorporating external information into the organizational learning capabilities. Innovation culture and innovation openness are two essential factors that impact the co-creation process. The most challenging aspect of building and cultivating an innovation culture is retraining the organization's mindset to mobilize teams to swiftly provide breakthrough products and services to the market. Shortly, ICT firms must adopt a new culture that fosters an open innovation mentality.

CONCLUSION

Since the ICT industry has been in a global turbulence, the company's innovation could not stand alone. CA is one of the collaboration types, which relates to the startup and its leading industry. Collaborating with startups is more beneficial for big firms or incumbents. The most important benefit for big firms is the flexibility and openness of startups to generate new opportunities for disruptive innovations. Big firms will also obtain gap resources and assets cheaply to keep their innovation engine running. CA benefits for startups are solving a lack of resources, lack of legitimacy within the market, funding constraints, and getting a more competitive business environment.

Data obtained from three Indonesia ICT companies support all hypotheses, which conclude that the OI strategy is suitable for startup–industry collaboration with proper alignment in BM. The OI strategy also generates a positive relationship for both companies. The hypotheses, linked to previous studies, have been transformed into the following five factors: co-creation, IP sharing, reducing R&D cost, risk sharing, and the main driver of the company's sustainable growth. All five factors are judged by three experts using ISM method.

The result shows that "co-creation" represented by BM becomes the most reliable driver in the issue of the importance of collaboration, and it leads to an independent factor that should be firstly developed and continuously improved. The IP-sharing and risk-sharing factors are both in the linkage quadrant and become sensitive factors. Therefore, IP management should be the key issue to succeed in the OI collaborations due to the existence of information asymmetry, defined as hidden information and hidden characteristics between companies. Eventually, startups and industries must have a proper contractual agreement once they decide to share the IP and risk either with good corporate governance or an adequate legal understanding for both sides. The integrity factor will be necessary for both to generate mutual benefit. Reducing R&D costs and the main driver of the company's sustainability growth are the dependent variables or outcomes of the collaboration between startup and leading industries. Both factors show the positive relationship between OI strategy and the company's performance.

Limitation And Future Research

The data comes from three big ICT companies and three top managements, which might not represent the industry cluster accurately. However, one of the research objects is the biggest ICT company, which is a state-owned enterprise. Future research should involve startups to get their perspectives on how an appropriate co-creation can be reached optimally. It might also develop a dynamic model to simulate the firm's performance related to OI activities.

It might be a linkage between OI and dynamic capabilities. The next research should broaden the model involving those capabilities. The effectiveness of OI activity depends on the firm's capacity, especially the dynamic ability, which is the dynamic resource-based view of the firm, exploring the synthesis of the RBV, and the dynamic capability in creating a competitive advantage. Therefore, it should be a proposed model describing the linkage between different types of dynamic capabilities and various forms of innovation, leading to value creation and industry leadership (Parthasarathy et al., 2011).

From the dynamic capability perspective, implementing OI will require a sensing tool development to outsource the appropriate technology, and a seizing tool to integrate all skills (Bogers et al., 2019). Realigning the organization to incorporate external knowledge will be part of the dynamic capability, together with developing a collaborative culture and adjusting the mix of internally and externally developed technologies.

The ISM is a qualitative tool with a basic binary concept. The main limitation of ISM is the relationship among variables that depends upon the expert's knowledge and experience. For further research, this tool could be enriched with machine learning, such as open mining or sentiment analysis, to obtain more accurate and better results with more extensive data, either secondary or primary data. ■

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