

THE IMPACT OF COLLABORATIVE INNOVATION ACTIVITIES AND INNOVATION STRATEGY ON INNOVATION PERFORMANCE IN THE TELECOMMUNICATIONS INDUSTRY: MEDIATING EFFECTS OF KNOWLEDGE SHARING

Derajat Nur Hakim

Universitas Indonesia, Jakarta

derajatnhakimdjoehana@gmail.com

Yasmine Nasution

Universitas Indonesia, Jakarta

yasmine73@ui.ac.id

Abstract

The Indonesian telecommunications industry is developing quickly and competitively, especially in the digital era. Technological developments and market preferences change industry boundaries, so market analysis methods are considered less important and do not provide a solid basis for long-term strategy formulation. Building on knowledge management and innovation capability theory, this study aims to reveal the mechanisms of collaborative innovation processes by investigating the complex relationships between important factors that affect firms' innovation performance in supply chain networks. Using the Structural Equation Model (SEM) method, the survey of 100 Unit Leaders Respondents in Indonesian Telecommunications companies showed a significant positive relationship between collaborative innovation activities, knowledge sharing, innovation strategy, and company innovation performance. In addition, it is expected that knowledge sharing plays a partial mediating role in the relationship between collaborative innovation activities and firm innovation performance. The innovation strategy moderately affects collaborative innovation activities about innovation performance. These results contribute to collaborative innovation process management by offering a nuanced conceptualization of collaborative innovation - the relationship between innovation performance between units within Indonesia's largest telecommunications company.

Keywords: Collaborative Innovation Activities, Knowledge Sharing, Innovation Strategy, Innovation Performance, Telecommunications.

Abstrak

Industri telekomunikasi Indonesia berkembang dengan cepat dan kompetitif, terutama di era digital. Perkembangan teknologi dan preferensi pasar mengubah batas-batas industri, sehingga metode analisis pasar dianggap kurang penting dan tidak memberikan dasar yang kuat untuk perumusan strategi jangka panjang. Membangun manajemen pengetahuan dan teori kemampuan inovasi, penelitian ini bertujuan untuk mengungkap mekanisme proses inovasi kolaboratif dengan menyelidiki hubungan yang kompleks antara faktor-faktor penting yang mempengaruhi kinerja inovasi perusahaan dalam jaringan rantai pasokan. Dengan menggunakan metode Structural Equation Model (SEM), survei terhadap 100 Responden Pimpinan Unit di perusahaan Telekomunikasi Indonesia menunjukkan hubungan positif yang signifikan antara kegiatan inovasi kolaboratif, berbagi pengetahuan, strategi inovasi, dan kinerja inovasi perusahaan. Selain itu, diharapkan berbagi pengetahuan memainkan peran mediasi parsial dalam hubungan antara kegiatan inovasi kolaboratif dan kinerja inovasi perusahaan. Strategi inovasi cukup mempengaruhi kegiatan inovasi kolaboratif tentang kinerja inovasi. Hasil ini berkontribusi pada manajemen proses inovasi kolaboratif dengan menawarkan konseptualisasi bernuansa inovasi kolaboratif – hubungan antara kinerja inovasi antar unit dalam perusahaan telekomunikasi terbesar di Indonesia.

Kata kunci: Kegiatan Inovasi Kolaboratif, Berbagi Pengetahuan, Strategi Inovasi, Kinerja Inovasi, Telekomunikasi.

INTRODUCTION

Routines are important in organizations because most work is done through routines. Innovation routines provide a good example of how routines can change and remain the same. One way of thinking about changes in routine is change triggered by an external crisis or shock.¹ Gersick and Hackman cite five reasons for changes in habitual group routines: (a) encountering new circumstances, (b) experiencing failure, (c) reaching milestones in the group's life or work, (d) accepting interventions that call members' attention to norms their group norms, and (e) must cope with changes in the structure of the group itself. Undoubtedly, new beginnings and major transitions are powerful incentives for changing how performance is achieved. Still, our understanding is limited if we consider these the only way organizational routines change.²

Evolutionary or ecological perspectives on routine also suggest a role for change in routine. Miner argues that these evolving jobs are routine and that their survival depends on features of the organizational context, features of the job and features of the individual who make the initial changes in the job. This routine overview perspective focuses on the agency's role, in this case, the business unit head, regarding the routine change process.³

Using grammatical analogies to understand organizational routines is not a single pattern but a set of possible patterns — activated and constrained by various organizational, social, physical and cognitive structures — by which organizational members enact certain performances. Exogenous change in the form of a change in organizational context or the introduction of new technology is certainly an important motivation for changing rules and repertoires.⁴ This perspective moves away from seeing routine as behavioural or cognitive and towards thinking about routine as something that includes both aspects. The routine performative model provides an overview of routines as continuous accomplishments. Van de Ven and Poole's notion of teleological change is that change is based on consensus. The agency is an important

¹ Volberda, Henk W., et al. "Strategizing in a Digital World: Overcoming Cognitive Barriers, Reconfiguring Routines and Introducing New Organizational Forms." *Long Range Planning* 54.5 (2021): 102110.

² Daniel, Carole, Pierre A. Daniel, and Hedley Smyth. "The Role of Mindfulness in the Management of Projects: Potential Opportunities in Research and Practice." *International Journal of Project Management* 40.7 (2022): 849-864.

³ Sharma, Abhinav, et al. "Hotels' COVID-19 Innovation and Performance." *Annals of Tourism Research* 88 (2021): 103180.

⁴ Zakaria, Imbalan, Suyono Suyono, and Endah Tri Priyatni. "Dimensi Berpikir Kritis." *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan* 6.10 (2021): 1630-1649.

aspect from this routine perspective. When we don't separate routine people from routine, we can see routine as a richer phenomenon.⁵

Innovation decisions are the most fundamental strategic decisions for every company because current innovation is vital for companies to enter new markets, increase current market share, and strengthen competitive advantage. This strong focus on innovation is motivated by increased competition in domestic and global markets, brought about by rapidly changing technologies, which can erode valuations in today's product markets and related services.⁶ This implies that innovation, which can be understood as transforming ideas, information and knowledge to increase competitiveness and sustainable competitive advantage, is an indispensable component of corporate strategy. There are several reasons for this, such as the need to offer better or even new products, adopt more efficient production and organizational methods, perform better in critical markets, and improve customer perception of a company's products. At the same time, we must remember that companies have different levels of resources and innovative capabilities.⁷

Companies employ different innovation strategies to guide their decisions about how limited innovation resources should be used to achieve their goals. Should companies focus on only one type of innovation or combine different types of innovation simultaneously? In either case, how to choose between product, process, market and organizational innovation and the possible combinations of these four basic types of innovation, given the limited resources for innovation? However, surprisingly little is known theoretically and empirically about the determinants of different firms' innovation strategies.⁸ The few studies by existing economists focus almost exclusively on the determinants of product and process innovation and incorporate product and process innovation. Market and organizational innovation are rarely considered in this study. Rather, they are considered more in the management literature; Schumpeter has clearly distinguished between at least four types of innovation. It is important to analyze theoretically and empirically not only the various innovation strategy options that firms choose but also the microeconomic determinants of a firm's innovation strategy.⁹

⁵ Aristi, Nindi, Preciosa Alnashava Janitra, and Puji Prihandini. "Fokus Narasi Kekerasan Seksual pada Portal Berita daring Selama Pandemi COVID-19." *Jurnal Kajian Komunikasi* 9.1 (2021): 121-137.

⁶ Mahadiansar, Mahadiansar, et al. "Realitas Perkembangan Investasi Asing Langsung di Indonesia Tahun 2019." *Matra Pembaruan: Jurnal Inovasi Kebijakan* 5.1 (2021): 65-75.

⁷ Yulianti, Prima, et al. "Analisis Knowledge Management Menggunakan Model Big Data di Media Sosial UMKM." *Jurnal Manajemen Informatika (JAMIKA)* 13.1 (2023): 24-39.

⁸ Azizi, Mohammad Reza, et al. "Innovative Human Resource Management Strategies during the COVID-19 Pandemic: A Systematic Narrative Review Approach." *Heliyon* 7.6 (2021): e07233.

⁹ Tirtayasa, Satria, Ira Nadra, and Hazmanan Khair. "Strategi Pemasaran terhadap Peningkatan Kinerja UMKM dimoderasi Teknologi pada masa Pandemi Covid-19." *Jurnal Ilmiah Manajemen dan Bisnis* 22.2 (2021): 244-259.

Collaborative innovation is a dynamic capability of the entity exploring the necessary modes of socio-economic transformation and evolution. As a result of collaborative innovation, people will collaborate more synergistically, generate new ideas, and gain a deeper understanding of shared values.¹⁰ As a result of collaborative innovation, new ideas, solutions, unexpected opportunities and desired results are created. Knowledge sharing can generate opportunities for companies to further benefit from the company's innovative endeavours. This knowledge sharing is carried out between units within Telkomsel, where the units work together with the strategic business partners of each unit.¹¹

This research will analyze how the performance of innovations carried out in telecommunications companies in Indonesia, namely PT Telkomsel, the largest telecommunications company in Indonesia, how innovation performance is affected directly or indirectly by routine activities between units within Telkomsel in collaborative innovation activities, knowledge sharing and innovation strategies.

LITERATURE REVIEW

Collaborative Innovation Activities

Kitchen argues that Collaborative innovation is pursuing innovation across company boundaries by sharing ideas, knowledge, expertise, and opportunities. West and Bogers summarize the stages of collaborative innovation: the process of innovation, development, integration, and commercialization of innovation. The contextual factors vulnerable to being defined and modified are the specific intention of managers, who need to be aware of which Intra organizational aspects facilitate the success of collaborative innovation activities. Innovation can be defined as a complex and iterative process in which problems are defined; new ideas are developed and combined; prototypes and pilots are designed, tested, and redesigned; and new solutions are implemented, deployed, and questioned.¹²

Innovation is a step of change or disruptive change. Innovation can be radical or incremental and based on creating original inventions that do not yet exist or adopting and adapting other people's innovations. Therefore, it is not where the source of innovation comes from but the implementation at the local level that determines whether something can be called an

¹⁰ Robertson, Jeandri, Albert Caruana, and Caitlin Ferreira. "Innovation Performance: The Effect of Knowledge-Based Dynamic Capabilities in Cross-Country Innovation Ecosystems." *International Business Review* (2021): 101866.

¹¹ Lazuardi, Muhammad Lutfi, and Iwan Sukoco. "Design Thinking David Kelley & Tim Brown: Otak Dibalik Penciptaan Aplikasi Gojek." *Organum: Jurnal Saintifik Manajemen dan Akuntansi* 2.1 (2019): 1-11.

¹² Bertello, Alberto, et al. "Unveiling the Microfoundations of Multiplex Boundary Work for Collaborative Innovation." *Journal of Business Research* 139 (2022): 1424-1434.

innovation.¹³ It is recognized that the internal company context is important for explaining the effects of collaborative innovation activities on innovation performance, and several authors have discussed the need to adopt a contingency approach to provide a deeper understanding of how organizational contextual factors may play a role as determinants of success factors when pursuing profit.¹⁴

It has been frequently stated that selecting the right partners when intending to develop collaborative innovation activities can be key to project success. The diversity of partner backgrounds is considered a source of creativity and a success factor for innovation projects. Companies also need to assimilate knowledge development in this collaboration to turn it into marketable technological innovations. Cohen and Levinthal created the absorptive capacity theory. Increasing enterprise accessibility to complementary resources, facilitating the exchange of explicit knowledge and tacit knowledge and reducing the risks of R&D activities by spreading innovation costs through different channels are the main advantages of having a collaborative innovation network.¹⁵

There are two specific reasons why inter-firm collaborative innovation activities in a strategic business partner chain network can contribute to enterprise innovation performance. First, collaborative innovation activities are a source of information channels that reduce the amount of time and investment required to gather information. Second, and more importantly, companies participating in collaborative innovation projects are one of the preconditions of a learning process in which companies discover new opportunities and gain new knowledge through interacting with others in the supply chain network.¹⁶

Innovation Strategy

Product innovation is a commodity or product that is new or significantly improved in terms of its characteristics or intended use, significant developments primarily in terms of technical specifications, parts and materials, integrated software, ease of use, or other functional characteristics—defined as the introduction of a service. It may employ new knowledge and

¹³ Hevner, Alan, and Shirley Gregor. "Envisioning Entrepreneurship and Digital Innovation through a Design Science Research Lens: A Matrix Approach." *Information & Management* 59.3 (2022): 103350.

¹⁴ Tojeiro-Rivero, Damián, and Rosina Moreno. "Technological Cooperation, R&D Outsourcing, and Innovation Performance at the Firm Level: The Role of the Regional Context." *Research Policy* 48.7 (2019): 1798-1808.

¹⁵ Guertler, Matthias Rudolf, and Nathalie Sick. "Exploring the Enabling Effects of Project Management for SMEs in Adopting Open Innovation—A Framework for Partner Search and Selection in Open Innovation Projects." *International Journal of Project Management* 39.2 (2021): 102-114.

¹⁶ Khourouh, Umu, Christina Sri Ratnaningsih, and Bayu Rahayudi. "Inovasi dan Daya Saing UMKM di Era New Normal: Dari Triple Helix Model ke Quadruple Helix Model." *Jurnal Manajemen dan Kewirausahaan* 9.2 (2021): 152-162.

technology or be based on new applications or a combination of existing knowledge and technology. Product innovation results from a difficult process caused by technological advances, changing customer requirements, shortening product cycles, and increasing domestic and international competition. It is usually assumed that successful product innovation requires strong interactions within the company and between the company and its customers and suppliers. Product innovation can be radical or gradual, but it can also be structural. With minor component changes but with major industry and market implications.¹⁷

Process innovation is the introduction of new or significantly improved production or delivery techniques. This includes major changes in technology, hardware, and software. They can be created to improve product and delivery quality and reduce product or delivery unit costs. However, process innovation and organizational innovation cannot be clearly distinguished. However, we prefer to think of process innovation as exclusively related to investments in new physical equipment that embody new knowledge, i.e. investments that result in technical changes embodied in the firm.¹⁸

Marketing innovation is the introduction of new marketing methods that involve significant changes in product design or packaging, product placement, or pricing strategy (the four Ps of marketing). The goal is to meet customer needs better, open up new markets or give the company's products a new market position to increase sales. Therefore the main objectives in introducing marketing innovations are to increase the total sales volume to make the exploitation of economies of scale possible, to effectively segment the market to capture a larger share of consumer surplus, to compete effectively on price, and to offer product characteristics that increase the willingness of customers to pay for these products. And finally, organizational innovation is the application of new organizational methods in the company's business practices, workplace organization or external relations. Organizational innovation can be manifested in the form of strategy versus organizational structure.¹⁹

Here "strategy" refers to the choice of long-term goals of the company and the allocation of resources for attaining those goals. In contrast, "structure" refers to how an organization divides its activities into several parts and then achieves coordination between them. Both forms of organizational innovation tend to improve firm performance by reducing administrative and

¹⁷ Blichfeldt, Henrik, and Rita Faullant. "Performance Effects of Digital Technology Adoption and Product & Service Innovation—A Process-Industry Perspective." *Technovation* 105 (2021): 102275.

¹⁸ Tirtayasa, Satria, Ira Nadra, and Hazmanan Khair. "Strategi Pemasaran terhadap Peningkatan Kinerja UMKM dimoderasi Teknologi pada masa Pandemi Covid-19." *Jurnal Ilmiah Manajemen dan Bisnis* 22.2 (2021): 244-259.

¹⁹ Medrano, Natalia, María Cornejo-Cañamares, and Cristina Olarte-Pascual. "The Impact of Marketing Innovation on Companies' Environmental Orientation." *Journal of Business & Industrial Marketing* 35.1 (2020): 1-12.

transaction costs, increasing workplace satisfaction, increasing labour productivity and gaining access to non-tradable assets, such as external tacit knowledge, and reducing supply costs external. They might include practices to codify knowledge by building a database of best practices, lessons learned and other tacit knowledge, introducing training programs to develop employee skills or initiating supplier or customer development programs. This implies that organizational innovation is closely related to all administrative efforts to update organizational routines, procedures, mechanisms, systems, etc. to promote teamwork, information sharing, coordination, collaboration, learning and innovation. However, when it comes to the determinants of organizational innovation, most of the research analyzes the determinants of adoption rather than the adoption of innovation.²⁰

Sharing Knowledge

Knowledge is a powerful resource that enables countries, organizations and individuals to achieve multiple benefits, such as enhanced learning, innovation and decision-making. Organizations engaged in inter-organizational collaborative business processes must share information and knowledge to enhance their knowledge base, innovation and competitiveness. With effective knowledge sharing, the strategic intent of inter-organizational collaboration for sustainable competitive advantage can be achieved by combining relevant organizational resources and capabilities of all parties.²¹

Knowledge sharing or knowledge sharing is one of the most important processes of knowledge management. In concluding an article, Argote conveys a knowledge management framework described in terms of knowledge creation, retention and transfer. Knowledge sharing is a common thread in the knowledge management process. Knowledge sharing creates opportunities to generate solutions and efficiencies that provide an initial value for successful innovation projects. According to Wang and NOE, knowledge sharing differs from a similar term, knowledge transfer. In their writings, knowledge sharing is only one part of knowledge transfer which is usually used to describe the objective movement of knowledge between different units, divisions, or organizations rather than individuals. While Wang and NOE use the term knowledge sharing as a subjective behaviour produced by one or more companies in the same supply chain.²²

Knowledge sharing is a social interaction involving exchanging knowledge, experience and R&D skills through a supply chain network. A group of people from companies that are in the

²⁰ Husaini, Husaini, and Happy Fitria. "Manajemen Kepemimpinan pada Lembaga Pendidikan Islam." *JMKSP (Jurnal Manajemen, Kepemimpinan, dan Supervisi Pendidikan)* 4.1 (2019): 43-54.

²¹ Wahyudi, Wahyudi, and D. Sunarsi. "Manfaat Penerapan Manajemen Pengetahuan bagi Kinerja Dosen di Masa Pandemi Covid-19." *JPPI (Jurnal Penelitian Pendidikan Indonesia)* 7.2 (2021): 285-291.

²² Wang, Zhaojing, et al. "Blockchain-Based Framework for Improving Supply Chain Traceability and Information Sharing in Precast Construction." *Automation in Construction* 111 (2020): 103063.

same supply chain network together to study a problem set, have a passion for a new product or service, and deepen their knowledge and expertise in a particular area by interacting in the context of a collaborative innovation project.²³ They operate as a "social learning system" where practitioners within the respective companies connect to solve technical problems, share new ideas, set new standards, and build new tools.²⁴

A knowledge-sharing community of practitioners is a type of network that performs peer-to-peer collaborative innovation activities to build new skills and manage the knowledge assets of the supply network. Wang & Hu believes that sharing knowledge based on mutuality, trust and respect results in long-term benefits, such as higher innovation performance and profits.²⁵

Innovation Performance

The quality of innovation at the organizational level can be measured in various ways. Tidd points out that some people use indicators available in the public domain, such as R& D spending, number of patents, and new product announcements, to measure innovation performance, while others use survey instruments to collect broader indicators, such as the ratio of research personnel to the total number of employees, in an organization and the ratio of sales or profits to new products or services launched. In addition, survey tools involving various elements of the innovation system can also be used to measure innovation performance based on perceptions. De Meyer and Garg's extended definition of innovation includes social and economic performance.²⁶ Fontana describes and examines the measurement of innovation performance based on the following dimensions:

- a) Internal performance analyzes organizational innovation before, during, and after the innovation process. This dimension assesses how tangible and intangible internal resources (such as resources, climate, and culture) contribute to innovation performance—showing that an organization has succeeded in cultivating innovation,

²³ Saputra, Eko, Iswandi Syahputra, and Bono Setyo. "Pemberitaan Media Online: Studi Kasus Konflik Budaya "Sedekah Laut" di Pantai Baru, Ngentak, Bantul, Yogyakarta." *Jurnal Ilmu Sosial Dan Humaniora* 9.2 (2020): 175-188.

²⁴ Li, Gang. "The Impact of Supply Chain Relationship Quality on Knowledge Sharing and Innovation Performance: Evidence from Chinese Manufacturing Industry." *Journal of Business & Industrial Marketing* 36.5 (2021): 834-848.

²⁵ Philsoophian, Maryam, Peyman Akhavan, and Morteza Namvar. "The Mediating Role of Blockchain Technology in Improvement of Knowledge Sharing for Supply Chain Management." *Management Decision* 60.3 (2022): 784-805.

²⁶ Yusr, Maha Mohammed, et al. "Determinants of SMEs' Product Innovation Performance in Malaysia: An Extended Model." *Cogent Business & Management* 9.1 (2022): 2152649.

knowledge management, and a climate for generating new ideas, selecting, developing, and deploying products resulting from the innovation process.²⁷

- b) The ability of the organization to transform creative and innovative ideas into tangible products, goods or services is called technical performance. The organizational ability to manage ideas, choices, and the process of creating innovative products is described in this dimension. Invention performance, which is a component of innovation process performance, is a subset of innovation technical performance. At the time of measurement, the minimum product is already in the prototype stage. The effectiveness of the innovation or development process can be measured by technical performance.²⁸
- c) The ability of the organization to sell innovative goods in the market is called commercial performance. This shows that the innovation process has resulted in products and services that can be purchased. Not always a commercially successful product means an economically successful product; therefore, economic performance in terms of profit must be measured as it indicates successful product commercialization.²⁹
- d) The term "social performance" refers to the good results produced by organizations due to their input, process and output innovations to relevant stakeholders and society as a whole. This is part of corporate social responsibility and corporate action to fulfil shared values with society and the community. According to the achievement of social performance, the organization has at least fulfilled its obligations to its stakeholders. Thus, social performance is more important than economic performance because organizations measure their economic performance by providing value to the relevant stakeholders.³⁰

RESEARCH METHOD

This study used a quantitative method; the information analyzed was obtained through primary data in the form of the distribution of questionnaires to respondents with approved statements from previous studies with some modifications. Researchers used the Structural Equation Model (SEM) as the main statistical tool in data analysis. SEM is used to examine the

²⁷ Kutieshat, Ruba, and Panteha Farmanesh. "The Impact of New Human Resource Management Practices on Innovation Performance during the COVID 19 Crisis: A New Perception on Enhancing the Educational Sector." *Sustainability* 14.5 (2022): 2872.

²⁸ Mikalef, Patrick, and Manjul Gupta. "Artificial Intelligence Capability: Conceptualization, Measurement Calibration, and Empirical Study on Its Impact on Organizational Creativity and Firm Performance." *Information & Management* 58.3 (2021): 103434.

²⁹ Tortora, Debora, et al. "'I digitize so I exist'. Searching for Critical Capabilities Affecting Firms' Digital Innovation." *Journal of Business Research* 129 (2021): 193-204.

³⁰ Liu, Wentong, et al. "The More The Better vs. Less Is More: Strategic Alliances, Bricolage and Social Performance in Social Enterprises." *Journal of Business Research* 137 (2021): 128-142.

relationship between the variables involved in this study and to test the conceptual model designed based on the relevant theory. Using SEM, researchers can examine the relationship between these variables and measure how much the proposed model matches the data collected.

RESULT AND DISCUSSION

Reliability Test

Two methods can be used to test the reliability of PLS, namely composite reliability and Cronbach's alpha. Composite reliability measures the actual value of the construct's reliability. On the other hand, Cronbach's alpha measures the lower limit of the construct's reliability value, meanwhile. The reliability of the composite is considered better when assessing the internal consistency of the structure. The rule of thumb for a composite reliability score is greater than 0.7, and Cronbach's alpha score is greater than 0.7 (Ghozali, 2016). Composite reliability measures the actual reliability value of a variable, while Cronbach's alpha measures the lowest reliability value of a variable, so the composite reliability value is > 0.6 , and Cronbach's alpha value is > 0.60 . For example, the combined reliability of all constructs is greater than 0.60. Measurement of Cronbach's negligence for all variables above 0.7 so that the variable can be said to be reliable, except for the economic performance dimension in the Innovation Performance variable.

Validity Test

From the results of the validity test of the Collaborative Innovation Activities variable, the Cronbach alpha value for all dimensions of collaborative innovative activity variables is above 0.7 so it is reliable. Indicators of all dimensions above 0.7 can be used except for CIA4 and CIA14 indicators. From the results of the validity test of the Knowledge Sharing variable, the Cronbach alpha value for all dimensions of the knowledge-sharing variable is above 0.7, so it is reliable. Indicators of all dimensions above 0.7 can be used except for indicators KS6 and KS20.

From the results of the validity test of the Innovation Strategy variable, the Cronbach alpha value for all dimensions of knowledge-sharing variables is above 0.7, so it is reliable. Indicators of all dimensions above 0.7 can be used except for indicators IS4, IS12, IS13, IS14, IS17 and IS25. Because 3 (three) indicators of the Business Process dimension were dropped so that the IS11 and IS15 indicators remained, the business process dimension was also not used. From the results of the validity test of the Innovation Performance variable, the Cronbach alpha value for all dimensions of the innovation performance variable is above 0.7, so it is reliable. Except for the dimensions of the Economic Performance Indicator from all dimensions above 0.7 so that can be used except for the IS6 indicator.

Discussion of Hypothesis Testing

Smart PLS does not require normally distributed data; parameter estimation can be done directly without requiring previous goodness-of-fit criteria. The statistical hypothesis is that H0 has no relationship between variables, while H1 has a relationship between variables. Furthermore, the test statistic is a t-value (t-statistics) > 1.96 , generated by the re-sampling technique with the bootstrap method on SmartPLS. The results of testing the hypothesis for the model in this study can be seen in Table 1 below:

Table 1. Hypothesis Test Results

Hypothesis	Influence between Variables	Path coefficients	T statistics (O/STDEV)	P values
H1	Collaborative Innovation Activities->Innovation Performance	0.291	2.323	0.020
H2	Knowledge Sharing->Innovation Performance	0.170	1.770	0.077
H3	Collaborative Innovation Activities->Knowledge Sharing	0.623	8.606	0.000
H4	Innovation Strategy->Innovation Performance	0.439	2.494	0.013
H5	Knowledge Sharing->Innovation Strategy	0.667	11.074	0.000

From the results table in Table 4.10 above, it can be seen that the relationship between Knowledge Sharing and Innovation Performance has no significant effect because it has a t-statistic value that is smaller than 1.96. On the other hand, the relationship between collaborative innovation activities and innovation performance, collaborative innovation activities and knowledge sharing, innovation strategy and innovation performance, and knowledge sharing and innovation strategy each has a significant influence. The results of hypothesis testing will be discussed in the sub-chapters one by one.

Suppose you look at the values of the extreme loading in Table 4.5. In that case, the evaluation image of the measurement model after several indicators drop shows several loading factors below 0.7 IS7, KS 21 and KS22. In accordance with existing provisions, these indicators should be discarded, but because these indicators are considered important for measuring constructs, they need to be maintained (not discarded) and besides that, the initial loading factor validation has been carried out. If you look at the t-value in Figure 4.5, the values of these indicators have a t-value above 1.96. These indicators are still able to explain the constructs they represent well.

Another thing to note is in hypothesis 2, the direct effect of the Knowledge Sharing construct on Innovation Performance is to have a T-Statistics of 1.770, thus stating that

Knowledge Sharing does not affect Innovation Performance. Still, if other constructs mediate it, it will have an effect. The Knowledge Sharing construct indirectly affects Innovation Performance when viewed from the path: Knowledge Sharing – Innovation Performance with a T-Statistics value of 11.074. Thus it can be said that the indirect effect of the Knowledge Sharing construct on Innovation Performance will be greater if it is influenced or mediated by the Innovation Strategy. This shows that the influence of the Innovation Strategy as a mediator between Knowledge Sharing on Innovation Performance has a greater effect than its direct effect. Comprehensively, this study's findings are that to improve innovation performance, telecommunications companies in Indonesia must carry out collaborative innovation activities, share knowledge and create innovative strategies to improve innovation performance. Sharing knowledge cannot stand alone without antecedents and mediation. Furthermore, the explanation of each hypothesis can be described as follows.

Effect of Collaborative Innovation Activities on Innovation Performance

The results of the hypothesis testing in Table 1 show the influence of Collaborative Innovation Activities on Innovation Performance. Collaborative Innovation Activities involve Communication and Interaction with strategic business partners, Collaboration, Co-creation and technology sources. In hyper-competitive environments such as companies in the telecommunications industry, Collaborative innovation in supply chain networks has been seen as an R&D process in which two or more supply chain partners work together to introduce a new product or service. From some existing supply chain literature, it is clear that companies can improve innovation performance by developing inter-firm collaboration with various supply chain partners. There are two specific reasons why participating in collaborative innovation activities between companies in a supply chain network can contribute to a company's innovation performance. First, collaborative innovation activities are an information channel resource that reduces the amount of time and investment required to gather information. Second, and more importantly, companies participating in collaborative innovation projects are considered a prerequisite part of the learning process, where companies discover new opportunities and gain new knowledge through interactions with others in the supply chain network.

Therefore, the first hypothesis put forward is that Collaborative Innovation Activities have an influence on Innovation Performance. The results of statistical tests conducted on data obtained from manager-level respondents at telecommunications companies in Indonesia show that all indicators used as measuring tools for Collaborative Innovation Activities have a strong correlation. This can be seen from all factor loading values above 0.7. The AVE (Average Variance Explained) value of the Collaborative Innovation Activities variable is 0.589, which

means that this variable can explain 58.9% of the variance of all indicators. Furthermore, the hypothesis test results produce a coefficient of determination (R^2) for the Innovation Performance variable of 0.689, which is classified as substantial or moderate. Collaborative Innovation Activities as an independent variable has a T-Statistics value where the coefficient of determination of Innovation Performance is 2.323 or higher than 1.96, as well as a p-value or sig. 0.020, less than 0.05. This means that the Collaborative Innovation Activities variable significantly influences the Innovation Performance variable. The results of this hypothesis test concluded that the data supported the first hypothesis. Supply chain companies participating in collaborative innovation activities also tend to generate more innovations.

Therefore, an explanation that can be found for the first hypothesis is that 66.7% of the respondents in this study were employees at the Head Office, with a majority of 36.7% from the sales directorate stating that in an environment that carries out collaborative innovation activities, it has a positive impact on Innovation Performance.

The Effect of Knowledge Sharing on Innovation Performance

Based on the results of hypothesis testing in Table 4.10, knowledge sharing cannot stand alone as having a positive impact on innovation performance. Rather it is strengthened by an innovation strategy. Knowledge Sharing involves sharing knowledge with external partners, trusting interpersonal self-efficacy, reciprocity and reputation. In a hyper-competitive environment such as companies in the telecommunications industry, knowledge sharing is an efficient way for companies to signal or signal to collaborative innovation partners that the company has knowledge of potential value for partners. These signals increase the attractiveness of companies as potential collaborators in intercompany projects related to innovation. Thus, companies that share knowledge in supply chain networks are more likely to build and engage in more collaborative innovation between companies with higher performance levels. Knowledge sharing can generate opportunities for companies to profit from their innovative endeavours.

Therefore, the second hypothesis put forward is that sharing knowledge can only stand with having a positive impact on innovation performance. Rather it is strengthened by an innovation strategy. The results of statistical tests conducted on data obtained from manager-level respondents at telecommunications companies in Indonesia show that all indicators used as measuring tools for Knowledge Sharing have a strong correlation. This can be seen from all factor loading values above 0.7 except KS6 on the external knowledge sharing dimension and KS20 on the reputation dimension. The AVE (Average Variance Explained) value of the Knowledge Sharing variable is 0.557, which means that this variable can explain 55.7% of the variance of all indicators. Furthermore, the hypothesis test results produce a coefficient of determination (R^2) for

the knowledge-sharing variable of 0.389, which is classified as weak. Knowledge Sharing as an independent variable has a T-Statistics value where the coefficient of determination of Innovation Performance is 1.770 or less than 1.96, as well as a p-value or sig. 0.077, more than 0.05. This means that the Knowledge Sharing variable weakly influences the Innovation Performance variable. The results of this hypothesis test concluded that the data did not support the second hypothesis. Therefore, an explanation that can be found for the second hypothesis is that 66.7% of the respondents in this study were employees at the Head Office, with a majority of 36.7% from the sales directorate stating that in an environment where knowledge sharing does not have a positive impact on Innovation Performance.

Effect of Collaborative Innovation Activities on Knowledge Sharing

The results of the hypothesis testing in Table 1 show the influence of Collaborative Innovation Activities on Knowledge sharing. Collaborative Innovation Activities involve Communication and Interaction with strategic business partners, Collaboration, Co-creation and technology sources. In hyper-competitive environments such as companies in the highly innovative telecommunications industry, Collaborative innovation in supply chain networks has been seen as an R&D process in which two or more supply chain partners work together to introduce a product or service. From some existing supply chain literature, it is clear that companies can improve innovation performance by developing inter-firm collaboration with various supply chain partners. There are two specific reasons why participating in collaborative innovation activities between companies in a supply chain network can contribute to a company's innovation performance. First, collaborative innovation activities are an information channel resource that reduces the amount of time and investment required to gather information. Second, and more importantly, companies participating in collaborative innovation projects are considered a prerequisite part of the learning process, where companies discover new opportunities and gain new knowledge through interactions with others in the supply chain network.

Sharing knowledge is an efficient way for companies to signal or signal to collaborative innovation partners that the company knows the potential value to partners. These signals increase the attractiveness of companies as potential collaborators in intercompany projects related to innovation. Thus, companies that share knowledge in supply chain networks are more likely to build and engage in more collaborative innovation between companies with higher performance levels.

Therefore, the third hypothesis is that Collaborative Innovation Activities influence Knowledge Sharing. The results of statistical tests conducted on data obtained from manager-level respondents at telecommunications companies in Indonesia show that all indicators used as

measuring tools for Collaborative Innovation Activities have a strong correlation. This can be seen from all factor loading values above 0.7. The AVE (Average Variance Explained) value of the Collaborative Innovation Activities variable is 0.589, which means that this variable can explain 58.9% of the variance of all indicators. Furthermore, the hypothesis test results produce a coefficient of determination (R^2) for the Knowledge Sharing variable of 0.389, which is classified as weak. Collaborative Innovation Activities as an independent variable has a T-Statistics value where the Knowledge Sharing coefficient of determination is 8.606 or higher than 1.96 and a p-value or sig: 0.000, less than 0.05.

This means that the Collaborative Innovation Activities variable significantly influences the Knowledge Sharing variable. The results of this hypothesis test concluded that the data supported the first hypothesis. Supply chain companies that participate in collaborative innovation activities also tend to generate more innovations. Therefore, an explanation that can be found for the third hypothesis is that 66.7% of the respondents in this study were employees at the Head Office, with a majority of 36.7% from the sales directorate stating that in an environment that carries out collaborative innovation activities, it has a positive impact towards Knowledge Sharing.

The Effect of Innovation Strategy on Innovation Performance

Based on the results of the hypothesis testing in Table 1 shows that there is an influence of Innovation Strategy on Innovation Performance. Innovation Strategy involves Information Technology Infrastructure, Customer Experience, Profitability and Quality of Products/Services. In a very competitive environment (hyper-competitive), companies in the telecommunications industry are very innovative, and an innovation strategy is very important. Open Innovation from the outside in is not directly related to innovation performance. Rather, this relationship is fully mediated by knowledge-sharing and innovation strategies. On the one hand, this means that to translate Open Innovation from the outside into better innovation performance, companies need to constantly and systematically share knowledge within and beyond their boundaries. On the other hand, it implies that companies need to develop an innovation strategy that clarifies the areas of innovation and required resources and establishes a formal planning process to achieve the same results.

Therefore, the fourth hypothesis put forward is that Innovation Strategy has an influence on Innovation Performance. The results of statistical tests conducted on data obtained from manager-level respondents at telecommunications companies in Indonesia show that all indicators used as measuring tools for the Innovation Strategy have a strong correlation. This can be seen from all factor loading values above 0.7. The AVE (Average Variance Explained) value of the

Innovation Strategy variable is 0.543, which means that this variable can explain 54.3% of the variance of all indicators. Furthermore, the hypothesis test results produce a coefficient of determination (R^2) for the Innovation Strategy variable of 0.445, which is classified as weak. Innovation Strategy as an independent variable has a T-Statistics value where the coefficient of determination of Innovation Performance is 2.494 or higher than 1.96, as well as a p-value or sig. 0.013, less than 0.05. This means that the Innovation Strategy variable significantly influences the Innovation Performance variable. The results of this hypothesis test conclude that the data support the fourth hypothesis. An explanation that can be put forward for the fourth hypothesis is that 66.7% of the respondents in this study were employees at the Head Office, with a majority of 36.7% from the sales directorate stating that in an environment where innovation strategies have a positive impact on innovation performance.

Effect of Knowledge Sharing on Innovation Strategy

Based on the results of the hypothesis test in Table 1 shows that there is an effect of Knowledge Sharing on Innovation Strategy. Knowledge Sharing involves sharing knowledge with external partners, trusting interpersonal self-efficacy, reciprocity and reputation. While the Innovation Strategy involves Information Technology Infrastructure, Customer Experience, Profitability and Quality of Products/Services. Knowledge sharing and innovation strategies are very important in a hyper-competitive environment, such as highly innovative companies in the telecommunications industry. Open Innovation from the outside in is not directly related to innovation performance. Rather, this relationship is fully mediated by knowledge-sharing and innovation strategies. On the one hand, this means that to translate Open Innovation from the outside into better innovation performance, companies need to constantly and systematically share knowledge within and beyond their boundaries. On the other hand, it implies that companies need to develop an innovation strategy that clarifies the areas of innovation and required resources and establishes a formal planning process to achieve the same results.

Therefore, the fifth hypothesis is that knowledge sharing influences the Innovation Strategy. The results of statistical tests conducted on data obtained from manager-level respondents at telecommunications companies in Indonesia show that all indicators used as measuring tools for the Innovation Strategy have a strong correlation. This can be seen from all factor loading values above 0.7. The AVE (Average Variance Explained) value of the Knowledge sharing variable is 0.557, which means that this variable can explain 55.7% of the variance of all indicators. The AVE (Average Variance Explained) Innovation Strategy value is 0.543, which means that this variable can explain 54.3% of the variance of all indicators. Furthermore, the hypothesis test results produce a coefficient of determination (R^2) for the Knowledge Sharing

variable of 0.389, which is classified as weak. An innovation Strategy of 0.445 is also classified as weak. Knowledge sharing as an independent variable has a T-Statistics value where the Innovation coefficient of determination is 11.074 or higher than 1.96, as well as a p-value or sig. 0.000, less than 0.05. This means that the Knowledge Sharing variable significantly influences the Innovation Strategy variable. The results of this hypothesis test concluded that the data supported the fifth hypothesis. An explanation that can be put forward for the fifth hypothesis is that 66.7% of the respondents in this study were employees at the Head Office, with a majority of 36.7% from the sales directorate stating that an environment that shares knowledge has a positive impact on innovation strategy.

CONCLUSION

In the telecommunications industry in Indonesia, innovation is the key so that a company can excel compared to its competitors. The results of the research test prove that collaborative innovation activities have a positive impact on knowledge sharing. Then there will be a positive relationship between knowledge sharing and innovation performance. Then the results of the research test revealed that the innovation strategy positively impacted innovation performance. Innovation strategy is heavily influenced by Customer Experience, Information Technology Infrastructure, and Profitability, and the weakest influence is Product/Service Quality. Then innovation test results reveal that knowledge sharing positively impacts innovation strategy. Sharing knowledge is strongly influenced by reciprocity or reciprocity, reputation, self-efficacy or individual confidence regarding their ability to organize, perform a task, achieve a goal, produce something and implement actions to achieve certain expertise. Variables Innovation performance in this study is strongly influenced by technical performance, social performance, commercial performance, and Internal Aspects of Innovation Performance.

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