EXTERNAL KNOWLEDGE SOURCING, INNOVATION AND PRODUCTIVITY AMONG INDONESIAN SMALL FAMILY FIRMS

Arif Singapurowoko, Universitas Islam Indonesia
Arif Hartono, Universitas Islam Indonesia

ABSTRACT

This study examines innovation activities of Indonesian small family firms that comprise of three interconnected stages i.e. knowledge sourcing, knowledge transformation, and knowledge exploitation that is termed as innovation value chain (IVC). Currently, IVC study on Indonesian family firms remain unexplored. Samples of the study are small family firms that operating their businesses in Yogyakarta province, Indonesia. Each IVC stage employs different statistical analysis methods. Probit regression, logistic regression, and OLS regression are employed in the first, second and third stage of the IVC, respectively. The study finds the existence of a complementary relationship among external sources of knowledge in the first link of the IVC. In the second link of the IVC, external knowledge from market (i.e. suppliers, customers, and competitors) and open sources (firms' association) positively influence innovation. In the last link of the IVC, positive associations were found between non-technological innovation (i.e. organizational and marketing innovation) and productivity.

Keywords: Innovation Value Chain, Small Family Firms, Yogyakarta, Indonesia.

INTRODUCTION

In the context of Indonesia, although previous studies on family firms (henceforth FFs) have been conducted, the studies tend to focus on two research themes. First, the studies related to influencing factors of the FFs performance. For instances, board structure and its impact on FFs performance (Prabowo & Simpson, 2011); performance comparison between the FFs and non-FFs that are listed in Indonesia Stock Exchange (Singapurwoko, 2013); impact of controlling mechanism on the FFs performance (Harjito & Singapurwoko, 2014); ownership structure and its influence on the FFs performance (Singapurwoko, 2015); and influence of management and executive compensation on the FFs performance (Subekti & Sumargo, 2015). While the second group of the study is related to management and leadership of the FFs. For examples, succession in the FFs (Tirdasari & Dhewanto, 2012); a case study of management control in an Indonesian family-owned university (Tsamenyi et al., 2013); leadership issue and management control system in the FFs (Efferin & Hartono, 2015); and entrepreneurial orientation in the FFs (Sobirin & Rosid, 2016).

Over the past decade, innovation studies in the context of FFs has received growing attention globally. However, insights on how Indonesian FFs performing innovation activities very limited or even do not exist. A recent systematic literature review on FFs' innovation covering 1961-2017 period reveals that there is no single reference used based on Indonesian FFs (Calabrò et al., 2018). Most of the reviewed studies based on developed countries context. Therefore, conducting this research is important since empirical evidence on Indonesian FFs

innovation activities remain unexplored. This study addresses these shortcomings by investigating innovation activities performed by Indonesian small FFs. The main research objective of this study is examining innovation activities of Indonesian small FFs that consist of three main activities i.e. knowledge sourcing, knowledge transformation, and knowledge exploitation. Accordingly, a research question that is addressed is how Indonesian small FFs perform innovation activities that links knowledge sourcing, knowledge transformation, and knowledge exploitation stages?

THEORETICAL FOUNDATION

Knowledge Sourcing Stage

In the knowledge sourcing stage, different sources of knowledge from internal and external firms including R&D and external knowledge are sourced (Hansen & Birkinshaw, 2007; Roper et al., 2008). Hence, the main issue that is addressed is the behavior of Indonesian small FFs in sourcing knowledge from the different external sources. More specifically, complementary relationships among external sources knowledge are tested. The study of complementarities can be linked to super-modularity theory (Milgrom & Roberts, 1995) that explains how the implementation of one activity increases the marginal returns from another. A large strand of literature reveals that complementary among external sources of knowledge and between internal R&D and external knowledge (Doran & O'leary, 2011; Ganotakis & Love, 2012; Roper, et al., 2008; Roper & Arvanitis, 2012). R&D activities are excluded from this study since small firms barely perform internal R&D. A firm may source knowledge from external sources such as customers, suppliers, competitors, consultants, universities and government research institutes.

Currently there are a few insights on complementary strategies in Indonesian innovation activities. Especially, any studies that exploit data from Indonesia innovation survey. The linkage among external knowledge searching widely and deeply, innovation barriers and innovation performance of Indonesian firms (Hartono & Kusumawardhani, 2019). Indonesian automotive industry develops innovation mainly from inside the organisation and competitors are the main source of external knowledge to support the creation of new products in a competitive market (Aminullah & Adnan, 2012). Even though literature in Indonesia context that discusses the involvement of external actors as sources of knowledge in the innovation process is scare, a complementary relationship between internal and external knowledge may exist to some extent. Therefore, an exploratory hypothesis to test the existence of complementary relationship in knowledge sourcing activity may be proposed:

H_1: *In knowledge sourcing activities, a complementary relationship exists among external sources of knowledge.*

Knowledge Transformation Stage

In the second stage of the IVC, different sources of knowledge use in the innovation activities are transformed into innovation output (Hansen & Birkinshaw, 2007; Roper et al., 2008). This following knowledge production function in which the success of knowledge transform activities relies on the firms' knowledge sources Therefore, the main issue addressed is the empirical assessment of the comparative impact of different sources of knowledge on

different types of innovation. The impact of knowledge on innovation shows different findings or inconclusive, accordingly this study is expected to shed the light on such inconclusiveness.

Previous studies also involve a range sources of knowledge such as customers, suppliers, external consultants, competitors, joint ventures, universities and public research centres (Roper & Arvanitis, 2012; Roper et al., 2008), or source groups that include suppliers, customers, competitors, consultants, universities and government research institutes (Doran & O'leary, 2011). No positive and significant impacts of external knowledge on innovation were found in Doran & O'leary (2011) study. Other studies find that only customers and suppliers positively and consistently influence innovation (Roper & Arvanitis, 2012; Roper et al., 2008). In the case of EU countries, science-based firms tend to do joint projects with external organizations, client and industry-based firms are more likely adopt more product innovation and supplier-based firms tend to engage in the acquisition of machinery and equipment (Srholec & Verspagen, 2012). In the case of Indonesian firms, to the best our knowledge, very few studies that expose this issue, especially studies use Indonesia innovation data. Hence, a hypothesis related to the link between sources of knowledge and innovation can be proposed:

H_2: *Different sources of knowledge have different impact on innovation.*

Knowledge Exploitation Stage

The final stage of the IVC is knowledge exploitation that generates value for the firm. Rooting from Geroski, (1993); work, previous scholars such as Ganotakis & Love (2012); Love et al. (2011); Roper et al. (2008) argue that in the knowledge exploitation stage the firm performance is affected by innovation output as the results from codified knowledge that is sourced from knowledge sourcing activity. They regard that innovation output need to be determined prior to the knowledge exploitation. Therefore, the main interest in this stage is how firms gain business productivity or profitability from the exploitation of adopted innovation. In this study productivity (indicated by total sales/number of employees) is used to measure how innovation affects overall firms' performance.

Prior IVC studies show contradictive findings. Major literature shows that innovation output in the form of product and process innovation significantly and positively influences innovation performance as measured by sales and employment growth (Ganotakis & Love, 2012; Roper et al., 2008). Surprisingly, both a negative impact (Roper et al., 2008) and no relationship (Ganotakis & Love, 2012) of product innovation success on productivity have been found. An additional hypothesis may be proposed:

H_3: *In knowledge exploitation activity, innovation positively affects a firm's performance.*

METHODOLOGY

A questionnaire was developed based on Oslo Manual (OECD/Eurostat, 2005) as the guidelines for collecting and interpreting innovation data. Questionnaires were distributed to small FFs in five regions in Yogyakarta province. Referring to Indonesia Statistics Bureau (BPS) on definition of a small firm, the surveyed firms consist of 5-19 employees. Convenient sampling method was employed and hence questionnaires were distributed to small FFs that are easy to be reached. Of 300 distributed questionnaires, 262 questionnaires were returned and used in this study. Data collection was conducted from January to May 2019.

Variables and Measures

Knowledge use as the input of innovation consists of 9 external sources of knowledge as presented in Table 1. The external sources of knowledge are as follows: (1) Suppliers, (2) customers, (3) Competitors, (4) Consultants, (5) Universities, (6) Government/public research institutes, (7) Industry associations, (8) Events, and (9) Scientific publications. The four types of innovation used in this study are in line with the Oslo Manual 3rd Edition (OECD & EUROSTAT, 2005). Product and process are innovations that normally are classified as technological innovations, while organizational and marketing are grouped under non-technological innovations (Mothe & Thi, 2010; Pippel, 2014; Schmidt & Rammer, 2006). In the first IVC stage, a simple approach of single equation Probit model is used to test complementary relationship. In the second IVC stage, Logit regression is used to test the impact of different sources of knowledge on different types of innovation. In the last IVC stage, OLS regression is used to measure the impact of innovation output on firms' productivity.

RESULTS

Table 1 reports descriptive statistics for the investigated variables in this study. Sources of knowledge used as innovation input can be categorized into market (suppliers, customers, competitors, and consultant), scientific (universities and public R&D), and open sources (exhibition, science publication, and trade association). It clearly seen that on average, customers and competitors are sources of external knowledge mostly sourced by the firms. While the least is knowledge that links to science such as university and public R&D.

Table 1
DESCRIPTIVE STATISTICS

VARIABLES	OBS	MEAN	SD	MIN	MAX
SUPPLIERS	262	**1.53**	1.25	0	4
CUSTOMERS	262	**3.31**	0.89	1	4
COMPETITORS	262	**2.76**	1.05	1	4
CONSULTANT	262	0.56	0.50	0	1
UNIVERSITY	262	0.27	0.44	0	1
PUBLIC R&D	262	0.22	0.41	0	1
EVENTS	262	1.50	0.93	0	3
SCIENCE_PUB	262	0.32	0.48	0	2
ASSOCIATIONS	262	**1.58**	0.91	0	3
PRODINNOV (0/1)	262	0.26	0.44	0	1
PRODINNOV-New2Market (0/1)	262	0.03	0.17	0	1
PRODINNOV-New2Firms (0/1)	262	0.25	0.43	0	1
PROCINNOV (0/1)	262	0.09	0.28	0	1
ORGINNOV (0/1)	262	**0.32**	0.47	0	1
MKTGINNOV (0/1)	262	**0.87**	0.34	0	1
PRODUCTIVITY (total sales/# of employee)	262	319	166	167	500

Table 2 presents the first link of IVC and it shows that complementary relationships exist among market (e.g. supplier, customer, and competitor) and between market and association. The firms tend not to source knowledge from consultant, university, public R&D, exhibition, and scientific publication. Therefore, it can be concluded that hypothesis 1 is supported.

Table 2
KNOWLEDGE SOURCING ACTIVITY

	1	2	3	4	5	6	7	8	9
1. Supplier	-	0.13*** (0.04)	0.14** (0.07)	0.09 (0.08)	0.10 (0.05)	0.03 (0.04)	0.06 (0.03)	0.04 (0.12)	0.17*** (0.08)
2. Customer	0.12*** (0.03)	-	0.19*** (0.08)	0.07 (0.05)	0.08 (0.05)	0.03 (0.04)	0.06 (0.03)	0.04 (0.03)	0.18*** (0.08)
3. Competitor	0.02** (0.04)	0.27*** (0.05)	-	0.06 (0.07)	0.05 (0.06)	0.04 (0.04)	0.05 (0.03)	0.04 (0.03)	0.22*** (0.08)
4. Consultant	0.16 (0.05)	0.06 (0.07)	0.09 (0.07)	-	0.06 (0.06)	0.03 (0.04)	0.05 (0.03)	0.05 (0.03)	0.01 (0.08)
5. University	0.01 (0.06)	0.13 (0.15)	0.05 (0.08)	0.10 (0.09)	-	0.04 (0.04)	0.05 (0.03)	0.05 (0.04)	0.03 (0.07)
6. Public R&D	0.02 (0.06)	0.09 (0.13)	0.09 (0.07)	0.08 (0.07)	0.06 (0.07)	-	0.07 (0.03)	0.06 (0.04)	0.03 (0.07)
7. Exhibition	0.07 (0.06)	0.18 (0.12)	0.09 (0.06)	0.10 (0.08)	0.07 (0.07)	0.07 (0.05)	-	0.05 (0.04)	0.04 (0.07)
8. Publication	0.01 (0.07)	0.11 (0.14)	0.15 (0.10)	0.08 (0.09)	0.08 (0.07)	0.08 (0.05)	0.08 (0.01)	-	0.05 (0.07)
9. Association	0.18** (0.08)	0.20*** (0.16)	0.19** (0.07)	0.12 (0.07)	0.04 (0.06)	0.08 (0.05)	0.08 (0.02)	0.09 (0.02)	-
Observations	262	262	262	262	262	262	262	262	262
LR chi2 ()	98.21	89.75	101.22	120.09	99.80	100.54	87.88	77.67	98.45
Prob. > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R2	0.45	0.36	0.27	0.38	0.25	0.41	0.39	0.40	0.39
Log likelihood	-423.35	-385.82	-421.61	-396.57	-417.17	-336.84	-293.78	-339.78	-441.23

Sig. levels *p≤.10, **p≤.05, ***p≤.001. All figures in the tables are marginal effects generated from probit models.

Table 3 shows the knowledge transformation activity. It shows that knowledge that is sourced from market e.g. suppliers, customers, and competitors, tend to have positive impact on all types of innovation. The strongest impact can be found on marketing innovation. While knowledge generated from association also tend to positively affect product and marketing innovation. By contrast, scientific sources of knowledge e.g. university and public R&D, have no impact on any types of innovation. This leads to the conclusion that different sources of external knowledge contribute to different type of innovation. Therefore, hypothesis 2 is supported.

Table 4 shows the final link in the IVC i.e. knowledge exploitation activity. The focus in this link is the impact of different types of innovation on the firms' productivity. The table shows that only organizational and marketing positively and significantly affect productivity. Although not all types of innovation positively contribute to the firms' performance, this suggests that innovation positively influence the firms' productivity. Therefore, hypothesis 3 is supported.

Table 3
KNOWLEDGE TRANSFORMATION ACTIVITY

Independent Variables	Product Innovation	Prodinov New2market	Prodinov New2firms	Process Innovation	Org. Innovation	Marketing Innovation
Supplier	0.04* (0.03)	0.02* (0.03)	0.03*** (0.03)	0.02 (0.03)	0.03 (0.03)	0.07*** (0.029)
Customer	0.18*** (0.03)	0.16*** (0.03)	0.13*** (0.03)	0.10* (0.03)	0.15* (0.03)	0.19*** (0.03)
Competitor	0.20*** (0.03)	0.17*** (0.03)	0.12* (0.03)	0.08** (0.03)	0.10** (0.03)	0.15*** (0.03)

Consultant	0.12 (.05)	0.07 (0.05)	0.11 (0.05)	0.12 (0.046)	0.07 (0.05)	0.06 (0.05)
University	0.09 (.07)	0.05 (0.06)	0.05 (0.07)	0.18 (0.06)	0.08 (0.06)	0.04 (0.06)
Public R&D	-0.11 (.07)	-0.03 (.06)	-0.06 (0.07)	-0.16 (0.07)	-0.10 (0.06)	-0.09 (0.07)
Exhibition	0.04 (0.05)	0.10 (0.05)	0.10 (0.05)	0.08 (0.04)	0.06 (0.05)	0.03 (0.05)
Publication	0.20 (0.05)	0.18 (0.04)	0.20 (0.04)	0.09 (0.04)	0.08 (0.04)	0.03 (0.04)
Association	0.17** (0.05)	0.03 (0.05)	0.01** (0.05)	0.17 (0.05)	0.15 (0.05)	0.18*** (0.05)
Observation	262	262	262	262	262	262
LR chi2 ()	273	231.29	341.3	374.1	325.07	372.49
Prob. > chi2	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R2	0.210	0.130	0.175	0.215	0.208	0.271
Log likelihood	-335.73	-345.13	-420.21	-375.03	-383.54	-402.56

Sig. levels *p≤.10, **p≤.05, ***p≤.001

Table 4
KNOWLEDGE EXPLOITATION ACTIVITY

Independent Variables	Productivity
PRODUCT INNOVATION	-259.498 (239.405)
PRODUCT INNOVATION (New to Market)	192.020 (378.886)
PRODUCT INNOVATION (New to Firms	-223.207 (315.436)
PROCESS INNOVATION	427.620 (366.921)
ORGANIZATIONAL INNOVATION	473.751**(224.151)
MARKETING INNOVATION	138.864**(310.340)
Observation	262
F (2, 255)	5.52
Prob. > F	0.00
R^2	0.27
Adj. R^2	0.19

Sig. levels *p≤.10, **p≤.05, ***p≤.001. The results are based on OLS regressions.

DISCUSSION AND CONCLUSIONS

The literature on the IVC framework has been widely used to analyze inter-relationships among firm interaction, innovation, and business productivity, however, based on the reviewed literature there is no empirical evidence on the IVC of Indonesia small FFs. Key findings of this study are as follows. First, in the first link of the IVC, this study finds the existence of strong complementary relationships among external sources of knowledge. External actors from market have important roles as knowledge providers if the firm also generates knowledge from market. In contrast, the firms' interactions with science institutions tend to be of lesser importance. The firms that source knowledge from market network interact less with science institutions, but they do interact with associations. Second, in the second link of the IVC, external knowledge that shaping innovations mainly comes from external knowledge from suppliers, customers and competitors. Knowledge generated from science institutions makes no significant contribution. Third, the final link of the IVC relates to the impact of innovation on productivity. Sourcing activity that relies on informal external networks, mainly from market, automatically influences

the minimum usage of other sources of knowledge such as scientific institutions that may provide additional added value for firms.

Findings from this study are expected to enrich literature of innovation studies in the context of developing countries in several ways. First, the fact that non-technological innovation is the highest proportion of innovation produced by the firms support and confirm previous studies that reveal most firms in in developing countries: tend to focus on market rather than technological innovation (Wamae, 2009) and beyond traditional focus on R&D (Srholec, 2011). Second, the highest proportion of knowledge sourced by the firms mainly from informal source of knowledge e.g. suppliers, customers and competitors. This also confirms previous innovation studies in Indonesia that reveal innovation in Indonesian manufacturing sectors generally as the results of learning through "*Informal experiences*" not through "*Formal scientific activity or R&D*" (Aminullah, 2012; Aminullah et al., 2014).

Finally, limitations of this study need to be acknowledged. First, this study is a cross-sectional in nature and as a result, the dynamics of Indonesian small FFs' IVC cannot be captured. Hence, future studies may address this limitation by conducting a longitudinal study. Second, this study only focuses on small FFs, as a result, generalization of the findings may not reflect all Indonesian FFs.

REFERENCES

Aminullah, E. (2012). Coping with low R&D Investment in Indonesia: Policy insights from system dynamics model. *Journal of S&T Policy and R&D Management, 10*(1), 1–10.

Aminullah, E., & Adnan, R.S. (2012). The role of academia as an external resource of innovation for the automotive industry in Indonesia. *Asian Journal of Technology Innovation, 20*(S1), 99–110.

Aminullah, E., Dian, P., Irene, M.N., & Laksani, C.S. (2014). How capital goods firms upgrade innovation capacity: a case study. *Journal of S&T Policy and R&D Management*, *12*(2), 85–98.

Doran, J., & O'leary, E. (2011). External interaction, innovation and productivity: An application of the innovation value chain to Ireland. *Spatial Economic Analysis*, *6*(2), 199–222.

Efferin, S., & Hartono, M.S. (2015). Management control and leadership styles in family business: An Indonesian case study. *Journal of Accounting and Organizational Change*, *11*(1), 130–159.

Ganotakis, P., & Love, J.H. (2012). The innovation value chain in new technology-based firms: Evidence from the U.K. *Journal of Product Innovation Management*, *29*(5), 839–860.

Geroski, P., Machin, S., & Reenen, J.V. (1993). The profitability of innovating firms. *The RAND Journal of Economics*, *24*(2), 198–211.

Hansen, M., & Birkinshaw, J. (2007). The innovation value chain. *Harvard Business Review*, *85*(6), 121–130.

Harjito, D., & Singapurwoko, A. (2014). The relationship of agency and performance in family business: Small and Medium Enterprise in Yogyakarta. *International Review of Management and Business Research*, *3*(3), 1369–1378.

Hartono, A., & Kusumawardhani, R. (2019). Innovation barriers and their impact on innovation: Evidence from Indonesian Manufacturing Firms. *Global Business Review, 20*(5), 1196-1213.

Love, J.H., Roper, S., & Bryson, J.R. (2011). Openness, knowledge, innovation and growth in UK business services. *Research Policy*, *40*(10), 1438–1452.

Milgrom, P., & Roberts, J. (1995). Complementarities and fit strategy, strcture, and organizational change in manufacturing. *Journal of Accounting and Economics*, *19*(2–3), 179–208.

Mothe, C., & Thi, T.U.N. (2010). The link between non-technological innovation and technological innovation. *European Journal of Innovation Management*, *13*(3), 313–332.

OECD/Eurostat. (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. OECD and Eurostat Publication (3rd Edition). Paris, France. https://doi.org/10.1787/9789264013100-en

Pippel, G. (2014). R&D cooperation for non-technological innovations. *Economics of Innovation and New Technology, 23*(7), 611–630.

Prabowo, M., & Simpson, J. (2011). Independent directors and firm performance in family controlled firms: Evidence from Indonesia. *Asian-Pacific Economic Literature*, *25*(1), 121–132.

Roper, S., & Arvanitis, S. (2012). From knowledge to added value: A comparative, panel-data analysis of the innovation value chain in Irish and Swiss manufacturing firms. *Research Policy*, *41*(6), 1093–1106.

Roper, S., Du, J., & Love, J.H. (2008). Modelling the innovation value chain. *Research Policy*, *37*(6–7), 961–977.

Schmidt, T., & Rammer, C. (2006). The determinants and effects of technological and non-technological innovations–Evidence from the German CIS IV. ZEW. Mannheim. Retrieved from http:// www.oecd.org/science/innovationinsciencetechnologyandindustry/37450197.pdf

Singapurwoko, A. (2013). Indonesian Family Business vs. Non-Family Business Enterprises: Which has Better Performance? *International Journal of Business and Commerce*, *2*(5), 35–43.

Singapurwoko, A. (2015). The impact of ownership structure on family firm performance: Evidence from The Indonesia Stock Exchange. In International Conference on Business, Marketing and Information System Management (BMISM'15) Nov. 25-26, 2015 Paris (France) (pp. 1–5).

Sobirin, A., & Rosid, A. (2016). Entrepreneurial orientation of family firm within maturity industry: A Multi-Case Study in Rice Milling Industry in Indonesia. *Procedia-Social and Behavioral Sciences*, *219*, 710–716.

Srholec, M. (2011). A multilevel analysis of innovation in developing countries. *Industrial and Corporate Change*, *20*(6), 1539–1569.

Srholec, M., & Verspagen, B. (2012). The voyage of the beagle into innovation: Explorations on heterogeneity, selection, and sectors. *Industrial and Corporate Change*, *21*(5), 1221–1253.

Subekti, I., & Sumargo, D.K. (2015). Family management, executive compensation and financial performance of indonesian listed companies. *Procedia - Social and Behavioral Sciences*, *211*, 578–584.

Tirdasari, N.L., & Dhewanto, W. (2012). Family business succession in Indonesia: A study of hospitality industry. *Procedia - Social and Behavioral Sciences*, *57*, 69–74.

Tsamenyi, M., Noormansyah, I., & Uddin, S. (2013). Management controls in family-owned businesses (FOBs) and management accounting on the adoption of organization interaction: A case study of an Indonesian family-owned University. *Accounting Forum*, *32*, 62–74.

Wamae, W. (2009). Enhancing the role of knowledge and innovation for development. *International Journal of Technology Management and Sustainable Development*, *8*(3), 199–220.