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The conference this year will be opened with a keynote presentation by Prof Dr Murali Raman from the Multimedia University, speaking on *"Fearlessness of Failing: Injecting Creativity in Developing an Entrepreneurial Mindset in a Digital World"* and in the afternoon the international consultant Mr Philip Merry, who will discuss, *"Entrepreneurship, Synchronicity & Leading with Heart: Intuiting the Future in a Quantum World"*.

The second day of the conference will be opened by Prof George Teodorescu; the Chairman of the Danubius Academic Consortium Ecosystem for Integral Innovation, who will be talking about *"Integral Innovation, a Brain to Business strategy for Leadership"*. And an afternoon keynote presentation by Adjunct Prof Dato' Dr Ghazali bin Dato' Mohd. Yusoff who is an Honorary Doctor of Law at the University of Nottingham will address the topic *"Islam and Business: Innovation and Entrepreneurship Incorporating Values and Belief in God"*.

With an initial submission of 176 abstracts, after the double blind, peer-review process there are 26 academic Research papers, 2 PhD Research papers, and 1 Work in Progress paper published in these Conference Proceedings. These papers represent truly global research in the field, with contributions from Australia, Canada, China, Finland, France, Germany, India, Indonesia, Iran, Italy, Japan, Malaysia, Nigeria, Philippines, Poland, Romania, Russia, Saudi Arabia, Taiwan, UK and USA.

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What Hamper Innovation of Indonesian Manufacturing Firms? Insight from the Indonesia Innovation Survey

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Abstract: *The main objective of this study is to provide new empirical evidences on obstacles that hamper innovation activities performed by Indonesian manufacturing firms. More specifically, this study aims to (1) investigate the innovation barriers perceived by Indonesian manufacturing firms based on the firms' innovativeness i.e. innovators versus non-innovators; (2) investigate the nature of any factors that hamper innovation faced by Indonesian manufacturing firms; (3) link different innovation barriers with different types of innovation adopted by Indonesian manufacturing firms, and (4) investigate the influence of innovation barriers on innovation success. The empirical analysis in this study is derived from the second Indonesia Innovation Survey (IIS) 2011 that covers 2009-2010 periods. The findings show that constraints related to financial and risk is the most important perceived by the firms. Innovators and non-innovators perceived the barriers differently. Based on factor analysis, the innovation barriers can be grouped and labelled as: "market and institution", "employee and organization", "financial and risk", and "knowledge and cooperation". The first two groups of barrier tend to have positive direction of influence on types of innovation and innovation success; by contrast, the last two groups of barrier are more likely have negative direction of impact. Based on the study findings, the following recommendations are proposed. Innovative firms that face revealed barriers related to employee and organisation is the necessity to implement better management of innovation activity e.g. education, training and workshop in order to minimise the impacts of the obstacles. Financial development or appropriate fiscal policy to provide the required finance to innovation activity may relevant to overcome financial and risk barrier, for instance the easiness access to financial intermediaries. In this case, the involvement from government is crucial.*

Keywords: *innovation barrier, manufacturing firms, Indonesia*

1. INTRODUCTION

A number of innovation barriers studies in different developing countries have been conducted, for examples, *Brazil* (e.g. Kuhl and da Cunha, 2013), *Cyprus* (e.g. Hadjimanolis, 1999), *China* (e.g. Fu et al., 2015, Savitskaya et al., 2010, Xie et al., 2010, Zhu et al., 2012), *Malaysia* (e.g. Shiang and Nagaraj, 2011), and *Turkey* (e.g. Demirbas et al., 2011). Surprisingly, there is no empirical evidence that focusses on innovation barriers faced by Indonesian firms. More specifically, there is no previous innovation barrier study that exploits Indonesia innovation survey data, therefore this study intends to address this gap. In the case of Indonesia, innovation barrier tend to be linked to various study's themes, for instances, Indonesian furniture SMEs strategy in accessing knowledge (e.g. Van Geenhuizen and Indarti, 2005); technological development in Indonesia (e.g. Okamoto and Sjoholm, 2001); technology transfer in an Indonesian turbine industry (e.g. Soekarno et al., 2009); and challenges in attracting foreign direct investment to Indonesia (Lipsey and Sjoholm, 2011).

This study is the first study that investigates innovation barriers on the basis of the Indonesia Innovation Survey (IIS) 2011 that covers 2009-2010 periods. The main objective of this study is to provide new empirical evidences on obstacles that hamper innovation activities performed by Indonesian manufacturing firms. More specifically, this study aims to: investigate the innovation barriers perceived by Indonesian manufacturing firms based on the firms' innovativeness i.e. innovators versus non-innovators; investigate the nature of any factors that hamper innovation faced by Indonesian manufacturing firms; link different innovation barriers with different types of innovation adopted by Indonesian manufacturing firms; and investigate the influence of innovation barriers on innovation success.

This study attempts to address the following research questions: (1) To what extent innovation barriers are perceived by Indonesian manufacturing firms? (2) What is the nature of innovation barriers encountered by Indonesian manufacturing firms? To what extent innovation barriers effect different types of innovation and innovation success of Indonesian manufacturing firms? Addressing the research questions is essential with the hope that the finding sheds the light on innovation barriers issues of Indonesian firms as well as enriches the innovation barriers literature in the context developing countries. Practically, findings from this study are expected can be used to assist policy makers to formulate any relevant innovation policies and strategies to overcome any factors that hinder innovation activities experienced by Indonesian manufacturing firms.

2. LITERATURE REVIEW & HYPOTHESES DEVELOPMENT

2.1 Innovation barriers and firm innovativeness

According to Hueske and Guenther (2015), previous studies show ambiguous findings on the relationship between the firm innovativeness and the perception of innovation barriers and only a minority of the studies that disclose that the innovativeness might influence innovation barriers' perception (e.g. Baldwin & Lin, 2002; D'Este *et al.*, 2012; Galia & Legros, 2004). This means that the relationship between innovation barriers and the firm innovativeness shows different ways of directions. The positive relationship may indicates revealed barriers and on the contrary, the negative relationship shows deterring barriers (D'Este *et al.*, 2012).

Referring to revealed barriers, when innovators face barriers in the innovation activities engagement, this does not prevent them from performing the innovation activities, but this increases their consciousness and knowledge through the direct experiences in overcoming the barriers (D'Este *et al.*, 2012). Previous studies that support this view found that the greater the firm's involvement in innovation activities, the greater the importance attached to the constraints to innovation or it shows positive association between innovation barriers' perceptions and innovation propensity (Baldwin & Lin, 2002; Galia & Legros, 2004; Hadjimanolis, 1999; Iammarino *et al.*, 2009). Further interpretation on the positive

association between innovation obstacles and innovation propensity on the studies that use innovation surveys (e.g. CIS) is that such association cannot be interpreted as preventing innovation but rather as a sign of how successful the firm (Baldwin & Lin, 2002; Tourigny & Le, 2004). While, deterring effect exists when there is a reverse causality between the innovation barriers' perception and innovation; therefore, innovation activity is significantly reduced by the existence of obstacles (e.g. Mohnen & Röller, 2005; Savignac, 2006; Tiwari *et al.*, 2007).

Using Canadian firms data, previous scholars, such as Mohnen and Rosa (2000) and Baldwin and Lin (2002), examine innovation constraints between innovators and non-innovators. Mohnen and Rosa (2000) use R&D activities as a proxy of innovation intensity and their study reveals that the more firms involve in R&D activities, the greater important attach to the innovation barriers. The later study also found a similar finding. On the basis of data from the UK CIS, a recent study conducted by D'Este et al., (2012) shows a positive relationship between innovation-active firms and barriers related to cost, knowledge, and regulation. The more firms engage heavily in innovation activities are more likely to perceive the three barriers are more important than firms do not engage in innovation activities, with the exception of constraints related to market. The second stream of literature shows negative association between the perception of innovation obstacles and firms' effort to innovate. For instances, using innovation data on French manufacturing firms, Savignac (2006) found that the likelihood that a firm will perform innovation activities is significantly reduced by the existence of financial obstacles. Based on the Dutch CIS data, Tiwari et al., (2007) found a strong and significant detterant impact on the presence of financial constrainst on R&D investment.

In the case of developing countries, revealed effects of innovation barriers on the propensity to innovate were found on the studies conducted by Hadjimanolis (1999) and Shiang and Nagaraj (2011). On the basis of innovation data on Cypriot small medium firms, Hadjimanolis (1999) found that the higher the importance of external barriers perceived by the SMEs' owner/manager, the higher is the innovativeness. A possible reason is because the innovative firms despite facing important barriers, they tend able to find ways to overcome the barriers. The same finding also can be found in Malaysian manufacturing firms i.e. the firms that engage in innovation activities are more likely to face greater barriers (Shiang & Nagaraj, 2011). Based on this, a hypothesis may be proposed:

H1 *Innovative firms perceive innovation barriers more important than non-innovative firms*

2.2 Innovation barriers, innovation and performance

Financial constraints and its impact on innovation performance (e.g. Canepa & Stoneman, 2002; 2008; Efthyvoulou & Vahter, 2012; Mohnen *et al.*, 2008; Savignac, 2006) and the factors influencing perceptions of constraints (e.g. Baldwin & Lin, 2002; Galia & Legros, 2004; Iammarino *et al.*, 2009) have been discussed in the majority of innovation barriers literature. However, the link between innovation barriers and different types of innovation adopted by firms tend to be less studied. The impact of innovation barriers on different types of innovation in the Spanish firms was studied by Guijarro et al., (2009). The study suggests that individual barrier have varying levels of impact on different types of innovations. The study found that process and management innovation are negatively affected by financial and human resources, while barriers related to external environment is positively affected the two types of innovation. Silva et al., (2007) linking a diverse of innovation barriers to the Portuguese firms' propensity for innovating the product or process innovation. The study found that high cost of innovation, lack of financing sources, lack of skilled personnel, and

lack of customers' responsive to new products significantly affect the propensity for innovating the product or process innovation (Silva *et al.*, 2007).

In the context of Indonesia, previous studies have linked innovation barriers to a wide range of Indonesia's development issues. Financial constraint found to be the most important barrier that hinder Indonesian furniture SMEs in accessing knowledge to be used in innovation process (Van Geenhuizen and Indarti, 2005) and also found to be the main constraint faced by majority of Indonesian SMEs owners (OECD, 2010). Knowledge and skills related barriers also hamper technological development in Indonesia. According to Okamoto and Sjoholm (2001) Indonesia suffers from lack of technological development driven by the low level of R&D budget and education and it affected the country to rely on foreign firms on the enhancement its technological capability. A case from an Indonesian turbine industry found that knowledge and skill barriers hamper technology transfer process of imported technology (Soekarno et al., 2009). The low level of the following conditions, e.g. scientific cooperation among Indonesian technology producers, internal R&D activities and technology absorptive capacity, hamper Indonesian firms from performing innovation activities (Lakitan, 2013).

Previous studies that investigate the impact of innovation barriers on innovation and firm performance have been conducted. Hewitt-Dundas (2006) found that different innovation barriers effects innovation success differently during two periods of innovation survey in Ireland. Lack of market opportunities in the former innovation survey significantly affected innovation success in the later period of innovation success. Lack of information on new technologies significantly influences innovation sales in both periods of surveys. The changes in the strength of certain obstacles (e.g. high risk of innovation, managerial expertise) over the two periods also affect the innovation success. Financial constraint found significantly and negatively affects: labour productivity across SMEs in European countries (Ferrando & Ruggieri, 2015); innovation performance of innovative firms in Western and eastern European countries (Efthyvoulou & Vahter, 2012); and innovation activities in various European countries (e.g. Canepa & Stoneman, 2002; Mohnen *et al.*, 2008; Savignac, 2006).

In developing countries context, a diverse of innovation barriers also found negatively affect different types of firms' performance. Constraints such as high cost of innovation, lack of appropriate source of finance, and lack of government's R&D and technology found negatively and significantly affect managers of Turkish SMEs (Demirbas *et al.*, 2011). Using panel data of start-ups in 61 developing countries, Doruk and Soylemezoglu (2014) find that start-ups and new business registration (bureaucratic barriers) and costs are main constraints that impede start-ups development. Based on this, the following hypotheses are proposed:

H2 *Different innovation barriers negatively influence different types of innovation.*

H3 *Different innovation barriers negatively influence innovation success.*

3. DATA AND METHODS

3.1 Data

The empirical analysis in this study is derived from the second Indonesia Innovation Survey (IIS) 2011 that covers 2009-2010 periods. The surveyed firms' classification is based on International Standard Industrial Classification (ISIC) Rev. 3.1. The IIS 2011 used Oslo Manual (OECD/Eurostat, 2005) as the guidelines for collecting and interpreting innovation data. In terms of firm size, the IIS 2011 surveyed only medium (20-99 employees) and large (more than 99 employees) Indonesian manufacturing firms (see table 1). Nearly 77% the surveyed firms are medium firms that consist of 20 to 99 employees, while around 23% of firms are large firms that consist of more than 99 employees. Based on the guideline, the IIS 2011 defined innovation as "the implementation of a new or significantly improved product

(good or services), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD & Eurostat, 2005, p.46).

Table 1 Indonesian manufacturing firms' classification (1179 firms)

Firms classification	Proportion
Firms' Size	
Medium (20-99 employees)	76.68
Large (more than 99 employees)	23.32
Innovativeness	
Innovator	61.15
Non-innovator	38.85
Innovation decision	
Product innovators	37.66
Process innovators	32.23
Organisational innovators	31.04
Marketing innovators	42.83
Innovation success (new to the market)	28.75
Innovation success (new to the firms)	35.79
Technology intensity	
Low-tech. (ISIC 15-22, 36-37)	73.45
Medium-low tech. (ISIC 23, 25-28)	17.39
Medium-high tech. (ISIC 24, 29, 31, 34 & 35)	8.23
High-tech. (ISIC 30, 32, 33)	0.93

3.2 Methods

T test is used in this study "for evaluating the difference between two groups of sample respondents on a single dependent variable" (Cooksey, 2007, p.194). In this case, the innovation barriers difference between two groups of innovators and non-innovators is assessed. Factor analysis (i.e. principal component analysis) is also employed in order to identify and to combine innovation barriers variables in "a weighted fashion to form components which account for the maximum amount of variability in the variables' scores" (Cooksey, 2007, p.138). Logistic regression is performed to handle predictions of and modelling responses to a categorical dependent variables i.e. innovation decisions. The firm that performs a type of innovation (product, process, organisational, or marketing) is coded 1, 0 otherwise. Finally, Tobit regression is employed to test the influence of innovation barriers on innovation success. Innovation success is indicated by sales of innovative products that new to the market and new to the firms that consists of 0 and positive proportion.

4. THE STUDY RESULTS

4.1 Descriptive statistics

Table 2 summarises the descriptive statistics of the study. On average, it can be observed that the highest proportion types of innovation adopted by Indonesian manufacturing firms is marketing innovation (42.8%), by contrast, the lowest proportion is organisational innovation (31%). The fact that proportion of non-technological innovation (i.e. marketing innovation) is the highest among the adopted innovation is typically innovation activities in developing countries that tend to focus on the market rather than on the technology (Wamae, 2009). Technological innovation (i.e. product and process innovations) is accounted for around 38% and 32%, respectively. In terms of innovation success, on average, the proportion of firms that sale product innovation new to the market is greater than product innovation new to the firm i.e. 15.37% versus 8.43%.

Turning to innovation barrier variables, the range of the responses related to innovation barrier questions is from 0 (not important) to 4 (very important). On average, the score of each barrier related to *financial and risk* (i.e. INFUND, EXFUND, COST and RISK) accounted nearly 3 and this indicates the top four mean scores compared to other types of barriers. This supports a previous innovation activities study comparison among developing countries stating that "firms in developing countries report that dominant barrier to innovation is the lack of funds – due either to the high costs of innovation or to the lack of internal or external funds available" (Bogliacino *et al.*, 2012, p.238). Then, it is followed by the mean scores of constraints related to *knowledge and market* (i.e. MKT_DOMINATION, COOPERATION, DEMAND_UNCERTAINTY, and TECH_INFO) accounted for 2.642, 2.598, 2.558, and 2.501 respectively. By contrast, the mean scores of the obstacles related to *employee and organisation* (i.e. ORGRIGID and MGR_RESIST) are the lowest among innovation barriers i.e. 1.789 and 1.732 respectively.

In regards to control variables, the mean of firm size as indicated by number of employee is nearly 175 people. Of surveyed firms, mature firms (more than 20 years) dominate in the IIS 2011. During 2009-2010 periods, on average exporters that sell their products to overseas is nearly 10%. Of surveyed firms, national firms dominate the sample of the survey. The proportion of national firms is significantly higher compared to multi nationals and joint ventures, i.e. nearly 90% versus 6% and 4.2% respectively. Most of surveyed firms are operated in their headquarters not in the plants (91% versus 9.2%). In relation to labour education, a majority of employees hold low level of education. Proportion of employees that hold education degrees lower than high school is accounted for more than 50% (i.e. around 56%). Percentage of labour that holds high school degree is around 36%. While, less than 5% of employee holds diploma and under graduate degree. In the case of technology intensity, there is a big difference between the mean of low- and high-technology i.e. 0.735 versus 0.009. It means that low-technology firms dominating the surveyed firms i.e. accounted for around 73%.

Table 2 Descriptive Statistics Outputs

VARIABLES	OBS.	MEAN	SD	MIN.	MAX.
Innovation Decision					
PRODINN	1179	.377	.485	0	1
PROCINN	1179	.322	.468	0	1
ORGINN	1179	.310	.463	0	1
MKTGINN	1179	.428	.495	0	1
Innovation Success					
INNSUCCESS_MARKET (%)	1179	8.429	16.985	0	100
INNSUCCESS_FIRMS (%)	1179	15.368	26.131	0	100
Innovation Barriers					
COST	1179	2.936	1.312	0	4
RISK	1179	2.880	1.313	0	4
INFUND	1179	2.847	1.381	0	4
EXFUND	1179	2.657	1.513	0	4
MKT_DOMINATION	1179	2.642	1.390	0	4
COOPERATION	1179	2.598	1.410	0	4
DEMAND_UNCERTAIN	1179	2.558	1.356	0	4
TECH_INFO	1179	2.501	1.360	0	4
PERSONNEL	1179	2.421	1.403	0	4
INFRASTRUCTURE	1179	2.385	1.436	0	4
MARKET_INFO	1179	2.342	1.342	0	4

LABOUR	1179	2.335	1.426	0	4
IND_STANDARD	1179	2.289	1.464	0	4
GOVREG	1179	2.254	1.480	0	4
CUSTOMER_ACC	1179	2.248	1.348	0	4
STAFF_RESIST	1179	2.000	1.436	0	4
ORG_RIGID	1179	1.789	1.400	0	4
MANAGER_RESIST	1179	1.732	1.395	0	4
Firm Resources					
SIZE	1179	174.61	1318.08	20	32977
AGE	1179	21.077	12.704	0	84
EXPORT	1179	9.726	25.106	0	100
OWN_NATIONAL	1179	0.899	.301	0	1
OWN_MULTINATIONALS	1179	0.059	.235	0	1
OWN_JOINT VENTURE	1179	0.042	.202	0	1
OPERATION_PLANT	1179	0.092	.289	0	1
OPERATION_HQ	1179	0.908	.289	0	1
EDU_UNDERHS	1179	56.247	36.423	0	100
EDU_HIGHSCHOOL	1179	36.430	31.492	0	100
EDU_DIPLOMA	1179	3.246	6.779	0	55
EDU_UNDERGRAD	1179	4.077	8.623	0	90
LOW TECH	1179	0.735	.442	0	1
MID-LOW TECH	1179	0.174	.379	0	1
MID-HIGH TECH	1179	0.082	.275	0	1
HIGH-TECH	1179	0.009	.096	0	1

Notes: Variables description can be found in appendix 1

Outputs of correlation between innovation barriers variables are presented in table 3. All the correlation among innovation barrier variables indicates positive and significant direction of relationships. It can be seen that in general, correlation coefficients show low and moderate relationships.

Table 3 Correlation of Innovation Barriers (1179 firms)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.INFUND	1																	
2.EXFUND	.75	1																
3.COST	.61	.58	1															
4.RISK	.54	.51	.68	1														
5.STAFF_RESIST	.35	.33	.34	.29	1													
6.MGR_RESIST	.32	.31	.30	.26	.69	1												
7.ORGRIGID	.31	.28	.27	.20	.60	.73	1											
8.PERSONNEL	.40	.38	.35	.30	.50	.45	.46	1										
9.TECH_INFO	.45	.42	.38	.33	.32	.31	.31	.50	1									
10.MKT_INFO	.40	.37	.34	.28	.35	.34	.37	.44	.57	1								
11. COOP	.49	.50	.41	.40	.31	.27	.30	.38	.49	.50	1							
12. LABOUR	.43	.39	.39	.37	.47	.44	.46	.52	.46	.44	.50	1						
13. MKT_DOMINATE	.30	.30	.36	.37	.25	.27	.29	.32	.29	.33	.30	.38	1					
14. DEMAND	.40	.37	.40	.39	.33	.34	.34	.33	.37	.38	.40	.45	.51	1				
15. CUSTOMER_ACC	.32	.31	.32	.33	.27	.30	.31	.27	.33	.44	.35	.37	.43	.56	1			

16. INFRA	.42	.41	.42	.41	.36	.35	.35	.42	.40	.37	.43	.51	.38	.45	.44	1		
17. STANDARD	.43	.43	.42	.39	.40	.41	.41	.39	.38	.39	.44	.50	.40	.44	.40	.59	1	
18. GOVREG	.41	.39	.40	.38	.39	.42	.42	.36	.36	.39	.43	.48	.38	.45	.40	.57	.85	1

All significant levels are at 1% ($p<0.01$).

4.2 Empirical Results

Table 4 clearly shows that the overall mean of the barriers related to *financial and risk factors* (i.e. COST, RISK, INFUND, and EXFUND) for all firms, non-innovators and innovators outnumbered the mean of other barriers (greater than 2.6). It means that cost and financial related barriers to be perceived as the most important barriers than other barriers. This finding supports a majority of previous studies on innovation barriers. While, barriers associated to manager and organisation behaviour towards innovation are the lowest mean (lower than 2.0). It applies for all firms, non-innovators and innovators. It means that such barriers perceived to be least important by the Indonesian manufacturing firms.

Table 4 T-test of innovation barriers between non-innovators and innovators firms (1179)

INNOVATION BARRIERS	OVERALL MEAN	NON-INNOVATORS	INNOVATORS	t Test
COST	2.936	2.952	2.926	.325
RISK	2.880	2.891	2.872	.235
INFUND	2.847	2.856	2.842	.170
EXFUND	2.657	2.697	2.632	.708
MKT_DOMINATION	2.642	2.631	2.649	-.218
COOPERATION	2.598	2.587	2.605	-.206
DEMAND_UNCERTAIN	2.558	2.570	2.551	.238
TECH_INFO	2.501	**2.592**	2.444	1.822*
PERSONNEL	2.421	2.397	2.436	-.455
INFRASTRUCTURE	2.385	2.404	2.373	.359
MARKET_INFO	2.342	2.408	2.300	1.356
LABOUR	2.335	2.397	2.295	1.197
STANDARD	2.289	2.352	2.250	1.164
GOVREG	2.254	2.279	2.237	.478
CUSTOMER_ACC	2.248	2.279	2.227	.645
STAFF_RESIST	2.000	1.782	**2.139**	-4.189***
ORGRIGID	1.789	1.642	**1.882**	-2.880***
MANAGER_RESIST	1.732	1.563	**1.839**	-3.324***

*$p<0.10$; **$p<0.05$; ***$p<0.01$

It can be observed that in general, non-innovators face greater obstacles than innovators. However, based on the t test results, innovators and non-innovators are significantly different on the four barriers related to knowledge (i.e. TECH_INFO, STAFF_RESIST, ORGRIGID and MANAGER_RESIST). Surprisingly, non-innovative firms only perceive (at marginal level) one type of barrier i.e. TECH_INFO that is more important than innovative firms. While innovators significantly perceive the rest of the three barriers are more important than non-innovators. Based on this, hypothesis 1 is accepted. The findings support previous studies of revealed barriers to innovation (e.g. Baldwin & Lin, 2002; Galia & Legros, 2004; Iammarino *et al.*, 2009) that state innovators reporting more likely to have experienced the barriers to innovation than non-innovators. This means that the more the innovators perform innovation activities, the greater they will experience impediments related to knowledge (i.e. STAFF_RESIST, ORGRIGID and MANAGER_RESIST). Despite the innovators face

greater levels of knowledge obstacles; however it does not stop them to perform innovation activities.

4.3 Factor Analysis

Table 5 displays the results of varimax rotated factor analysis of the 18 innovation barrier variables.

Table 5 Component Loadings for Innovation Barriers

VARIABLE	FACTOR1	FACTOR2	FACTOR3	FACTOR4
INFUND	-.067	.015	**.476**	.099
EXFUND	-.065	.005	**.476**	.087
COST	.033	.002	**.502**	-.066
RISK	.090	-.045	**.487**	-.118
STAFF_RESIST	-.040	**.519**	.051	-.004
MANAGER_RESIST	.009	**.564**	-.002	-.054
ORGRIGID	.039	**.520**	-.072	.017
PERSONNEL	-.073	.251	.019	**.336**
TECH_INFO	-.052	-.035	.030	**.557**
MARKET_INFO	.048	-.020	-.086	**.543**
COOPERATION	.048	-.073	.141	**.366**
LABOUR	.129	.163	.015	.223
MKT_DOMINATION	**.400**	-.067	-.021	.014
UNCER_DEMAND	**.394**	-.063	-.013	.084
CUSTOMER	**.413**	-.108	-.107	.150
INFRASTRUCTURE	**.334**	.023	.067	.023
STANDARD	**.413**	.102	.058	-.111
GOVREG	**.427**	.111	.040	-.132
Eigenvalue	7.866	1.226	1.632	1.063
Cronbach's alpha			.924	
Kaiser-Meyer-Olkin			.917	
Percentage of total variance explained			65.50	

Factor 1: "market and institutions" barriers; Factor 2: "employee and organisation" barriers; Factor 3: "financial and risk" barriers; Factor 4: "knowledge and cooperation" barriers.

Factor loadings above 0.3 were used for factor grouping. Bartlett test of sphericity: 12000, significance=0.000. The Kaiser-Meyer-Olkin measure of sampling adequacy =0.917 is well above the acceptable range (0.50) (Hair *et al.*, 2014). The scale reliability value for each factor (coefficient alpha) is 0.924. The factors from the principal components analysis are grouped and labelled into four groups of barriers related to "market and institution", "employee and organisation", "financial and risk", and "knowledge and cooperation".

4.4 Logistics Regression

Table 6 presents the logistic regression outputs that consist of six models. Dependent variables consist of six different types of innovation i.e. product innovation, product innovation that new to the markets (radical innovation), product innovation that new to the firms (incremental innovation), process innovation and organisational innovation. Independent variables consist of four different innovation barriers that emerged from factor analysis. While control variables encompass firms resources, employee quality as indicated by level of education, and technology intensity. Despite market and institution related barriers

have positive direction of the influence on types of innovation; however there is no significant relationship between such barriers and any types of innovation. Inline to market and institution barriers, the second group of barrier i.e. employee and organisation attitudes have positive direction of the influence on types of innovation. The barriers positively and strongly influence all types of innovation (except ORGINN). In contrast to the first two of innovation barriers, financial and risk constraints are more likely to have negative direction of influence on types of innovation. In addition, the financial and risk barriers significantly influence all types of innovation except MKTGINN. The last group of barrier i.e. knowledge and cooperation are more likely to have negative direction of influence on types of innovation. The barriers significantly influence both PRODINN_NEW2MARKET and PROCINN. This finding support a previous study that shows innovation barriers affected types of innovation differently (Guijarro *et al.*, 2009). Based on this hypothesis 2 can be answered.

Table 6 Logistic regression outputs

INDEPENDENT VARIABLES	Model 1 PRODINN	MODEL 2 PRODINN_NEW2MKT[1]	MODEL 3 PRODINN_NEW2FIRMS[2]	MODEL 4 PROCINN	MODEL 5 ORGINN	MODEL 6 MKTGINN
Market & institution	.013 (.019)	.022 (.018)	.008 (.019)	.031 (.019)	-.023 (.018)	-.009 (.019)
Employee & organisation	**.078***** (.013)	**.083*****(.013)	**.074***** (.013)	**.045*****(.013)	.017 (.013)	**.061*****(.014)
Financial & risk	**-.034**** (.016)	**-.047*****(.015)	**-.031***(.016)	**-.038****(.015)	**-.050*****(.015)	-.014 (.016)
Knowledge & cooperation	-.028 (.019)	**-.043****(.017)	-.013 (.018)	**-.034***(.018)	-.016 (.017)	-.017 (.019)
Size	-.00002 (.00002)	-.00001 (.00002)	-.00001 (.00002)	.000 (.000)	-.00002 (.00002)	-.00002 (.00002)
Firm age	.0003 (.001)	-.0004 (.001)	-.00003 (.001)	-.001 (.001)	.00001 (.001)	-.001 (.001)
Export	**.001***(.001)	**.0009***(.0005)	**.001****(.001)	.001 (.001)	.0001 (.0005)	.001 (.001)
Operation (Plant)	-.049 (.051)	-.039 (.048)	-.023 (.050)	-.060 (.051)	-.051 (.051)	-.031 (.053)
Operation (Head Quarter)	-	-	-	-	-	-
Ownership (National)	.043 (.073)	-.001 (.067)	.052 (.073)	.078 (.074)	.002 (.069)	.087 (.076)
Ownership (Multinational)	.035 (.091)	-.045 (.085)	.027 (.091)	.093 (.092)	-.035 (.089)	.081 (.094)
Ownership (Join Venture)	-	-	-	-	-	-
EDU (Under High School)	-.002 (.002)	-.002 (.002)	-.002 (.002)	-.001 (.002)	-.001 (.002)	-.002 (.002)
EDU (High	-.002	-.002 (.002)	-.003 (.002)	-.001 (.002)	-.001 (.002)	-.003 (.002)

School)	(.002)					
EDU (Diploma)	-.002 (.003)	-.002 (.003)	-.003 (.003)	-.004 (.003)	-.002 (.003)	-.001 (.003)
EDU (Undergrad)	-	-	-	-	-	-
Low-Tech	-.099 (.141)	-.170 (.124)	-.121 (.138)	.181 (.170)	-.042 (.135)	-.027 (.148)
Med-Low Tech	-.115 (.144)	-.194 (.127)	-.127 (.141)	.097 (.173)	-.086 (.138)	-.097 (.151)
Med-High Tech	-.044 (.148)	-.111 (.130)	-.062 (.144)	.187 (.175)	-.101 (.142)	.035 (.154)
High-Tech	-	-	-	-	-	-
Observation	1179	1179	1179	1179	1179	1179
Log likelihood	-756.53	-674.75	-744.35	-725.18	-708.92	-787.70

$^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$, all coefficients are presented in marginal, standard errors are in the parentheses

[1]Product innovation that new to the market; [2]Product innovation that new to the firms

Turning to control variables, a majority of the variables have no significant effect on all types of innovation. Positive and significant effect can only be found in the influence of exporters on PRODINN, PRODINN_NEW2MARKET, and PRODINN_NEW2FIRMS. However the impact level was found very weak. The rest of the control variables, such as firms' size, age, labour quality (employee education levels), and technology intensity variables have negative association with types of innovation.

4.5 Tobit Regression

Table 7 displays output of the Tobit regression and it can be observed that barriers related to market and institution and employee and organisation have positive direction of influence on innovation success variable. Employee and organisation barriers strongly and significantly impact both innovation success that new to the market and firms. In contrary, financial and risk as well as knowledge and cooperation barriers negatively associate to innovation success. Both groups of barriers negatively and significantly influence innovation success that new to the market. Based on the study findings, therefore, hypothesis 3 is supported.

Table 7 Tobit regressions outputs

INDEPENDENT VARIABLES	MODEL 1 INNSUCCESS_MARKET	MODEL 2 INNSUCCESS_FIRMS
Market & institution	.663 (.644)	.166 (1.016)
Employee & organisation	**2.868*****(.466)	**3.651*****(.728)
Financial & risk	**-1.243****(.518)	-.924 (.835)
Knowledge & cooperation	**-1.799*****(.614)	-.509 (.979)
Size	-.0003 (.001)	-.001 (.001)
Age	-.009 (.036)	.011 (.057)
Export	.026 (.017)	**.065****(.028)
Operation (PLANT)	-1.515 (1.662)	-2.712 (2.669)
Operation (Head Quarter)	-	-
Ownership (National)	-.309 (2.300)	1.261 (3.800)
Ownership (Multinational)	-1.724 (2.943)	1.195 (4.763)
Ownership (Join Venture)	-	-
EDU (Under High School)	-.080 (.054)	-.055 (.092)
EDU (High School)	-.082 (.058)	-.104 (.097)
EDU (Diploma)	-.053 (.105)	-.097 (.176)
EDU (Undergrad)	-	-
Low-Tech	-5.187 (4.295)	-2.861 (7.289)
Med-Low Tech	-5.969 (4.398)	-3.236 (7.439)
Med-High Tech	-3.688 (4.502)	.778 (7.613)

High-Tech	-	-
Observation	1179	1179
Log likelihood	-2139.37	-2715.71

$^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$, all coefficients are presented in marginal, standard errors are in the parentheses

In terms of control variables, only exporters that positively and significantly impact innovation success that new to the firms. The rest of the control variables such as firms' size, age, ownerships, employees' education levels and technology intensity have non-significant impact on innovation success variable and tend to have negative association with both innovation success that new to the market and new to the firms.

5. CONCLUSION AND IMPLICATIONS

This study aims to investigate the nature of innovation barriers faced by Indonesian manufacturing firms and its impact on the adopted types of innovation and innovation success by using innovation data from the Indonesia Innovation Survey 2011 that covers 2009-2010 periods. To date there is no existing studies that empirically investigate innovation barriers of Indonesian manufacturing firms by using data on the Indonesia Innovation Survey. This study is important to be conducted because it is crucial to understand what actually barriers that hamper innovation activities of Indonesian manufacturing firms as well as to promote any policy to overcome the barriers.

Innovative and non-innovative firms only perceive the innovation barriers related to knowledge differently. Non-innovators perceive lack of information on technology is more important than the innovators. While the innovators perceive barriers related to employee and organisation (i.e. staff and manager resistance toward change and organisational rigidity) are more important than non-innovators. The fact that innovators experience such barriers greater or more important than non-innovators cannot be assumed that the barriers automatically prevent the innovators from performing innovation activities and this so called revealed barriers. The awareness towards the barriers may be gained through learning and experience during the firms performing innovation activities (see D'Este *et al.*, 2012 for review). The more the innovative Indonesian manufacturing firms perform innovation activities, the greater their level of awareness and experiences toward barriers related to employee and organisation.

The direction of the barriers' impact on innovation success is in line to the barriers impact on types of innovation. The first two constraints have positive association to innovation success; conversely the last two barriers show negative direction. Market and institution constraints have no significant impact on both innovation successes. Employee and organisation barriers positively and significantly influence both innovation successes. Constraints related to financial and risk, and knowledge and cooperation significantly and negatively influence the innovation success that new to the markets. However both groups of barriers have no significant impact on the innovation success that new to the firms.

Based on the aforementioned findings, recommendation to overcome innovation barriers may be proposed. From the firms' perspective, innovative firms that face revealed barriers related to employee and organisation is the necessity to implement better management of innovation activity e.g. education, training and workshop in order to minimise the impacts of the obstacles. Financial development or appropriate fiscal policy to provide the required finance to innovation activity may relevant to overcome financial and risk barrier, for instance the easiness access to financial intermediaries (e.g. banks, venture capital, etc.). In this case, the involvement from government is crucial.

Lastly, the limitations of this study need to be acknowledged. *Firstly*, this study is a cross sectional research that portray a period of investigation i.e. 2011. Future studies may address this by using panel data of innovation survey, therefore the change and dynamics of innovation barriers can be detected. *Secondly*, the data derived from IIS 2011 only covers Indonesian manufacturing firms. Future studies may elaborate innovation barriers differences between manufacturing and service firms. *Thirdly*, innovation barriers against the firms' size are not investigated in this study, therefore insight on how small, medium and large firms in facing different types of innovation are not-exist. *Fourthly*, the impact of industry sectors on innovation barriers is absent in this study, therefore in the future how different industry sectors perceive innovation barriers can be studied.

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APPENDIX

Appendix 1 The main and control variables of the study

VARIABLES	DESCRIPTION
Dependent variables	
PRODINN	Product innovation (0/1)
PROCINN	Process innovation (0/1)
ORGINN	Organisational innovation (0/1)
MKTGINN	Marketing innovation (0/1)
INNSUCCESS_MKT	Proportion of innovative products' sales that new to the market (%)
INNSUCCESS_FIRMS	Proportion of innovative products' sales that new to the firms (%)
Independent variables (0=not important, 1=very low, 2=low, 3=medium, 4=very important)	
Financial & risk barrier	
INFUND	Lack of funds within your enterprise or group
EXFUND	Lack of finance from sources outside your enterprise
COST	Innovation cost too high
RISK	Excessive perceived risks
Knowledge barrier	
STAFF_RESIST	Staff resistance (being not open) towards change
MGR_RESIST	Manager resistance (being not open) towards change
ORG_RIGID	Organizational rigidities within the enterprise
PERSONNEL	Lack of qualified personnel
TECH_INFO	Lack of information on technology
MKT_INFO	Lack of information on markets
COOPERATION	Lack of ability to find cooperation partners for innovation
LABOUR	Inability to allocate labour in innovation activities because production has higher priority
Market barrier	
MKT_DOMINATION	Market dominated by foreign established enterprises
UNCER_DEMAND	Uncertain demand for innovative goods/services
CUSTOMER_ACC	Lack of customers' acceptance
Institutions barrier	
INFRASTRUCTURE	Lack of sufficient infrastructure to support innovation activities
IND_STANDARD	Lack of industry standard from government
GOVREG	Lack of regulation from government
Control variables	
SIZE	Firms' size
AGE	Firms' age
EXPORT	Proportion of exported product from total sales
OPERATION	Firms' operation: plant, headquarter
OWNERSHIP	Firms' ownership: national, multinationals, joint ventures
LABOUR QUALITY	Lower than high school, high school, diploma, under graduate
TECH. INTENSITY	Low-tech, Mid-low tech, Mid-high tech, High-tech