The role of innovation capacity and technology adoption towards product innovation performance measurement in micro small enterprises food industry

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Abstract. This study aims to measuring and revealing the role of innovation capacity and technology adoption towards product innovation performance in Micro Small Enterprises (MSEs) Food Industry. The research has applied analysis and clustering, regression and path analysis, by collecting data from a set of questionnaires to 76% of the total MSEs in food industry under the guidance of Research Unit for Natural Product Technology-Indonesia Institute of Sciences. The results demonstrated that innovation capacity variable has a significant effect which leads to a positive association with product innovation performance, as well as the existence of a significant indirect relationship through adoption technology as a mediator variable. Suggestions for conducting technology intervention in accordance with the results of regression test and clustering that are formed based on product characteristics and scale of business to improve food safety and product innovation performance are presented.

Keywords: product innovation performance, inovation capacity, adoption technology, food safety, clustering.

1. Introduction

A rapidly changing and highly competitive business environment after the opening of ASEAN Free Trade Area brought greater threat for the sustainability of Micro Small Enterprises (MSEs) in each country. They have to compete with the same products and their substitutes, and were forced to enter into a competition without consideration of their initial conditions in level playing field. Attacked from international food production, aside of being threat for MSEs in Food Industry (FI), will also decrease the interest to consume local foods due to various choices. The reduction level of local foods consumption has affected the declining in product demand and therefore it will reduce income and endanger the survival of related MSEs. MSEs in Food Industry have their own production characteristics such as, using local ingredients from local natural resources. Therefore it will preserve the local wisdom and support food safety in the region.

The problems faced by MSEs in Food Industry aside from competition, are the consumers’ demands towards products’ safety and quality. This demand becomes the drive for the enterprises to improve qualities and food security guarantee for consumption. In order to survive in the competition and to fulfil
consumer’s need, enterprises should develop and make innovation to their product due to meet the needs and expectations demanded. One of the significant factors in product innovation is innovation capacity of the organization [1]. Akman [2], explains the capacity of innovation as an important factor that facilitates innovative organizational culture, characteristics of the promotion of internal activities, and understanding capabilities and appropriate responses to the external environment. The capacity of innovation could also be described as the ability to continually develop innovation in response to environmental changes [3]. So that it could be interpreted, the Capacity of innovation is a major concern to ensure its sustainable development.

The use of technology as a solution in food processing activities has been expected to increase the products’ safety and quality. Considering the business scale, it is certainly not easy for small enterprises to provide technology, because investment is costly. The division of Research Unit for Natural Product Technology (RUNPT) from Indonesia Institute of Sciences (IIS) that is located in Yogyakarta is a non-ministerial government office for science and research in Indonesia which has a track record of intervention programs of using technology to help MSEs in Food Industry. The MSEs in Food Industry could undertake technology adoption activity from RUNPT IIS to develop their product, or add some features. Technology adoption conducted by MSEs in Food Industry is assumed to trigger the product innovation.

There are many studies investigate the impact of innovation capacities that affect the development of new products. However, a large proportion of those studies focus on radically new products, products that offer new benefits or attributes previously unknown to the market, fewer studies focus on incrementally new products [4]. This study focus on innovation that are developed based on existing products or add some features to existing products in MSEs Food Industry, and investigates the role of innovation capacity towards product innovation performance, both directly and through technology adoption as a mediator variable.

2. Theoretical background

2.1. Product innovations performance

Product innovations performance is the result of company effectiveness and efficiency in developing and introducing new products in the market, and can be measured by market share and profit orientation [5]. Product Innovation can be defined as product development that have a series of different performance features and attributes that create a different set of benefits from the product that exists from the customer's perspective [4]. Product Innovation becoming one of the most helpful factors to overcome competition pressure [6]. This also apply to all of the SMEs, because innovation have important role in competitive advantage [7]. Cao & Lumineau [8] stated that developing and introducing innovative products that meet the consumer need is a great fundamental to achieve competitive advantage. Therefore in the calculation, we need to focus on market acceptance towards the innovated product. Product innovations performance can be evaluated from 3 items: constant or improved market share towards available products; get the market share for new demanded products; and expand customers variety [1].

2.2. Micro small enterprises (MSEs) food industry

MSEs food industry in Indonesia have a role as one of a driver for the local economy. According to data that has been accessed from Central Statistic Agency [9] on May 2019, the production index of micro and small industries in Indonesia continues to increase from 2011 to 2019. In general, the food industry production index exceeds the industrial production index (overall) from 2013 to 2019. The food industry production index in 2019, for the first quarter is 188.59 and the beverage industry is 169.85, production base 2010 = 100 [9]. The definition of MSE in this research is based on the Indonesia regulation, number 20 year 2008 about criteria of micro, small and medium enterprises in Indonesia [10]. According to the regulation a business can be categorized as micro enterprise if they have maximum net worth Rp 50,000,000.00 (fifty million rupiah) excluding assets; or receive the maximum of Rp 300,000,000. 00
2.3. Innovation capacity

Innovation capacity is defined as developing concepts of new products for commercialization that can be brought to the market [13], also to promote, developed, and escalate the product, technique, and system management [14]. Innovation capacity consists of product innovation, process innovation, service innovation, and organization innovation [14–15]. Innovation capacity that have significant impact towards Product Innovation Performance and have been tested in previous study by Dorodian et al [1] on SMEs are: (i) Knowledge and Technology Management Capability (KTMC); (ii) Idea Management Capability (IMC); (iii) Project Development Capability (PDC); (iv) Commercialization Capability (CC). These dimensions are in-line with The Organisation for Economic Co-operation and Development (OECD) recommendation in 2005 for developing countries whereas innovation measurement on SME needs to be focused on innovation process and also based with capacities development and results.

2.4. Technology adoption

Technology adoption have the objective to improve the efficiency and effectiveness of production process, also to stimulate product innovation. According to Godoe and Johansen [16], there are 2 important factors that could affect the result of adoption technology, technology acceptance and technology readiness. Technology acceptance is how the technology affecting individual perspetion when using the related technology. There are two dimension in technology acceptance: perceived usefulness, is how much a person believe that by using certain system will increase the work and performance; perceived ease of use, is how much a person believe by using certain system will make work easier or effortless. Technology readiness is explaining on how individual personality can affect the technology acceptance potential.

2.5. Technology transfer intervention

Cummings and Worley [17] stated that intervention is a series of sequentially planned activities to help an organization strengthen its effectiveness. For small-scale enterprises with limited resources will have significant issue to enhance product innovation, so they need intervention from external parties. One of the government interventions that need to be done to enhance product innovation performance is technology transfer, because technology is an important tool to get and maintaining competitive advantage [18].

One of the important indicators to be observed in food industry is the food safety. According to Indonesia regulation number 7 year 1996 about food safety [19], whereas the provided foods must be of quality, have proper nutrition, safe for consumption, evenly distributed and affordable by each individual. Strengthened by Law No. 18 year 2012 concerning food chapter II article 4 point b, food safety and food quality are the main aspects of food prerequisites in Indonesia [20]. According with international food standard as quoted by Vesna et al [21], the determinants of food safety starts from the pre-process handling, production process, product storage, and product distribution. Therefore, it is necessary that the technology transfer intervention for MSE in food industry have to improve the product innovation.
and quality that refers towards food safety. Rogers [22], mentioned there are 4 factors of technology transfer: (1) Technology transfer with orientation towards market and producer, (2) Emphasis on organization, activities of technology transfer are usually carried out as part of the organizational structure, (3) technology transfer is done through planning and development, (4) technology transfer is a way to commercialize the results of technology and the diffusion of innovation.

3. Hypothesis and research model

3.1. Innovation capacity and product innovation performance
Innovation capacity have multidimensional construction, due to perspective variance of innovation management [23]. Dimensions of innovation capacity that have significant impact towards product innovation performance and have been developed and that have been examined and specifically aims for SMEs are: (1) Knowledge and Technology Management Capability (KTMC); (2) Idea Management Capability (IMC); (3) Project Development Capability (PDC); (4) Commercialization Capability (CC) [1]. Thus, the factors above will be developed as foundation for questionnaire items that later on will be distributed to MSE FI under the guidance of RUNPT IIS as respondents for this research.

3.1.1. Knowledge and technology management capability towards product innovation performance.
Knowledge Management Capability can be separated into two categories, knowledge Infrastructure capability and knowledge process capability. Inside the knowledge infrastructure capability occurred technology element, which will make it possible for knowledge integration within organisation towards innovation, transfer, and storage of knowledge resources for the company. Technology consists of important element for the creation of knowledge and critical empowerment tool of knowledge management program [24]. It is suspected that technology variable have contribution towards performance. Hence, when technology is connected with the other resources such as knowledge and process acquisition, it will improve organization performance [25]. One of the competitive performance of organization is product innovation performance [1]. Therefore, the hypothesis that can be developed is:

H1.1: Knowledge and technology management capability have significant impact towards product innovation performance.

3.1.2. Idea Management Capability (IMC) towards product innovation performance.
Management is the coordination from all of the resources throughout planning, leadership, and control process to achieve the objective, thus management capability is selected as one of the must have aspect for organization [26]. On the other hand, idea management implicate the licensed ideas of one organization, empower the organization members to work collaboratively and determine better solution for organization, managing and communicating idea development thoroughly started from conceptualized the ideas until the implementation [27]. Idea management is very important for constant innovation within the organization, since it will create impacts for the organization performance [28]. Idea management capability is one of the dimension inside innovation capacity construction and have connection with the product performance [1]. Thus, the hypothesis that can be developed is as the following:

H2.1: Idea management capability has significant impact towards product innovation performance.

3.1.3. Project Development Capability (PDC) towards Product Innovation Performance.
Project development is one of the triggers to perform product innovation. Moreover, project development is very critical for performance important variable in research and studies [29]. Hence, the hypothesis that can be developed is as the following:

H3.1: Project development capability has significant impact towards product innovation performance.
3.1.4. Commercialization capability towards product innovation performance. Herdman [30], stated that commercialization is driven by company expectation to get competitive advantage in the market towards their product, process, or other significant services. According to Hassan [31], commercialization capacity is very important towards competitive business continuation. Hence, commercialization capacity become one of the most important aspect in measuring the competitive performance whereas product innovation performance is included. In managing the commercialization process, protection towards intelectual property is considered to be a significant tool for SME in promoting their innovation continuity and strengthening the company’s competitive advantage. Structural or systematic approach for commercialization management, even in small company, can affect on how entrepreneurs see the benefits of commercialization towards innovation [1]. Therefore, we can develop the hypothesis as the following:

H4.1: Commercialization capability has significant impact towards product innovation performance.

3.2. The direct and indirect influence between innovation capacity towards product innovation performance and adoption technology as mediator variable

Issue for SME in developing their products is relating with their organization capacity [32–38]. Tidd and Bessant [39], define successful MSE are those who able to innovate through technology adoption with the objective to give them market competitive advantage. In other words, they claimed that MSE who innovate shows business growth and continuous performance compared with MSE who do not use technology. Furthermore, technology have been acknowledge as one of the tool to practice innovation in a business [40]. A study from Sitharam and Hoque [41] stated that MSE performance is influenced with resource allocation and government intervention. Government intervention is mediated through technology transfer activity to MSE Food Industry. From the perspective of MSE, Adoption of technology is a mediator variable. Mediator variable or often called as intervention variable, is a variable that mediated the relation between dependent and independent variable [42]. Therefore, we can develop the hypothesis as the following:

H5.1a: Innovation capacity has significant impact towards technology adoption

H5.1b: Innovation capability and technology adoption have significant impact towards product innovation performance

The developed research model in is shown in figure 1.

![Figure 1. Research model.](image-url)
4. Methodology

Data is collected from field survey that preceded by literature review and questionnaire making. Methods that are used in this research are analysis and clustering, regression and path analysis. Analysis and clustering would be develop on questions related to demographic, scale of business and product cararacteristic.

Regression tool will statistically prove the link between independent and dependent variable. Independent variables that are developed according with this research model are innovation capacity. Innovation Capacity will be specifically explained from four dimention. Based on these four dimention are developed as principal framework for the questionaire that will be distributed to respondents. KTMC is developed into 5 factors with 8 items in the questioner, IMC is developed into 4 factors with 5 items, PDC is developed into 5 factors with 5 items, and CC is developed into 5 factors with 6 items.

To do the measurement for direct-indirect relation beetween innovation capacity towards product innovation performance will be used path analysis. Path analysis as a methodology holds strength because it allows researchers to study direct and indirect effect simultaneously with multiple independent and dependent variables [42]. As the dependent variable is Product Innovation Performance. Product innovation performance were evaluated from 3 factors, adopted from research of Dorodian et al [1]. There are constant or increasing market share for available products, to get new market share for developing products, and expanding customers variance, developed into 3 items. All items are measured with likert scale, five point interval scale starting from one to five. Technology adoption, will play the role as mediator variable. The question is modified from two factors proposed in the adopted from the research of Godoe and Johansen [15], which are technology acceptance and technological readiness, developed into 11 items.

5. Result and discussions

5.1. Situational analysis and clustering

5.1.1. Responden characteristic. This study use 37 respondents that are being surveyed and we get the respondent demographic data as shown in table 1.

| Description          | Quantity | Total percentage |
|----------------------|----------|------------------|
| Level of Education   |          |                  |
| Elementary School    | 3        | 8                |
| High School          | 16       | 43               |
| Diploma-Master Degree| 18       | 49               |
| Position             |          |                  |
| Owner                | 3        | 8                |
| Manager              |          |                  |

Survey is conducted with 37 respondents that represent 34 MSEs under the guidance of IIS. MSE in FI under the guidance of IIS recorded in 2019 have the total of 45 MSE, so the sample population in this study is 76% from the total of MSEs under the guidance of RUNPT IIS. Education level for the respondents are separated into 3 categories. Elementary school graduates is 8%, High School graduates is 43%, and diploma to master degree is 49%.

For the enterprise demographic data, the number of employee are separated into two categories, for MSE that have employee under 4 people is 29%, and MSE that have employee from 5–30 is 71%. MSE that have turnover less than Rp 300.000.000.00 is 29% and MSE that have turnover more than Rp 300.000.000.00 – Rp 2.500.000.000.00 is 71%, as shown in table 2.
### Table 2. Enterprise characteristic.

| Description                  | Quantity | Total percentage |
|------------------------------|----------|------------------|
| Number of employee           | 10       | 29               |
| 1–4                          | 24       | 71               |
| 5–30                         |          |                  |
| Turnover per year (Rupiah)   | 10       | 29               |
| < 300,000,000                | 24       | 71               |
| 300,000,000 – 2,500,000,000  |          |                  |

5.1.2. Product profile analysis. Type of food that is being produced by respondents is mostly local/traditional foods. Food production from MSEs food industry that is being respondents are as the following: gudeg, empis-empis, garlic peanuts, cashew, empal gentong, brongkos, sampel pecel, tempe, brongkos jamur, chocolate powder, various flavored chocolate bars, jenang, bread, goats milk and processed tubers. These products therefore are being categorized into two types, which are wet food products and dry food products. The category is based on physical appearance of the product and water content analysis of the product. For final product that have water content more than 4% is categorized as wet food products, while the product that have water content less than 4% is categorized as dry food product, as shown in table 3.

### Table 3. Product category.

| Product Type | Number of Enterprise | Percentage |
|--------------|----------------------|------------|
| Wet          | 21                   | 62%        |
| Dry          | 13                   | 38%        |

5.1.3. Clustering. From the categorization on demographic analysis product and profile analysis, it resulting on categorization based with type of enterprise scale and type of wet or dry food production which represent on the table 4 below.

### Table 4. Type of product and scale.

| Enterprise Scale          | Wet Food Production | Dry Food Production |
|---------------------------|---------------------|---------------------|
| Micro (Domestic Food Industry) | 4                   | 7                   |
| Small                     | 17                  | 6                   |

5.2. Regression analysis

5.2.1. Correlation, reliability, and validity test result. The first step to do is reliability test in order to know the extent to which an instrument used can be trusted or can be relied upon to measure desired behaviour. The reliability test is done by determine value of Cronbach’s Alpha from the measurement tool. According to Sekaran [44] if the value of Cronbach’s alpha is less than 0.6 indicate bad result, 0.7 indicate acceptable value, and number above 0.8 indicates good result. Reliability test is used for each of dimension in this research. Reliability test of the questionnaire is stated by the Cronbach’s alpha. The result shows that the questionnaire is compatible and has consistency to be measurement tool. The questionnaire has the Cronbach’s alpha result above 0.8 in total of 38 questions. According to Cortina [45], the result of Cronbach’s alpha above 0.7 can be categorized as a good measurement tool. This represent that the whole questionnaire is valid and reliable to measure the variables in accordance with
the research model used for the objective in this research. After the validity and reliability test, hence passed for extract:

Table 5. Correlation, reliability, and validity test result.

| Dimension | Items | Cronbach’s Alpha Result |
|-----------|-------|-------------------------|
| KTMC      | 8     | 0.918                   |
| IMC       | 5     | 0.880                   |
| PDC       | 5     | 0.886                   |
| CC        | 6     | 0.899                   |
| TA        | 11    | 0.969                   |
| PIP       | 3     | 0.946                   |

5.2.2. Regression test of KTMC towards PIP. Hypothesis for regression analysis test is as the following:

H₁₀ = There is no significant impact from KTMC towards PIP
H₁₁ = There is significant impact from KTMC towards PIP

To know the value of regression coefficient we have to use coefficient output as represent on table 6.

Table 6. Regression test of KTMC towards PIP.

| Variables*) | Unstandardized coefficients | Standardized coefficients | t   | sig. | Model Summary |
|-------------|-----------------------------|---------------------------|-----|------|---------------|
|             | B                           | Std error                 | beta|      | R²            |
| Constanta   | 1.126                       | 2.097                     | 0.537| 0.595|               |
| KTMC        | 0.343                       | 0.018                     | 0.700| 5.792| 0.000         | 0.489          |

Dependent variable PIP
a = Constant number from unstandardized coefficients. The value is 1.126. This number representconstant value that mean if there is no KTMC then the consistent value of PIP is 1.126.
b = Regression coefficient value. The value is 0.343. This number mean if there is additional 1% of KTMC, there will 0.343 rise in PIP.

In general the equation for simple linear regression is Y = a + bX.

Hence the regression equation would be as the following: PIP = 1.126 + 0.343 KTMC

To make sure if the regression coefficient significant or not by the objective if the KTMC variable have significant impact towards variable we can test the hypothesis by comparing significant value with probability of 0.05 or by using other way that is comparing calculated t using t table. Hypothesis testing by comparing significant value is as the following: If the significant value is lesser than probability 0.05 it means there is impact from KTMC towards PIP, and if the significant value is bigger than probability 0.05 it means there is no significant impact from KTMC towards PIP.

The coefficient output above, the significant value is 0.000 and lesser than probability 0.05 so we can conclude that H₁₀ is rejected and H₁₁ is accepted, thus ‘there is significant impact from KTMC towards PIP’. In order to see how big of the impact is KTMC towards PIP in simple regression analysis, we use R square or R² in the output of SPSS model summary. Here it shows that the value of R² is 0.489. This number means that the impact from KTMC towards PIP is 48.9%, while the rest with the number of 51.1% is affected by other variables that is not being calculated or examined.

5.2.3. Regression test of IMC to PIP. Given Hypothesis that:

H₂₀ = There is no significant impact from IMC towards PIP
H₂₁ = There is significant impact from IMC towards PIP

The output from the SPSS shows on table 7.
Table 7. Regression test of IMC towards PIP.

| Variables* | Unstandardized coefficients | Standardized coefficients | t    | sig. | R Square |
|------------|-----------------------------|---------------------------|------|------|----------|
|            | B          | Std error | beta |      |          |
| Constanta  | 6.243      | 1.971     | 3.168| 0.003| 0.266    |
| IMC        | 0.320      | 0.090     | 0.516| 3.564| 0.001    |

Dependent variable PIP

a = Constant number for unstandardized coefficients. Here the value is 6.243. This number is the constant value that means if there is no IMC then the consistent PIP value is 6.243.
b = Regression coefficient number. The value is 0.320. This number indicate that every 1% rise in IMC, the PIP will increase by 0.320.

From the coefficient output we know there is significant value of 0.001 lesser than probability 0.05. We can conclude that H₃.₀ is rejected and H₃.₁ is accepted, which means ‘there is significant impact from IMC towards PIP’.

The equation is: PIP = 6.243 + 0.320 IMC

The output result of R² is in the number of 0.266. This number indicate that the impact of IMC variable towards PIP is 26.6% while the rest 73.4% is affected from other variables that is not being calculated or examined.

5.2.4. Regression test of PDC towards PIP. Given Hypothesis that:

H₃.₀ = There is no significant impact of PDC towards PIP
H₃.₁ = There is a significant impact of PDC towards PIP

The output from the SPSS shows as below:

Table 8. Regression test of PDC towards PIP.

| Variables* | B     | Std error | beta | t    | sig. | R Square |
|------------|-------|-----------|------|------|------|----------|
| Constanta  | 4.195 | 1.609     | 2.608| 0.013|      |          |
| PDC        | 0.426 | 0.075     | 0.691| 5.663| 0.000| 0.478    |

a = Constant number from unstandardized coefficient, the number is 4.195. This is a constant number which means if there is no PDC than the consistent number of PIP is 4.195.
b = Regression coefficient number is 0.426. This number indicate every additional 1% rise of PDC, the PIP will increase as much as 0.426.

From the output coefficient above we can see that the significant value is 0.000 lesser than probability 0.05 so we can conclude that H₃.₀ is rejected and H₃.₁ is accepted which means ‘There is significant impact of PDC towards PIP’. Output result, the value of R² is 0.478. This number indicate that PDC have impact of 47.8% while the rest 52.2% is affected by other variables that are not examined or calculated. The equation is as the following: PIP = 4.195 + 0.426 IMC.

5.2.5. Regression test of CC towards PIP. Given Hypothesis that:

H₄.₀ = There is no significant impact of CC towards PIP
H₄.₁ = There is a significant impact of CC towards PIP

The output from the SPSS shows as below:
Table 9. Regression test of CC towards PIP.

| Variables* | Unstandardized coefficients | Standardized coefficients | t    | sig. | Model Summary |
|------------|-----------------------------|---------------------------|------|------|---------------|
|            | B                           | Std error                 | beta |      | R Square      |
| Constanta  | 4.062                       | 1.549                     | 2.623| 0.013|               |
| CC         | 0.356                       | 0.060                     | 0.710|      |               |

a = Constant number of unstandardized coefficients. The value is 4.062. This is a constant number that means if there is no CC, the consistent value of PIP is 4.062.

b = Regression coefficient number is 0.356, this number indicate every additional 1% rise of CC, the PIP will increase as much as 0.356.

From the output above we get the significant value as much as 0.000 smaller than the probability 0.05. From here we can conclude that H₄.₀ is rejected and H₄.₁ is accepted, which means, ‘There is a significant impact of CC towards PIP’. The output result, R square is 0.505. This indicates that the impact of CC towards PIP is as much as 50.5%, where the rest 49.5% is affected by other variables that are not being examined or calculated. The equation, PIP = 4.062 + 0.356 CC

5.3. Path analysis
To do the measurement for direct-indirect relation between innovation Capacity towards product innovation performance will be used path analysis.

5.3.1. Path analysis of Innovation Capacity (IC) to TA (regression from IC to TA).

Table 10. Regression of IC towards TA.

| Variables* | Unstandardized coefficients | Standardized coefficients | t    | sig. | Model Summary |
|------------|-----------------------------|---------------------------|------|------|---------------|
|            | B                           | Std error                 | beta |      | R Square      |
| Constanta  | 17.848                      | 5.889                     | 3.031| 0.005|               |
| IC         | 0.305                       | 0.056                     | 0.675|      |               |

Dependent Variable: TA
H₅.₀ a: There is no significant impact of IC towards TA
H₅.₁ a: IC has significant impact towards TA
The output shows that significant value of IC variable is 0.000, smaller than 0.05 (0.000.0.05). From here we can conclude that H₅.₀ a is rejected and H₅.₁ a is accepted. This means that model I regression ‘IC have significant impact towards TA’. The value of R square in the model summary table is 0.456, which indicate the impact contribution from CI towards TA is 45.6%. Meanwhile the other 54.4% is the contribution from other variables. As for the value of e 1 can be calculated as the following: e 1 = √(1−0.456) = 0.738. The path shown on figure 2.
5.3.2. Path of IC and TT towards PIP (Regression of IC and TT towards PIP).

**Table 11. Regression of IC and TT towards PIP**

| Variables * | Unstandardized coefficients | Standardized coefficients | t    | sig. | Model Summary |
|-------------|------------------------------|---------------------------|------|------|---------------|
|             | B                            | Std error                 | beta |      | R Square      |
| Constanta   | -0.354                       | 5.889                     |      | 0.854|               |
| TA          | 0.130                        | 0.049                     | 0.392| 2.676| 0.011         |
| IC          | 0.069                        | 0.022                     | 0.456| 3.114| 0.004         |

Dependent Variable PIP

- H$_{5.0}$ b: There is no significant impact of IC and TA towards PIP
- H$_{5.1}$ b: IC and TA have significant impact towards PIP

The output shows the significant value of IC variable is 0.004, and TA is 0.011, which is smaller than 0.05. From this value we can conclude that model 2 regression: "IC and TA have significant impact towards PIP", therefore H$_{5.0}$ b is rejected and H$_{5.1}$ b is accepted. The value of R square in the model summary table is 0.603, which means the contribution impact from IC and TA towards PIP is 60.3%, while the other 39.7% is the contribution from other variables. As for the value of $e^2$ we can seek the $e^2$ in the following calculation $e^2 = \sqrt{1 - R^2} = 0.630$. The path model is shown on figure 3.

**Figure 2.** Path analysis of IC to TA.

**Figure 3.** Path analysis of IC and TA towards PIP.
According to figure 2 and figure 3, we can build the whole path of the model as the following:

![Figure 4. Full Path of IC and TA towards PIP.](image)

Impact analysis of IC through TA towards PIP, it is known that direct impact from IC towards PIP is 0.456. Meanwhile, the indirect impact of IC through TA towards PIP is $0.675 \times 0.392 = 0.265$. Based from the calculation above, the direct value is 0.456 and the indirect value is 0.265. It is shown that the value of direct impact is bigger than indirect impact.

5.3.3. Discussion. Independent testing each dimensions of innovation capacity show that commercialization capability have the biggest score impacting product innovation performance, which is 50.5%, the second highest is knowledge and technology management capability (48.9%), and the third one is project development capability (47.8%). Whilst idea management capacity have only 26.6% impact to product innovation performance. Cluster is made to simplify selection process of suitable transfer technology program. Based on this research, Food Industry MSE under the guidance of RUNPT IIS are grouped in claster according to business scale and product type, which are Micro and Small Entrepreneur with production of wet and dry foods. Based on the situational observations on programs activity are being conducted by RUNPT IIS for the Food Industry, could be suggested as bellow:

5.3.4. Transfer technology for wet foods products. The wet food product will be categorized into 5 types, according with the characteristics of wet food products, which are (1) wet food products with a combination of solid ingredients (i.e. gudeg), (2) food products with gravy from vegetable ingredient, (3) animal-based food products (i.e. meat and fish) with gravy, (4) Food products that are being cooked in the canning kitchen, (5) fermented food products (i.e. tempe). The technology transfer program is canning technology. To produce foods that are safe for consumption, this group is related with quality control handlers in the canning technology process. The quality control for canning technology can be separated into 5 categories of wet food products as the following (1). Analysis of the material’s visual appearance, organoleptic (odor/odorless), physical (slimy or not), and the composition of raw materials, (2). Physical appearance analysis (material form/material pieces), organoleptic (flavor), (3). Analysis of visual appearance of material (meat cuts), organoleptic (i.e. peculiar smell of sauce, taste does not feel sour/stale), (4). Analysis of the physical appearance of the material (damaged or not), the distinctive smell of bacem or curry or other types. Transfer technology programs from LIPI to the micro and small scale needs certain mechanisms and approaches. There are 2 (two) technology transfer schemes that can be used, namely in site technology and out site technology. In site technology is the process of utilizing technology using existing facilities, but with a slight change in scale, while out site technology is the use of technology by MSEs, where MSEs purchase equipment according to the desired scale (usually a 1000 can/day scale). In MSEs technology site will be given time to use the equipment through the makloon scheme, usually MSEs are...
directly fostered starting from product characterization, facilitation of distribution permits until they can market their products. The time given up to three years. In this scheme MSEs are not required to have their own production equipment, only after the formation period (3 years) is the MSEs expected to provide their own equipment for production. For out site technology, SMEs hold their own equipment according to the scale desired under the guidance of RUNPTT IIS. For this scheme MSEs have to spend considerable capital but the production process can be carried out on their own and adjust to field conditions. In accordance with the running capacity for MSEs, usually 1000 cans/day. MSEs FI canning process is different with the other canned food products because it produces local/traditional foods, when it is canned they have taste the same as if it is served directly. The result also has to have the same quality and safe to be consumed. Consumers demand towards products’ safety and quality become the principal to improve quality and food product safety guarantee.

Aside of food canning technology for SMEs scale, RUNPT-IIS also introduce retort pouch, flexible packaging in the form of pouch that can be used to pack fast foods or Meal Ready to Eat (MRE). Retort pouch is made from aluminium foil lamination and polymer, resistant to sterilization, and can be stored for years in room temperature. Sterilization process is an important stage in the food product packaging using retort pouch, because it is related with deactivation of harmful bacteria, ie. Bacillus stearothermophilus.

5.3.5. Transfer technology for the dry product. Technology transfer program that are being conducted by RUNPT IIS for MSEs Food Industry in this category is food processing technology. RUNPT IIS provides programs and facilities to help MSEs in the food industry in accordance with the needs of MSEs, among others:

a. Cocoa Processing; there are some technology adoption that is given starting from roasting, separation of cacao skin and nib, the making of chocolate candy with ballmill, pressing the chocolate paste, and alkalization.

b. Peanuts Processing; Technology adoption that is given includes the production improvement and processing with training. Good way to process food, standardization of product manufacturing processes so that product quality is more stable, providing production machinery such as coconut grater machines and bean grinders, spinners, so that efficiency and production run optimally.

c. Processed beverages into a solid form; Transferring technology to the application of fito-pharmaceutical technology, and product innovation into solid dosage forms. This is necessary because: (1) solid dosage forms are more stable in the storage (stability); (2) More reproducible quality (reproducibility); (3) practical but still accepted by consumers (acceptability). One of the selected solid dosage forms is the preparation of instant powder. Using this technology, MSEs can create new product and market development to achieve growth, increase sales, profitability and flexibility.

5.3.6. Good manufacturing practises. Factor that is also important to create high quality product is the production environment that support the good food production/good manufacturing practices. RUNPT IIS is socializing and give training on how to produce good food that will increase food safety for home industries that is already determined by NADFC (National Agency of Drug and Food Control of Republic of Indonesia). One of the requirement is small industrial buildings and facilities that can guarantee that food during the production process is not polluted by physical, biological and chemical hazards and is easy to clean and sanitize. The production room must be arranged in such a way as to facilitate the production process from the raw material to the finished product. However, the limited space owned by SME make it impossible for area separation between processes that allow cross contamination. The process of crossing and washing should be done in a separate room. In order to overcome the issue, the process is carried out in the same area and in significant distance with the semi-
finished products. The adjustment of production facilities is arranged according to the processing sequence to facilitate the production process.

6. Managerial implication
From the regression output it was demonstrated that innovation capacity and technology transfer in MSE under the guidance of RUNPT IIS significantly have positive impact towards product innovation performance.

The strategy that needs to be taken based on the measurement results in this study is that intervention with an improvement program in commercialization capability, knowledge and technology management capability, and project development capability will be effective to improve the performance of product innovation on MSE food industry, because these three dimensions occupy three major with significant influence. The improvement strategy in the weakest dimension (idea management Capability) also needs to be taken as a long-term strategy, since this dimension also shows significantly have positive impact towards product innovation performance.

Results of path analysis, it is shown that both the direct influence of IC and the indirect influence through the TA mediator variables, demonstrate significant and positive influence on PIP. The direct effect of IC towards PIP is 0.456, while the indirect effect of IC through TA towards KP is 0.265. The value of direct influence is greater than the value of indirect influence. This shows that the TA process is not yet running well, evaluation and strategies are needed to investigate.

7. Conclusion and recommendation
Study about the importance of innovation capacity and technology adoption role towards product innovation performance in MSE Food Industry under the guidance of RUNPT IIS is proven if it affected. From this research it shows that there is significant relation between innovation capacity and product innovation performance directly and indirectly through mediator variable of technology adoption. The contribution impact from innovation capacity and technology transfer towards product innovation performance is 60.3%.

This study is a part of bigger research and has limitation in respondent scale. Thus, it is suggested to have further research. We invite more researchers to study about product innovation performance measurement for SME scale, particularly in food industry. This will help to widened important issues for researchers and enterprises.

References
[1] Doroodian M, Ab Rahman M, Kamarulzaman Y and Muhamad N 2014 Designing and validating a model for measuring innovation capacity construct Adv. Decs. Sciences 1–11
[2] Akman G and Yilmaz C 2008 Innovative Capacity, innovation strategy, and market orientation: an empirical analysis in Turkish software industry International J. Inn. Man 12 69–111
[3] Olsson A, Wadeli C, Odenrick P and Bergendahl M 2010 An action learning method for increased innovation Capacity in organisations Act. Learng. Practice 7 167–79
[4] Hoonsopon D and Ruenrom G 2012 The impact of organizational capabilities on the development of radical and incremental product innovation and product innovation performance J. Man. Iss. 24 250–276
[5] Liu W and Gina K A 2018 Enhancing product innovation performance in a dysfunctional competitive environment: The roles of competitive strategies and market-based assets Ind. Mark. Man. 73 7–20
[6] Godener A and Soderquist K E 2004 Use and impact of performance measurement results in R&D and NPD: An exploratory study R&D Man. 34 191–219
[7] Subrahmanya M H B 2009 Nature and strategy of product innovations in SMEs: A case study based comparative perspective of Japan and India Inn. Man. Pol. Prac. 11 104–113
[8] Cao and Lumineau 2015 Revisiting the interplay between contractual and relational governance: A qualitative and meta analytic investigation J. Oper. Man. 33 15–42
[9] [BPS-Statistik] Badan Pusat Statistik 2019 https://www.bps.go.id/linkTableDinamis/view/id/1011

[10] Kemenperin Kementerian Perindustrian 2019 Peraturan menteri perindustrian 14 http://jdih.kemenperin.go.id/site/hasil_pencarian_detail

[11] [BPS-Statistik] Badan Pusat Statistik 2019 Metodologi https://www.bps.go.id/subject/35/usaha-mikro-kecil.html#subjekViewTab 2

[12] World Bank 2003 Small and medium enterprises across the globe http://documents.worldbank.org/curated/en/819161468766822276/pdf/multi 0 page.pdf

[13] Chamsuk W, Phimonsathien T and Fongsuwan W 2015 Research and development (R&D) capabilities and innovation Capacity that affect the enterprise competitive advantage in the Thai automotive parts industry: SEM approach Intl. J. Arts Sci. 8 441–57

[14] Calantone R J, Cavusgil S and Zhao Y 2002 Learning orientation, firm innovation Capacity, and firm performance Industr. Mark. Management 31 512–24

[15] Kafetzopoulos D and Psomas E 2015 The impact of innovation Capacity on the performance of manufacturing companies J. Manu. Tech. Man. 26 104–131

[16] Godoe P and Johansen T S 2012 Understanding adoption of new technologies: Technology readiness and technology acceptance as an integrated concept J. Eur. Psy. Stu. 3 38–52

[17] Cummings T G and Worley C G 2009 Organization development & change 9 th edition (Mason: South Western Cengage Learning)

[18] Ansoff I and McDonnell H 1990 Implanting Strategic management 2 nd edition (UK: Prentice Hall International)

[19] Indonesia regulation number 7 year 1996 about food safety

[20] Law 18 year 2012 concerning food chapter II article 4 point b

[21] Vesna P, Predrag V and Milivoje C 2017 Food safety and quality policy in the republic of serbia Econ. Agr. 4 1607–17

[22] Rogers E M 2002 The nature of technology transfer Sci. Com. 23 323–41

[23] Perdomo-Ortiz J, Gonzalez-Benito J and Galende J 2006 Total quality management as a forerunner of business innovation Capacity Technovation 26 1170–85

[24] Anderson K K 2009 Organizational capabilities as predictors of effective knowledge management: An empirical examination (Florida: Nova Southeastern University)

[25] Story W 2016 Impact of Supply Chain Technology Response Capacity of Firm Performance and Supply Chain Technology Performance (Memphis: University of Memphis)

[26] Jolly B, Isa F M, Othman S N and Ahmdon M A S 2016 The influence of management Capacity, marketing Capacity, and competitive advantage on Malaysian construction project performance Intl Rev. Managm. Marketing 6 142–48

[27] Bank J and Raza A 2014 Collaborative Idea Management: A driver of continuous innovation Tech. Inn. Review 11–16

[28] Sandstrom C and Bjork J 2010 Idea management systems for a changing innovation landscape Intl J. Prodt. Development 11 1504

[29] Al Otaibi S, Osmani M and Price A D F 2012 A framework for improving project performance of standard design models in Saudi Arabia J. Eng. Prof. Prod. Management 3 85–98

[30] Herdman R C 1995 Innovation and commercialisation of emerging technologies (USA: Printing office of technology assessment)

[31] Hassan B E H 2012 Firm size and technology commercialization in Canada’s biotechnology and manufacturing sectors with a focus on medium-sized firms (Ottawa: Telfer School of Management)

[32] Mills A and Smith T 2010 Knowledge management and organizational performance: A decomposed view J. Knowld. Managm. 15 156–71

[33] Joo H Y and Suh H 2017 The Effects of Government Support on Corporate Performance Hedging against International Environmental Regulation Sust. S 920171980
[34] Kusumawardhani D, Rahayu A Y and Maksum I R 2015 The role of government in MSMEs: The empowerment of MSMEs during the free trade era in Indonesia Aust. Acc. Bus. Fin. J. 9 23–42

[35] Julien P A, Joyal A and Deshaies L 1994 SMEs and international competition: Free trade or globalization J. Sma. Bus. Man. 52–63

[36] Organisation for Economic Co-operation and Development (OECD) 2008 Enhancing the role of SMEs in Global Value Chains https://www.oecd.org/publications/enhancing-the-role-of-smes-in-global-value-chains-9789264051034-en.htm

[37] Gunasekaran A, Rai B K and Griffin M 2011 Resilience and competitiveness of small and medium size enterprises: An empirical research Int. J. Prod. Res. 49 5489–509

[38] Irjayanti M and Aziz A M 2012 Barrier factors and potential solutions for Indonesian SMEs Procedia Econ. Fin. 44 3–12

[39] Tidd J and Bessant J 2010 Managing innovation: Integrating technological, market, and organizational change 4th edition (West Sussex: John Wiley and Sons)

[40] Tornatzky L G and Fleischer M 1990 The processes of technological innovation (Lexington: Lexington Books)

[41] Sitharam S and Hoque M 2016 Factors affecting the performance of small and medium enterprises in KwaZulu Natal, South Africa Prob. Persp. Man. 14 277–88

[42] Namazi M and Namazi N R 2015 Conceptual analysis of moderator and mediator variables in business research Procedia Econ. Fin. 36 540–554

[43] Stage F K, Carter H C and Nora A 2004 Path analysis: An introduction and analysis of a decade of research J. Edu. Res. 98 5–13

[44] Sekaran U 1992 Research methods for business 4th edition (Jakarta: Salemba empat)

[45] Cortina J M 1993 What is coefficient alpha? An examination of theory and applications J. appl. Psych. 78 98