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# Exploring manufacturing flexibility, company atriutes, and operational performance within Indonesian manufacturing SMEs

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**Abstract**
Research focusing on the implementation of manufacturing flexibility and its implication on the operational performance of manufacturing SMEs is limited. This study is aimed to find out the implementation of five different types of manufacturing flexibility and it's on four different aspects of operational performance. In particular, this study was intended to examine if the degree of manufacturing flexibility and operational performance differ across company size, age, age, market orientation, and sector. This study followed a survey method to collect data concerning the implementation of manufacturing flexibility and its implication on the operational performance of manufacturing SMEs. The sample involved in this study comprises 174 Indonesian manufacturing SMEs located in Cikarang Region, West Java Province of Indonesia. The results revealed that manufacturing flexibility and operational performance vary across company size, age, and market orientation, however, there were only two types of manufacturing flexibility scores that follow this pattern. Furthermore, the results demonstrated that company size significantly does not affect scores of manufacturing cost performance, indicating that company size had little impact on manufacturing cost performance. Lastly, it was found that scores of product quality performance significantly vary across ages and market orientation. A similar pattern takes place in scores of manufacturing lead time and delivery performance.

**Keywords:** manufacturing flexibility, operational performance, company atributes, Indonesian manufacturing SMEs

## 1. Introduction
Literature in general agree that the pressure of industrial competition will increase in the future. To face increasingly market competition and changes in the business environment, manufacturoing companies are required to develop new ways to win the competition. Defined as the ability of a company to respond effectively to changes occuring in the internal and external environment, many experts argue that building manufacturing flexibility is an effective approach to winning industrial competition (Alvarez-Gil, 1994; Olhager, 1993). Researchers such as Gupta and Somers (1999) and Sethi and Sethi (1990) suggest manufacturing companies to develop the ability to respond to various changes efficiently and effectively. This responsiveness is indicated, among others, by their ability to run their production system efficiently and effectively, to produce many different products, and to shorten their product development process. The consideration of developing manufacturing flexibility has become very important in the design and operation of manufacturing systems. Competition globalization clearly underlines the need for a higher manufacturing flexibility. In addition, shorter product life cycles, greater product diversity, and market fragmentation indicate that manufacturing flexibility need to be considered for the long-term sustainability of many companies (Alvarez-Gil, 1994).
Furthermore, the literature suggests that manufacturing flexibility would provide substantial performance achievements. For example, machine, product mix, and volume flexibilities affect the financial performance improvement (Gupta and Somers, 1999; Pagell and Krauses, 2004; Larso and Dollen, 2009). However, some experts have revealed that other variables such as business strategy, innovation capability, and environmental conditions play an important role in determining relationship involving manufacturing flexibility and the company performance (Camison and Villar-Lopez, 2010; Zhang *et al*., 2003). Such a condition indicates that both manufacturing flexibility and company performance are multidimensional and complicated constructs. Thus, evaluating the achievement of types of manufacturing flexibility and company performance will provide insight into the efforts companies need to perform in improving their performance. In other words, additional studies of these two constructs are needed to provide further insight into the mechanism of improving operational performance through the development of manufacturing flexibility (Vokurka and O'Leary-Kelly, 2000; Hallgren and Olhager, 2009).
In addition, the literature highlights that manufacturing flexibility is a multidimensional construct. Yet, it is not clear if all dimensions of manufacturing flexibility have the same role in improving the company performance. For example, product flexibility positively plays a role in improving product quality and net income, while volume flexibility positively plays a role in increasing sales growth (Zhang *et al*., 2003). Such conditions indicate that each type of manufacturing flexibility has different roles in improving the company performance. In other words, not all types of manufacturing flexibility are always beneficial in all manufacturing environments (Purwanto *et al*., 2015). Furthermore, the literature underlines the importance of examining the role of various company attributes in the relationship between manufacturing flexibility and the company performance. It is argued that various company attributes such as company size and operating age have an impact on relationship between manufacturing flexibility and company performance (Vokurka and O'Leary-Kelly, 2000; Purwanto *et al*., 2015). Besides, the study of manufacturing flexibility and company performance is mostly carried out on

large companies in developed countries. Given the differences in characteristics between SMEs and large companies (Liu *et al*., 2009), it is important to explore further how the application of manufacturing flexibility and its implications on the company performance in manufacturing SMEs.

## 2. Literature Review and Hypotheses

### 2.1 Manufacturing flexibility

The literature review shows that manufacturing flexibility has been defined in various different ways. For example, manufacturing flexibility can be referred to as the ability a company to respond to environmental changes in a short time and low cost ways; the ability of a manufacturing system to adapt to the environmental changes and process requirements effectively; or the ability of a production system to deal with instability originating from the environment (Sethi and Sethi, 1990: Vokurka and O'Leary-Kelly, 2000; Zhang *et al*., 2003). The definitions illustrate that manufacturing flexibility is the ability of the manufacturing function to react to environmental changes. It also refer to the ability of a company to manage production the existing resources efficiently to deal with changes in the company environment. Furthermore, literature in general suggest that building manufacturing flexibility is an effective approach to dealing with an uncertain corporate environment. In this case, manufacturing flexibility is cited as a competitive strategy for manufacturing companies, aside from product costs and quality, in order to increase the competitiveness. In particular, many experts state that the performance of a company depends on the ability of the company to adjust the type of flexibility they build with the type of environmental uncertainty faced by the company. Thus, the challenge faced by current operations managers of companies, in an effort to make this adjustment process, is to determine the dimensions of flexibility to be developed in order to improve their company performance (Slack, 2005; Cousens, *et al*., 2009; Rogers, *et al*., 2011).

Many researchers agree that manufacturing flexibility is a complex and multidimensional concept. D'Souza and Williams (2000) classified the dimensions of manufacturing flexibility into two: i.e. external and internal flexibilities. External flexibility includes volume flexibility and diversity flexibility while internal flexibility consists of process flexibility and material handling flexibility. External flexibility refers to the company capability in meeting the market and customer needs, while internal flexibility refers to operational activities of manufacturing functions. According to Zhang *et al*. (2003), external flexibility is usually easier to be recognized and feeled as it it has a direct impact on the competitiveness. Conversely, internal flexibility is better known as the company's requirements to operate efficiently. It has no directly relation to the market and environmental uncertainties.

Other researchers (Alvarez-Gil, 1994; Gupta and Somers, 1992) classified manufacturing flexibility can be classified into the following types: machine flexibility, material handling flexibility, process flexibility, product flexibility, routing flexibility, volume flexibility, expansion flexibility, programming flexibility, production flexibility, and market flexibility. In this case [1], machine flexibility relates to various operations that can be carried out by a machine without causing high costs or using an excessive amount of time in switching from one operation to another [2]; flexibility in material handling is defined as the ability of material handling systems to effectively move different types of goods through manufacturing facilities; [3] process flexibility is defined as the ability of a manufacturing system to produce a number of different types of goods without experiencing too long a set-up [4]: product flexibility is defined as the ease with which new components can be added or substituted for existing components, or the ease with which the current component mix can be changed at a relatively low cost in a short time [5]; routing flexibility refers to the ability of a manufacturing system to produce an item with an alternative route to the system [6]; volume flexibility is the ability of the manufacturing system to be operated profitably at different output levels, allowing factories to adjust production at different levels of production [7]; flexibility of expansion is the extent of the overall effort needed to increase the capacity and capability of manufacturing systems [8]; programming flexibility is the ability of the system to operate unattended for a long period of time [9]; production flexibility is the whole type of goods that can be produced by a manufacturing system without massive addition of equipment; and [10] market flexibility can be defined as the ease with which manufacturing systems can adapt to changes in the market environment (Alvarez-Gil, 1994).

### 2.2 Operational performance

Company performance is one of the main variables widely used by researchers in the area of management. It is based on the premise that the company performance is determinant for survival and business success in the midst of increasing business competition. A number of company operations and strategies are valued by their contribution to the company performance. Measuring company performance, therefore, is an important action to be taken. The results of this measurement allow the companies to evaluate and build on various specific actions that have been and will be carried out, in order to face the present competition and to determine the future competitive strategies (Richard *et al*., 2009).

Furthermore, the literature suggests that the measurement of operational performance is one of the dominant themes in many studies in the field of operations and strategy management. Referred to as the ability of a company to reduce management costs, order time, waiting time, increase the effectiveness of raw material use, and distribution capacity; operational performance is considered to have an important role for the company in increasing the effectiveness of production activities and in creating high-quality products. Many experts consider that the measurement of operational performance is needed when the company is dealing with the customer satisfaction fulfillment. In addition, operational performance also has an important role in improving business processes and activities directed at the organizational improvement and innovation. The increased operational performance in turn will lead to the financial performance in the future (Bayo-Moriones and de Cerio, 2002; Truong *et al*., 2017).

Manufacturing performance, which is part of operational performance, is a type of performance commonly used in the field of operations management. This type of performance is a type of corporate performance in achieving its basic objectives: productivity, quality and service. There are several studies that consider three dimensions of performance: namely cost or efficiency, quality and time. Efficiency refers to the use of all available resources to a

minimum to achieve maximum results. Efficiency enables companies to produce low-cost products because of a reduction in waste and allowing the plant to provide value to customers. Quality is generally defined as conformity with the specifications that have been set. Quality-based performance measures have focused on issues such as the number of defects produced and quality costs. Meanwhile, the first dimension of time-based performance is on-time delivery while the second dimension refers to the speed of the production process: i.e. the time span between the time of receipt of material and the time of product delivery to customers (Bayo-Moriones and de Cerio, 2002).

Then, the literature generally views that the basic purpose of operational performance is cost or efficiency, quality, and time. Efficiency refers to the use of all available resources to a minimum to achieve maximum results. Efficiency enables companies to produce low-cost products because of a reduction in waste and allowing the plant to provide value to customers. Quality is generally defined as conformity with the specifications have been set. Quality-based performance measures have focused on issues such as the number of defects produced and quality costs. Meanwhile, the first dimension of time-based performance is on-time delivery while the second dimension refers to the speed of the production process: i.e. the span between the time of material receipt and the time of product delivery to customers (Bayo-Moriones and de Cerio, 2002).

### 2.3 Company's attributes

Four attributes of company were being investigated in this study, i.e. company size, age, market orientation, and sector. Vokurka and O'Leary-Kelly (2000) argued that the larger companies commonly have more resources to invest in manufacturing flexibility, presuming that increasing size leads to a corresponding increase in manufacturing complexity. Such a condition would lead to the need for a proper selection the types and degrees of manufacturing flexibility of the company, which in turn, impact the degree of performance. Jimenez-Jimenez and Sanz-Valle (2011) proposed that the knowledge, skill, and experience would help the companies to develop their operations more efficiently and effectively. Meanwhile, geographically market orientation is very likely to correlate to the necessities of developing manufacturing flexibility. The premise is that, a wider geographic market scope will lead to an increasing number and size of competitors. Increasing competition and pressure in the marketplace forced manufacturing organizations to develop new strategies and methods for their manufacturing system. This in turn, would stimulate the need for manufacturing flexibility (Petroni and Bevilacqua, 2000). Furthermore, Slack (2005) found that manufacturing flexibility was perceived and implemented differently across industrial sectors. Abdel-Maksoud (2004) found that product quality performance seemed to vary across sectors. Figure 1 depicts the conceptual model of in this study. Refering to the figure, hypothesized that company attributes (size, age, market orientation, and sectors) would impact the types and degree of manufacturing flexibility and operational performance.

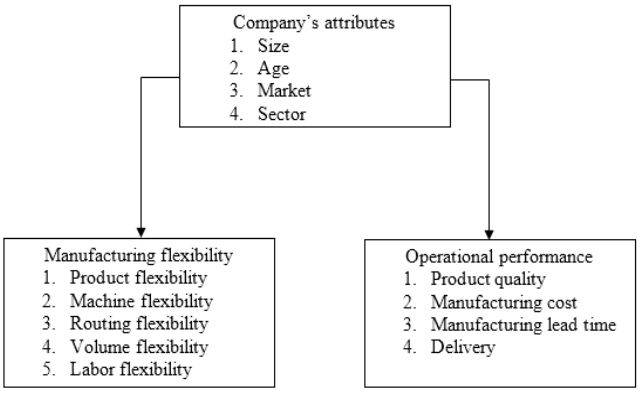


**Fig 1:** Conceptual model of this study

## 3. Research Methodology

### 3.1 Research design

This study applied a cross-sectional survey design to collect data concerning manufacturing flexibility, operational performance, and company atribut. In this case, the instrument used in the study is questionnaires distributed directly to the respondents. The instruments consist of three parts. Part A is intended to obtain data about the company profile, Part B contains the items related to the degree of manufacturing flexibility implementation, Part C contains the items related to company performance. All items are measured using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The sample involved in this study comprises 174 Indonesian manufacturing SMEs located in Cikarang Region, West Java Province of Indonesia.

### 3.2 Variables Measurement

**Manufacturing flexibility**

For the purpose of this study, five types of manufacturing flexibility were taken into account, i.e. machine flexibility, routing flexibility, labor flexibility, product flexibility, mix flexibility, and volume flexibility. The items for these five types of manufacturing flexibility were adopted from Zhang *et al*. (2003) and Das (2001). In this study, all of these items were measured using perceptual scales using a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

**Operational performance**

Referring to Abdel-Maksoud (2004) and Ahmad and Schroeder (2003), this study focused on four types of operational performance: product quality, manufacturing cost, manufacturing lead time, and delivery performance. This study applied perceptual measures to measure the operational performance. In this case, respondents were requested to provide the extent of their company performance relative to that of their principal competitor using a five-point Likert-type scale ranging from 1 (Much worse) to 5 (Much better).

**Company's attributes**

This study performed multivariate analysis of variance (MANOVA) to examine if the degree of manufacturing

flexibility and operational performance differ across company size, age, age, market orientation, and sector. Company size was measured on the basis of employees' number, company age was measured based on how long the company has been operating, market oriented refers to prime market segment geographically the company pursues, sector concern with industry wherein the companies operate.

## 4. Results and Discussions

This study then performed a one-way MANOVA analysis to examine whether there is any difference between companies across size, age, market orientation, and sector on their scores in both manufacturing flexibility and operational performance. Towards this end, three subsequent steps were conducted; multivariate tests, tests of between-subjects effects, and multiple comparisons. For the purpose of this study, four models of MANOVA were developed. MANOVA 1 is concerned with the relationship between company size and manufacturing flexibility and operational performance. MANOVA 2 was intended to tests the differences in manufacturing flexibility and operational performance across age. MANOVA 3 aims at examining the differences in manufacturing flexibility and operational performance across market orientation. MANOVA 4 assesses the differences in manufacturing flexibility and operational performance across the sector. Table 3 summarized the results of MANOVA.

### Company's size, manufacturing flexibility, and operational performance

MANOVA 1 is concern with the effects of company's size on manufacturing flexibility and operational performance. The results of multivariate test confirmed that scores in manufacturing flexibility and operational performance significantly varies across size. The results of test of between-subjects effects show that the difference in manufacturing flexibility significantly occurs on routing and volume flexibilities scores. Furthermore, the results of comparison between subjects demonstrate that the difference in routing flexibility take place between MCR and MDM companies and between MCR and LRG companies, while the difference in volume flexibility take place between MCR and MDM companies. Meanwhile, the difference in operational performance scores significantly takes place on the delivery performance scores. This difference arises between MCR and MDM companies and between MCR and LRG companies.

### Company's age, manufacturing flexibility, and operational performance

With respect to MANOVA 2, the results verified that scores of manufacturing flexibility and operational performance significantly differ across ages. It was found that the difference in manufacturing flexibility significantly exist in product flexibility scores. In this regard, this difference arises between NW and GR companies and between NW and MT companies. Meanwhile, the difference in operational performance emerged in quality improvement, manufacturing cost reduction, and delivery performance scores. In particular, the differences in quality improvement arise between NW and GR companies and between NW and MT companies. NW and GR companies, as well as NW and MT companies, also differ in term of manufacturing cost reduction and delivery performance.

### Market orientation, manufacturing flexibility, and operational performance

MANOVA 3 is concerned with the effects of company's market orientation on manufacturing flexibility and operational performance. In this perspective, it was found that market orientation has a significant effect manufacturing flexibility and operational performance as well. Further analysis demonstrated that the difference in routing and product flexibilities significantly exists. The results verified that the difference in routing flexibility scores particularly arises between LOM and IOM companies. LOM companies also differ with IOM companies in terms of product flexibility scores. Concerning the differences in operational performance, it was found that the differences arise in manufacturing cost, lead time, and delivery scores. The differences in manufacturing cost scores arise between LOM and NOM companies and between LOM and IOM companies. LOM companies also differ with IOM companies in terms of lead time. As for delivery scores, the differences arise between LOM and NOM companies as well as between LOM and IOM companies.

### Sector, manufacturing flexibility, and operational performance

In relation to MANOVA 4, the results presented show that industrial sector has no significant effect on manufacturing flexibility scores and operational performance score. The result confirmed that the scores in manufacturing flexibility and operational performance do not vary across the sector.

**Table 1:** The results of comparison between subjects

| Size | Comparison | Manufacturing flexibility | | | | | Operational performance | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Machine | Labor | Routing | Product | Volume | Quality | Cost | Lead time | Delivery |
| 1 | 2 | 0.757 | 0.370 | 0.174 | 0.153 | 0.748 | 0.857 | 0.209 | 0.806 | 0.704 |
| | 3 | 0.773 | 0.324 | 0.033** | 0.065* | 0.327 | 0.131 | 0.125 | 0.737 | 0.019** |
| | 4 | 0.994 | 0.346 | 0.025** | 0.215 | 1.000 | 0.648 | 0.132 | 0.644 | 0.016** |
| 2 | 1 | 0.757 | 0.370 | 0.174 | 0.153 | 0.748 | 0.857 | 0.209 | 0.806 | 0.704 |
| | 3 | 1.000 | 1.000 | 0.891 | 0.985 | 0.871 | 0.399 | 0.996 | 1.000 | 0.160 |
| | 4 | 0.516 | 1.000 | 0.778 | 0.999 | 0.705 | 0.969 | 0.988 | 0.986 | 0.128 |
| 3 | 1 | 0.773 | 0.324 | 0.033** | 0.065* | 0.327 | 0.131 | 0.125 | 0.737 | 0.019** |
| | 2 | 1.000 | 1.000 | 0.891 | 0.985 | 0.871 | 0.399 | 0.996 | 1.000 | 0.160 |
| | 4 | 0.524 | 1.000 | 0.991 | 0.969 | 0.253 | 0.733 | 0.999 | 0.995 | 0.993 |
| 4 | 1 | 0.994 | 0.346 | 0.025** | 0.215 | 1.000 | 0.648 | 0.132 | 0.644 | 0.016** |
| | 2 | 0.516 | 1.000 | 0.778 | 0.999 | 0.705 | 0.969 | 0.988 | 0.986 | 0.128 |
| | 3 | 0.524 | 1.000 | 0.991 | 0.969 | 0.253 | 0.733 | 0.999 | 0.995 | 0.993 |
| Wilks' lambda | | 0.765** | | | | | 0.825** | | | |

**Note:** Significance at, *p<0. 10 **p<0.05 ***p<0.01

**Table 1:** (Continued)

| Age | Comparison | Manufacturing flexibility | | | | | Operational performance | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Machine | Labor | Routing | Product | Volume | Quality | Cost | Lead time | Delivery |
| 1 | 2 | 0.933 | 0.581 | 0.237 | 0.023** | 0.205 | 0.002*** | 0.061* | 0.902 | 0.083* |
| | 3 | 0.844 | 0.854 | 0.138 | 0.004*** | 0.551 | 0.006*** | 0.077* | 0.475 | 0.062* |
| 2 | 1 | 0.933 | 0.581 | 0.237 | 0.023** | 0.205 | 0.002*** | 0.061* | 0.902 | 0.083* |
| | 3 | 0.537 | 0.198 | 0.804 | 0.518 | 0.856 | 0.976 | 0.961 | 0.589 | 0.864 |
| 3 | 1 | 0.844 | 0.854 | 0.138 | 0.004*** | 0.551 | 0.006*** | 0.077* | 0.475 | 0.062* |
| | 2 | 0.537 | 0.198 | 0.804 | 0.518 | 0.856 | 0.976 | 0.961 | 0.589 | 0.864 |
| Wilks' lambda | | 0.836** | | | | | 0.850** | | | |

Note: Significance at, *p<0.10 **p<0.05 ***p<0.01

**Table 1:** (Continued)

| Market | Comparison | Manufacturing flexibility | | | | | Operational performance | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Machine | Labor | Routing | Product | Volume | Quality | Cost | Lead time | Delivery |
| 1 | 2 | 0.058* | 0.967 | 0.377 | 0.539 | 0.829 | 0.158 | 0.004*** | 0.278 | 0.001*** |
| | 3 | 0.441 | 0.946 | 0.003*** | 0.011** | 0.484 | 0.123 | 0.006*** | 0.031** | 0.002*** |
| 2 | 1 | 0.058* | 0.967 | 0.377 | 0.539 | 0.829 | 0.158 | 0.004*** | 0.278 | 0.001*** |
| | 3 | 0.936 | 0.883 | 0.054* | 0.089* | 0.287 | 0.776 | 0.643 | 0.319 | 0.657 |
| 3 | 1 | 0.441 | 0.946 | 0.003*** | 0.011** | 0.484 | 0.123 | 0.006*** | 0.031** | 0.002*** |
| | 2 | 0.936 | 0.883 | 0.054* | 0.089* | 0.287 | 0.776 | 0.643 | 0.319 | 0.657 |
| Wilks' lambda: | | 0.832** | | | | | 0.767** | | | |

**Note:** Significance at, *p<0.10 **p<0.05 ***p<0.01

**Table 1:** (Continued)

| Sector | Comparison | Manufacturing flexibility | | | | | Operational performance | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Machine | Labor | Routing | Product | Volume | Quality | Cost | Lead time | Delivery |
| 1 | 2 | 0.968 | 0.058 | 0.966 | 0.967 | 0.247 | 0.875 | 0.997 | 0.063 | 0.967 |
| | 3 | 0.899 | 0.809 | 0.998 | 0.983 | 0.190 | 0.994 | 0.996 | 0.311 | 0.996 |
| | 4 | 0.833 | 0.967 | 0.970 | 0.968 | 0.228 | 0.784 | 0.708 | 0.793 | 0.997 |
| 2 | 1 | 0.968 | 0.058 | 0.966 | 0.967 | 0.247 | 0.875 | 0.997 | 0.063 | 0.967 |
| | 3 | 0.667 | 0.502 | 0.929 | 0.853 | 0.986 | 0.974 | 1.000 | 0.958 | 0.997 |
| | 4 | 0.967 | 0.298 | 1.000 | 1.000 | 0.990 | 0.991 | 0.793 | 0.597 | 0.997 |
| 3 | 1 | 0.899 | 0.809 | 0.998 | 0.983 | 0.190 | 0.994 | 0.996 | 0.311 | 0.996 |
| | 2 | 0.667 | 0.502 | 0.929 | 0.853 | 0.986 | 0.974 | 1.000 | 0.958 | 0.997 |
| | 4 | 0.485 | 0.982 | 0.939 | 0.872 | 1.000 | 0.917 | 0.855 | 0.899 | 1.000 |
| 4 | 1 | 0.833 | 0.967 | 0.970 | 0.968 | 0.228 | 0.784 | 0.708 | 0.793 | 0.997 |
| | 2 | 0.967 | 0.298 | 1.000 | 1.000 | 0.990 | 0.991 | 0.793 | 0.597 | 0.997 |
| | 3 | 0.485 | 0.982 | 0.939 | 0.872 | 1.000 | 0.917 | 0.855 | 0.899 | 1.000 |
| Wilks' lambda | | 0.803 | | | | | 0.893 | | | |

**Note:** Significance at, *p<0.10 **p<0.05 ***p<0.01

## 5. Conclusions

This study primarily aims to explore the degree of manufacturing flexibility and operational performance within Indonesian manufacturing SMEs. In particular, this study was intended to examine if the degree of manufacturing flexibility and operational performance differ across company size, age, age, market orientation, and sector. The result advance the current knowledge concerning types of manufacturing flexibility being implemented by the Indonesian manufacturing SMEs and its impact on various dimensions of operational performance. The results revealed that manufacturing flexibility and operational performance vary across company size, age, and market orientation. It seems that, in the context of Indonesian manufacturing SMEs, both manufacturing flexibility and operational performance scores tend to increase in accordance with the increase of size, age, geographical market orientation of the company. However, it is important to note here that there were only two types of manufacturing flexibility scores (i.e. mix and volume flexibility) that follow this pattern.

Furthermore, the results demonstrated that company size significantly does not affect scores of manufacturing cost performance, indicating that company size had little impact on manufacturing cost performance. It seemed that more employees' number did not necessarily help larger manufacturing SMEs achieve a greater manufacturing cost performance. In other words, it is very likely that manufacturing, despite their size, concern with manufacturing cost reduction efforts. In regards to product quality performance, it appeared that its scores do not vary between size, indicating that smaller manufacturing SMEs seemed to achieve product quality performance equally as larger manufacturing SMEs. Yet, scores of product quality performance significantly vary across ages and market orientation. In particular, mature manufacturing SMEs and national/international market-oriented manufacturing SMEs are very likely to achieve better quality performance than others. A similar pattern takes place in scores of manufacturing lead time and delivery performance. It seemed that mature manufacturing SMEs and national/international market-oriented manufacturing SMEs more concern with manufacturing lead time reduction efforts and put a greater emphasize on the delivery performance enhancement than new and local market-oriented manufacturing SMEs.

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