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The impact of lean manufacturing practices on operational and business performances at SMES in the wooden furniture industry

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Abstract

Purpose – First, this study aims to examine the level of implementation of lean manufacturing (LM) practices by the small- and medium-sized enterprises (SMEs) in the wooden furniture industry in Jepara. Second is to examine the impact of LM practices on operational performance (OP) and business performance (BP). Third is to examine the impact of LM practices on BP with OP as a mediating and moderating variable. OP is the quantifiable aspect of the process of an organisation, such as production cycle time, reliability and inventory turnover, whereas BP is usually related to the responsibility of the firms to their shareholders and has the goal of profit maximization.

Design/methodology/approach – This study used primary data collected through an offline questionnaire. The questionnaire was intended to identify the extent of the implementation of LM practices and the level of OP and BP achieved by SMEs. The LM practices consist of 6 dimensions with 26 indicators; OP, 4 dimensions with 11 indicators; and BP, 3 dimensions with 9 indicators. The data obtained from the questionnaire were processed via partial least squares (PLS) regression using the SmartPLS software. PLS is generally used to assess the extent to which LM practices predict values in OP and BP.

Findings – A total of 100 questionnaires were administered, of which 81% were properly filled, completed and returned. The result of the study confirms that LM practices should be applied collectively and comprehensively as each practice is interdependent. Moreover, it confirms that these practices have a direct effect on OP and BP and that OP can drive broader BP measures. Finally, the result confirms that these practices can improve BP indirectly with OP as a mediator variable. While the empirical evidence in this study supported the role of OP as a mediating variable between the implementation of LM practices and OB, it did not support the role of OP as a moderating variable.

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Research limitations/implications – First, it is arguable that LM practices, OP and BP are only measured by the Likert scale, which would likely create bias and inconsistency from the owners or managers of SMEs in expressing the level of LM practices and performances achieved by the SMEs in the wooden furniture industry. Future research may help establish qualitative approaches to better measure the LM practices as well as the OP and BP through observation and probing. Second, this study was limited geographically (limited to only the SMEs in the wooden furniture industry in Jepara and did not cover all regions in Central Java as well as in Indonesia). Therefore, a wider geographical area could be considered, including the other regions in Indonesia which also produce wooden furniture.

Practical implications – This study practically contributes to the LM body of knowledge by identifying the relationships among the LM practices, OP and BP in SMEs. Understanding these relationships will help the owner or managers of SMEs make better decisions in achieving the OP and BP. The owner or managers of SMEs who implement the LM practices individually may experience disappointing performance results as these practices should be applied collectively and comprehensively.

Social implications – The LM practices may help the owners or managers of the SMEs to be competitive and achieve the optimum result.

Originality/value – This is the first known study that adopts the PLS framework to examine how OP measurement affects the relationship between the LM practices and BP in the case of the SMEs in Indonesia.

Keywords Operational performance, Mediating role, Business performance, Lean manufacturing practices, Moderating role, SMEs of wooden furniture

Paper type Research paper

1. Introduction

Indonesia is among the biggest furniture producers in Asia along with China, India, Malaysia and Thailand, especially wooden furniture (Priyono, 2009). The Indonesian furniture industry is an export-oriented sector that significantly contributes to the country's manufacturing sector. Currently, the Indonesian furniture industry has almost 140,000 enterprises and more than 437,000 employees, with an investment value of approximately IDR 5.0tn. According to the Association of Indonesian Furniture and Handicraft Industry (ASMINDO), in 2017, the value of Indonesian furniture export was about US$1,627bn. This indicates a slight value increase of 1% of the Indonesian furniture export in 2016, which was US$1,607bn. Although the Indonesian furniture industry, especially the wooden furniture industry, has a significant contribution to the Indonesian manufacturing sector annually, the comparative advantage of Indonesian wooden furniture is still weak compared with those of China and Vietnam. China can massively produce furniture with good quality at low prices, whereas Vietnam is a beginner that is rapidly growing (Purnomo, 2013). Indonesia only has 1.34% of the total trade value, whereas China holds 28.58% (Ziraga and Wandebori, 2015).

The wooden furniture industry in Indonesia has encountered several obstacles, which prevented it from competing appropriately with those in other countries. First, the wood materials are no longer abundant and are becoming harder and more expensive to obtain. The total demand for the wooden industry sector is predicted to be more than 63.48 million m^3 of roundwood per year, whereas the total demand for the pulp and paper industry is predicted to be 22.52 million m^3. Due to the very limited source, the price of teak increased by approximately 25% in 6 months, from IDR 8 million/m^3 to IDR 10 million/m^3 at the end of 2003. According to the Association of Indonesian Furniture and Handicraft Industry (ASMINDO), over the past 5 years, the price of teak has increased by an average of 10%–20% per year (Priyono, 2009). Second, most of the enterprises in the wooden industry furniture are not able to carry out the production process efficiently (particularly in the use of raw materials). The inefficiency in the use of raw materials is reflected in the amount of wood materials being wasted. According to Purwanto (2011), the amount of waste produced by the furniture industry is approximately 40% of the total raw materials used. Therefore, given the above background and problem, the enterprises in the wooden furniture industry need to implement lean manufacturing (LM) practices to maximise resource utilisation (in this case, the source of wood materials) through waste minimisation. In more detail, this study focuses on the implementation of LM practices by small- and medium-sized enterprises (SMEs) in the wooden furniture industry in Jepara since this region is well known as a furniture-making region in Central Java. The wooden furniture industry in Jepara employs nearly 120,000 workers, processes 0.9 million m^3 of wood/year and accounts for 26% of the district's economy (Larasatie, 2018). The Jepara wooden furniture industry is considered to be a relatively small-scale and unmechanised industry; however, it is capable of producing specialised products for export furniture markets (Alexander and Alexander, 2000).

The concept of LM was first introduced by the Japanese car manufacturer Toyota Motor Corporation in the late 1950s and was named the Toyota Production System (TPS). Numerous studies have reported the significant benefits of LM practices in large enterprises (Shah and Ward, 2003, 2007; Belekoukias *et al.*, 2014; Bevilacqua *et al.*, 2017); however, only a few have reported the significant benefits of these practices in SMEs. In this case, most of the studies on LM practices in SMEs focussed on the level of implementation and the development of presentational and analytical frameworks (Kumar *et al.*, 2006; Upadhye *et al.*, 2010; Vinodh *et al.*, 2011; Panizzolo *et al.*, 2012; Arya and Jain, 2014; Arya and Choudhary, 2015; Gupta and Jain, 2013). The literature concerning the impact of LM practices on the operational performance (OP) and business performance (BP) in SMEs is limited. Thus, further investigation on the relationship among the LM practices, OP and BP in SMEs is strongly needed. In this study, a twofold attempt has been made to fill the gap by first assessing the extent of LM practice implementation by SMEs in the wooden furniture industry and, subsequently, analysing the impact of LM practices on the OP and BP of SMEs in the wooden furniture industry.

This research has several objectives. First, this study aims to examine the level of implementation of LM practices by the SMEs in the wooden furniture industry in Jepara. Second is to examine the impact of LM practices on OP and BP. Third is to examine the impact of LM practices on BP with OP as a mediating and moderating variable.

2. Literature review

2.1 Lean manufacturing practices

The LM concept can be traced back to Womack *et al.* (1990) when such a concept was perceived as a counter-intuitive alternative to the traditional Fordism manufacturing model. After the seminal work done by Womack *et al.* (1990), numerous transformations of LM practices have been discussed by several authors, such as Oliver *et al.* (1996), Delbridge (1998), Shah and Ward (2003), Delbridge *et al.* (2000), Bicheno (2004), Hines *et al.* (2004), Holweg (2007) and Bhasin (2008). Moreover, many books have also been published by different authors, such as Oliver *et al.* (1994), Womack and Jones (1996), Delbridge (1998, 2003), Pascal (2002), Liker (2004) and Mann (2005), to enhance the knowledge of lean. The LM concept can also be traced back to the TPS, which was pioneered by Japanese engineers Taiichi Ohno and Shigeo Shingo. The LM concept was created in Japan after the Second World War when Japanese manufacturers recognised that this concept can give the manufacturers a competitive edge by decreasing cost and increasing quality and productivity. During that time, Toyota could produce automobile products in large quantities and variations with less defects, human effort, inventory and investment (Bhamu and Singh Sangwan, 2014).

As the LM concept has been broadly discussed and enriched by many researchers, its definitions and scope have extended. According to Pettersen (2009), there is no consensus on the definition of LM among the authors. It can be defined as a way (Storch and Lim, 1999), a process and a set of principles (Womack *et al.*, 1990), a set of tools and techniques (Bicheno, 2004), an approach (Taj and Morosan, 2011), a philosophy (Liker, 1996; Cox and Blackstone, 1998; Singh, 1998; Comm and Mathaisel, 2000; Liker and Wu, 2000; Holweg, 2007; Shah and Ward, 2007; De Treville and Antonakis, 2006), a concept (Naylor *et al.*, 1999), a practice (Simpson and Power, 2005), a system (Womack and Jones, 1996; Cooper, 1996; Shah and Ward, 2007; Hopp and Spearman, 2004), a programme (Hallgren and Olhager, 2009), a manufacturing paradigm (Rothstein, 2004; Seth and Gupta, 2005) or a model (Alves *et al.*, 2012). The scope of LM includes product development (Krafcik, 1988), operations management (Narasimhan *et al.*, 2006), total supply chain (Womack *et al.*, 1990; Singh, 1998; Naylor *et al.*, 1999; Comm and Mathaisel, 2000; Cooney, 2002), human design element (Shah and Ward, 2003), manufacturing paradigm (Rothstein, 2004; Seth and Gupta, 2005) and market demand and environmental changes (Alves *et al.*, 2012). Moreover, overall consensus is still lacking, not only on the definition and scope of LM but also on the basic LM practices that can yield better performance (Ahmad *et al.*, 2004; Bhasin, 2011; Shah and Ward, 2007). Thus, there are no universal basic practices of LM.

Table 1 presents the top 10 LM practices proposed by previous authors, namely, just in time (JIT); statistical process control or total quality management; setup time reduction or quick changeover technique; pull or Kanban system; total productive maintenance or total preventive maintenance; group technology or flow-oriented layout or cellular manufacturing; communication and relationship with suppliers; statistical process control; employee involvement; human resource management, scheduling, production control and levelling; and lot size reduction. Out of these 10 practices, only 6 have been used in this research due to the condition of the object of this study: statistical process control or total quality management, pull or Kanban system, total productive maintenance, communication and relationship with suppliers, employee involvement and scheduling, production control and levelling. Although JIT is the most mentioned LM practice by the previous authors, this research preferred to use the pull system compared with the JIT practices. In this case, not all production processes carried out by SMEs in the wooden furniture industry follow the JIT process. For example, the SMEs in the wooden furniture industry cannot implement JIT for wood materials as these are no longer abundant and are becoming harder and more expensive to obtain. However, the SMEs in the wooden furniture industry can still collaborate strategically and mutually with their suppliers to ensure the quality of the raw materials, as well as the Eco-label for wood. The group technology or flow-oriented layout is not used in this study as most of the production processes of SMEs in the wooden furniture industry belong to a job–shop production system that arranges the machines with the same process and purposes in a workshop. In the group technology production system, the machines are arranged in such a way that the numbers of transits of the semi-manufactured products and the specialised experts of certain operations are minimised (Khaledan and Shirouyehzad, 2014). As most SMEs in the wooden furniture industry belong to the job–shop production system, this study also did not use the setup time reduction/quick changeover technique and lot size reduction. Finally, although there is no consensus with regard to the items belonging to each dimension of the LM practices, the LM practices used in this study are described as follows:

- Statistical process control or total quality management can be found in the studies by Wantuck (1993), Shah and Ward (2003), Olsen (2004), Dal Pont *et al.* (2008), Taj and Morosan (2011), Yang *et al.* (2011), Furlan *et al.* (2011), Ghosh (2012),

Dimension of Lean Manufacturing Practices	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Total
Just in time	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X			X	X	X		X		X		X	X		X	24
Statistical process control or total quality management		X			X			X				X				X	X	X	X		X		X	X	X	X		X	X	X	X	X	18
Setup time reduction/quick changeover technique	X	X	X	X							X		X								X	X		X		X		X	X	X	X	X	15
Pull production/Kanban	X	X	X	X															X		X	X	X		X	X			X	X	X	X	14
Total productive maintenance or total preventive maintenance			X		X			X								X			X		X		X		X	X			X	X	X	X	13
Group technology/flow-oriented layout/cellular manufacturing								X			X		X	X	X	X				X						X		X	X				10
Communication and relationship with suppliers								X													X				X	X		X	X	X	X		8
Employee involvement and human resource management					X			X				X				X	X	X										X	X		X		9
Lot size reduction	X	X	X	X																			X			X				X			7
Scheduling, production control and levelling														X											X	X		X		X	X		6
Continuous improvement		X																					X		X					X			4
Customer involvement;								X													X								X		X		4
5S practices																									X					X	X	X	4
Cross-functional work force	X		X																				X										3
Continuous flow;																					X								X			X	3
Visual control																									X					X	X		3
Flexible and cross functional teams																			X						X	X				X			4
Value chain													X							X													2
Inventory reduction																								X				X					2
Work standardisation																									X					X			2
Small number of supplier																									X					X			2
Teams and corporate culture		X																										X					2
Work organization																				X													1
Repetitive production														X																			1
Waste minimization															X																		1
Process and process technologies																												X					1
Productivity improvement																								X									1
Improvement in on-time delivery																								X									1
Bottleneck/constraint removal																														X			1
New equipment and technology																														X			1

Sugimoro et al (1977); Monden (1981);
1 Pegels (1984)
2 Wantuck (1983)
3 Lee and Ebrahimpour (1984)

(*continued*)

Table 1.
Dimension of LM practices according to several authors

Table 1.

Dimension of Lean Manufacturing Practices	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Total
4																			Suzaki (1985)														
5																			Shah and Ward (2003)														
6																			Fullerton *et al.* (2003)														
7																			Ahmad *et al.* (2004)														
8																			Olsen (2004)														
9																			Abdallah and Matsui (2007)														
10																			Matsui (2007)														
11																			Jayaram *et al.* (2008)														
12																			Dal Pont *et al.* (2008)														
13																			Fullerton and Wempe (2009)														
14																			Hallgren and Olhager (2009).														
15																			Rahman *et al.* (2010)														
16																			Taj and Morosan (2011)														
17																			Yang *et al.* (2011)														
18																			Furlan *et al.* (2011)														
19																			Ghosh (2012)														
20																			Moyano-Fuentes and Sacristan-Diaz (2012)														
21																			Hofer *et al.* (2012)														
22																			Chavez *et al.* (2013)														
23																			Losonci and Demeter (2013)														
24																			Dora *et al.* (2013)														

Hofer *et al.* (2012), Losonci and Demeter (2013), Dora *et al.* (2013), Lyons *et al.* (2013), Nawanir *et al.* (2013), Godinho Filho *et al.* (2016), Panwar *et al.* (2018), Shrafat and Ismail (2019) and Yadav *et al.* (2019). Statistical process control or total quality management is related to a set of interrelated initiatives to ensure the quality of the products and the equipment used for manufacturing these products (Yang *et al.*, 2011). According to Godinho Filho *et al.* (2016) and Yadav *et al.* (2019), the statistical process control or total quality management is a tools that use a chart to show a defect on the shop floor, a cause-and-effect diagram to identify the causes of the quality problem, process capability studies before launching the product and statistical technique to reduce process variance. Statistical process control or total quality management also uses a visual control system to make the problem visible, giving authorised to shop-floor employee to stop production for quality problems and using the tool to tracing the source and remedy it when the quality problem detected (Nawanir *et al.*, 2013).

- The pull or Kanban system can be found in the studies by Sugimori *et al.* (1977), Monden (1983), Pegels (1984), Wantuck (1983), Lee and Ebrahimpour (1984), Suzaki (1985), Ghosh (2012), Hofer *et al.* (2012), Chavez *et al.* (2013), Losonci and Demeter (2013), Dora *et al.* (2013), Lyons *et al.* (2013), Nawanir *et al.* (2013), Godinho Filho *et al.* (2016), Panwar *et al.* (2018), Yadav *et al.* (2019) and Shrafat and Ismail (2019). The pull or Kanban system controls the flow of resources (Antony *et al.*, 2012). In the pull or Kanban system, items are produced only when called for by the customer or called for by subsequent work station, and production is performed based on the shipment of goods from the previous work station or in which the items are necessary (Nawanir *et al.*, 2013); Yadav *et al.*, 2019).
- Total productive maintenance can be found in the studies by Lee and Ebrahimpour (1984), Shah and Ward (2003), Olsen (2004), Taj and Morosan (2011), Ghosh (2012), Hofer *et al.* (2012), Losonci and Demeter (2013), Lyons *et al.* (2013), Nawanir *et al.* (2013), Thanki and Thakkar (2014), Panwar *et al.* (2018) and Yadav et al.. (2019). Total productive maintenance is an approach for optimising equipment effectiveness, eliminating breakdowns and promoting autonomous maintenance by operators through day-to-day activities involving the total workforce (Bhadury, 2000). It consists of planned activities for regularly maintaining all the equipment as well as the excellent records of all equipment and maintenance process on the shop floor (Shah and Ward, 2003; Godinho Filho *et al.*, 2016; Yadav *et al.*, 2019). According to Nawanir *et al.* (2013), total productive maintenance also includes the efforts to ensure that the equipment is ready for production at all times, the periodic inspection and the preventive maintenance to reduce the probability of machine breakdown.
- Communication and relationship with suppliers can be found in the studies by Olsen (2004), Hofer *et al.* (2012), Lyons *et al.* (2013), Nawanir *et al.* (2013), Thanki and Thakkar (2014), Panwar *et al.* (2018) and Yadav *et al.* (2019). They are related to the strategic and mutual collaboration between suppliers and manufacturers with the goal of eliminating waste (Nawanir *et al.*, 2016). According to Nawanir *et al.* (2013), there are several items related to communication and relationship with suppliers, namely, solving problems, working together and establishing a long-term relationship with suppliers, on-time delivery of materials or products by suppliers, warehouse maintenance by suppliers and provision of engineering and quality management assistance by suppliers. According to Godinho Filho *et al.* (2016),

communication and relationship with suppliers also include the commitment of the supplier to annual cost reduction, intensive communication with key suppliers at the corporate level and taking active steps to reduce the number of suppliers. Moreover, communication and relationship with suppliers are also related to the provision of supplier feedback on the quality and delivery performance (Yadav *et al.*, 2018).

- Employee involvement can be found in the studies by Shah and Ward (2003), Olsen (2004), Dal Pont *et al.* (2008), Taj and Morosan (2011), Yang *et al.* (2011), Furlan *et al.* (2011), Thanki and Thakkar (2014), Godinho Filho *et al.* (2016) and Yadav *et al.* (2019). Employee involvement is related to the participation and empowerment of employees in the decision-making and problem-solving and increased autonomy in the work processes (Odero and Makori, 2018). It also involves shop-floor employees lead product/process improvement efforts, drive suggestion programmes and perform multiple tasks in the production process.
- Scheduling, production control and levelling can be found in Hallgren and Olhager (2009), Lyons *et al.* (2013), Nawanir *et al.* (2013), Thanki and Thakkar (2014), Panwar *et al.* (2018), and Yadav *et al.* (2019). Scheduling, production control and levelling are all related with the creation of short-term production plans for plants or other individual production areas (Caplinskas *et al.*, 2012). According to Nawanir *et al.* (2013) and Yadav *et al.* (2019), the indicators of scheduling, production and levelling are mix production on the same machines and equipment, accurate forecast to reduce variability in the production, production of products with relatively fixed quantity per production period, production of more than one product model every day, equalisation of workloads in each production process, production of the same combination of products every day and sufficient quantity of every product model to respond to variations in customer demand.

2.2 Relationship between lean manufacturing practices and operational performance

LM practices have always been related with OP (Shah and Ward, 2003). OP is the quantifiable aspect of an organisation's process, such as production cycle time, reliability and inventory turnovers. By measuring OP, the significance of the products and services provided and the methods established by the organisations can be determined; thus, OP can used as a tool to help the organisations make a target to achieve and increase what they do (Voss *et al.*, 1997). According to Swink *et al.* (2005), previous studies have used OP as an aggregate construct consisting of several components. Similarly, Ketokivi and Schroeder (2004) and Flynn *et al.* (1995) stated that OP is usually measured as a composite of several performance dimensions. Due to this argument, this study also used OP as an aggregate construct consisting of several measures.

Then, the measures of the OP construct can be retrieved from Slack *et al.* (2006) and Jabbour *et al.* (2013). According to them, the OP construct can be divided into five components, namely, cost production or product cost, product quality, speed or time-to-market, dependability or reliability on quick delivery and manufacturing flexibility. Moreover, the relationship between LM practices and OP has been defined by several researchers, such as Motwani (2003), Kumar *et al.* (2006), Slomp *et al.* (2009), Upadhye *et al.* (2010), Vinodh *et al.* (2011), Nawanir *et al.* (2013), Filho *et al.* (2016) and Yadav *et al.* (2019). Motwani (2003) reported that the implementation LM practices by a medium-sized automotive manufacturing company can reduce the cycle time, setup time, inventory level and lead time of the product development. Kumar *et al.* (2006), Upadhye *et al.* (2010) and Yadav *et al.* (2019) reported that the implementation of LM practices by Indian SMEs can reduce the number of defects or the rejection rate, number of inventories, production cost and amount of production waste. It can also increase the overall equipment effectiveness (OEE), financial savings and productivity level. In line with Kumar *et al.* (2006), Upadhye *et al.* (2010) and Yadav *et al.* (2019), Vinodh *et al.* (2011) also reported that the implementation of LM practices by Indian automotive valves manufacturing organisation can increase the OEE and reduce machine downtime. Moreover, Slomp *et al.* (2009) reported that the implementation of LM practices by SME manufacturing electrical distribution and control equipment can reduce the flow time and increase the on-time delivery by as much as 55%–80%. Nawanir *et al.* (2013) reported that the implementation of LM practices by 135 large companies in Indonesia from a variety of industries can reduce scrap and rework costs, cycle time, manufacturing cost and customer lead time, as well as increase first pass yields and labour productivity. Godinho Filho *et al.* (2016) reported that the implementation of LM practices by Brazilian SMEs can reduce the stock levels and operational costs. Thus, based on the result of the previous study and to evaluate the impact of the implementation of LM practices by the SMEs in the wooden furniture industry on their OP, this study proposed the following hypothesis:

H1 1. The implementation of LM practices has a positive significant impact on OP.

2.3 Relationship between lean manufacturing practices and business performance

BP is usually related to the responsibility of the firms to their shareholders, and its objective is profit maximisation (Rappaport, 1987). According to the previous research conducted by Narasimhan and Kim (2002), Ahmad *et al.* (2004), Fullerton *et al.* (2003), Lin *et al.* (2005), Menor *et al.* (2007) and Yang *et al.* (2010), BP may be correlated with customer satisfaction and market, customer and financial performances. In this case, the empirical evidence for the impact of LM practices on BP remains controversial, despite the association between them having been extensively researched and confirmed (Laugen *et al.*, 2005). Some have reported a positive relationship (Christopher and Towill, 2000; Fullerton *et al.*, 2003; Shah and Ward, 2003; Ward and Zhou, 2006; Tu *et al.*, 2006; Fullerton and Wempe, 2009; Bhasin, 2013; Alcaraz *et al.*, 2014; Panwar *et al.*, 2018), whereas others have found a negative relationship (Bortolotti *et al.*, 2013; Chen and Tan, 2013). Specifically, the positive relationship among the implementation of LM practices, customer satisfaction and market and financial performances can be found in the studies by Christopher and Towill (2000), Fullerton *et al.* (2003), Shah and Ward (2003), Ward and Zhou (2006), Tu *et al.* (2006) and Fullerton and Wempe (2009). According to Shah and Ward (2003) and Ward and Zhou (2006), LM practices have a positive impact on customer satisfaction as they increase the responsiveness and reduces the lead time. In addition, Tu *et al.* (2006) suggest that LM practices can improve manufacturing productivity by reducing setup times and decreasing work in process inventory by improving throughput times and thus increasing **market performance**. LM practices have a positive impact on **financial performance** as they improve organisational processes and cost efficiencies (Kinney and Wempe, 2002; Fullerton *et al.*, 2003; Christopher and Towill, 2000; Callen *et al.*, 2005: Fullerton and Wempe, 2009; Karim and Arif-Uz-Zaman, 2013; Jasti and Kodali, 2014). Kinney and Wempe (2002), Callen *et al.* (2005) and Karim and Arif-Uz-Zaman (2013) compared the profitability of LM practices adopters and non-adopters. They found that the adopters of LM practices obtain more profit than the non-adopters. Thus, based on the result of the previous study and to evaluate the impact of the implementation of LM practices by the SMEs in the wooden furniture industry on their BP, this study proposed the following hypothesis:

H2. The implementation of LM practices has a positive significant impact on BP.

2.4 Lean manufacturing practices, operational performance and business performance

OP refers to the measurable aspects of the process outcomes inside the organisation, such as production cycle time, reliability and inventory turnovers. OP in turn affects the BP measures, such as market share and customer satisfaction (Voss *et al.*, 1997). The relationship between OP and BP has been supported by Fullerton and Wempe (2009) and Said *et al.* (2003); the better the OP, the better the BP. Then, with regard to the implementation of LM practices, Fullerton and Wempe (2009), Nawanir *et al.* (2013) and Shrafat and Ismail (2019) indicated the role of OP as a mediating variable between LM practices and BP. In this case, LM practices can indirectly improve BP with OP as a mediator variable. So, based on the result of the previous study and to evaluate the relationship between OP and BP and the role of OP as a mediating variable, this study proposed the following hypothesis:

H3. OP has a positive relationship with BP.

H4. OP mediates the relationship between the implementation of LM practices and BP.

Moreover, to check whether OP has a moderating effect on the relationship between LM practices and BP, this study also proposed the following hypothesis. Referring to Xu *et al.* (2006), when hypothesising that the effect of one variable on another variable is contingent on a third variable, it is common to implement either a mediation perspective or moderating perspective:

H5. OP has a moderating effect on the relationship between the implementation of LM practices and BP.

In this case, although previous research in organisational behaviour usually suggests a moderating role for feedback, such as that delivered by OP, in the achievement of goals (Locke and Latham, 2002), Fullerton and Wempe (2009) failed to prove the role of OP as moderating variable in the relationship between the implementation of LM practices and BP.

Based on *H1* until *H5*, the relationship among the implementation of LM practices, OP and BP is demonstrated in Figure 1.

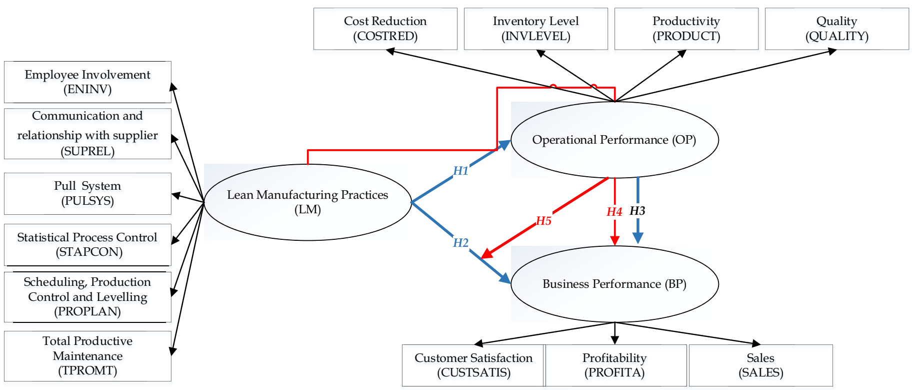

Figure 1.
Relationship between the implementation of LM practices, OP and BP

The main idea of Figure 1 can be explained as follows. The implementation of LM practices (employee involvement, communication and relationship with supplier, pull system, statistical process control, scheduling, production control and levelling, and total productive maintenance) may have a positive, significant and direct impact on OP (customer satisfaction, profitability and sales) and BP (cost reduction, inventory level, productivity and quality). It is also possible that LM practices have a positive, significant and indirect impact on BP through OP. In this case, OP can mediate or accelerate the relationship between the implementation of LM practices and BP.

3. Method of research

3.1 Sample of the research

The SMEs become the sample of this study is not proportional to the total number of enterprises in the wooden furniture industry in Jepara. The minimum number of samples of this study follows the rule of thumb of the partial least squares (PLS) regression. According to Chin (1998), the minimum sample size should be 10 times the largest number of structural paths directed at a particular latent construct in the structural model. The conceptual model of this study (see Figure 1) has four paths directed to the dependent variable (one path not directed to the dependent variable as it indicates the moderating effect). Thus, based on this condition, the minimum sample size of this study should be 40 SMEs. A total of 100 questionnaires were distributed to the middle or top management of the SMEs. They were asked to answer the questionnaires and return them within 20 days of receipt in an enclosed self-addressed envelope. The return shipping cost was provided by the authors. Specific characteristics were used to identify appropriate surveyed of 100 SMEs: the survey was restricted to the employees of SMEs who had sufficient LM experience and exercised a managerial role related to LM. Such a non-random sampling, in this case the purposive sampling technique, has been commonly used in previous LM studies. About 30 days later, the SMEs who did not respond were contacted by telephone to maximise the response rate. Finally, 81% of the 100 questionnaires administered were properly filled, completed and returned. This percentage is sufficient for a study conducted in a developing country. The number of the sample meets not only the minimum requirement but also the 16.10% response rate experienced by Nawanir *et al.* (2013) and Nawanir *et al.* (2016) in studying the LM practices in Indonesia.

Moreover, in terms of the type of furniture, the results revealed that 54 (66.67%) of the surveyed SMEs can be classified as indoor furniture workshops, 2 (2.47%) as outdoor furniture workshops and 25 (30.86%) as a mix of indoor and outdoor furniture workshops. Indoor furniture workshops make furniture that will be used in the dining room, living room, study room, family room, bedroom, library, kitchen, terrace and others. Conversely, outdoor furniture workshops make furniture that will be used outdoors. Indoor and outdoor furniture workshops have dissimilarities in terms of motif and process of finishing and it will affect the wood waste resulted (Susanty *et al.*, 2020).

3.2 Measures

According to previous authors (such as Christopher and Towill, 2000; Fullerton *et al.*, 2003; Motwani, 2003; Shah and Ward, 2003; Godinho Filho *et al.*, 2016; Kumar *et al.*, 2006; Fullerton and Wempe, 2009; Slomp *et al.*, 2009; Upadhye *et al.*, 2010; Vinodh *et al.*, 2011; Nawanir *et al.*, 2013; Yadav *et al.*, 2019; Nawanir *et al.*, 2013; and Shrafat and Ismail, 2019), three constructs were included in this research. The first construct was used to measure the LM practices implemented by SMEs in the wooden furniture industry. Then, to limit the number of LM practices to enable the applicability of the measurement instrument in an operational context, this study considered the dimension of LM practices based on the top 10 LM practices proposed by previous authors (Table 1) as well as the suitability of those dimensions adopted by SMEs in the wooden furniture industry. In this case, based on the recommendations in the literature, this study identified the LM practices in three stages. First, this study conducts extensive review related to the LM practices proposed by more than 30 authors. Second, this study only focused on the top 10 LM practices. Third, this study only included LM practices that have been adopted by SMEs in the wooden furniture industry. Finally, the LM practices consist of 6 dimensions with 26 indicators. Out of these 26 indicators, 5 were used to measure employee involvement, 4 to measure production planning, 4 to measure statistical process control, 5 to measure supplier relationship and 4 to measure total productive maintenance.

The second and third constructs were used to measure the OP and OB achieved by SMEs upon the implementation of the LM practices. OP consisted of 4 dimensions with 11 indicators. Out of these 11 indicators, 2 were used to measure cost reduction, 3 to measure inventory level, 2 to measure productivity and 4 to measure quality. BP consisted of three dimensions (customer satisfaction, profitability and sales) with 3 indicators. The dimensions and indicators in OP and BP were adapted from Nawanir *et al.* (2013), Godinho Filho *et al.* (2016) and Yadav *et al.* (2019). Table 2 presents in detail the dimensions and indicators.

In this case, the extent of the implementation of LM practices and the achievement of OP and BP were measured on a perceptual scale using a five-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; and 5 = strongly agree). Moreover, the extent of the implementation of LM practices and the achievement of OP and BP were measured based on its value during the past 3 years to reduce temporary fluctuations in each indicator. Specifically, for each indicator, the levels of LM practices, OP and BP were represented by the average of the measurement indicator ratings.

3.3 Data processing technique

The data were processed via PLS regression using the SmartPLS software. The SmartPLS software is commonly used to evaluate the convergent and discriminant validity as well as the reliability of the instrument. It is also used to test the hypothesised model. PLS regression is one of the methods used in the variance-based structural equation modelling. One of its most outstanding aspects is that it is a method based on composites instead of common (reflective) factors or causal formative constructs. PLS regression involves a sequence of multiple regressions that allow the weights of construct components (when reaching the predefined level of convergence) and the paths to be estimated between exogenous and endogenous constructs (Esposito-Vinzi *et al.*, 2010; Henseler *et al.*, 2009; Felipe *et al.*, 2017). The algorithm is established in several stages. The first stage iteratively estimates the latent variable scores (LVS). The second stage solves the measurement model by estimating the outer weights and loadings (beginning with the LVS estimated in the first stage). The third stage estimates the parameters of the structural model (Hair *et al.*, 2017).

4. Method of research

4.1 Measurement model, validity and reliability

The measurement model was evaluated by convergent and discriminant validity and reliability. To ensure convergent validity, this study followed the argument of Fornell and Larcker (1981). It retained the indicators with a factor loading of greater than 0.5 and eliminated any indicator with a factor loading of less than 0.5 (Fornell and Larcker, 1981). Subsequently, the factor loading of each indicator is re-calculated. The final factor loading of each indicator and the average variance extracted (AVE) value, as well as the composite

Table 2. Construct validity and reliability

Constructs/Dimensions		Indicators	Outer Loading for First Order	Outer Loading for Second Order	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
LM Practices	Employee involvement (ENINV)	Shop-floor employees are actively involved in problem-solving (ENINV1)			0.925 0.845	0.934 0.897	0.431 0.686
		Shop-floor employees are key to problem-solving teams (ENINV2)	0.728	0.620			
		Shop-floor employees lead product/process improvement efforts (ENINV3)	0.870	0.705			
		Shop-floor employees drive suggestion programmes (ENINV4)	0.844	0.607			
		Shop-floor employee undergo training to perform multiple tasks in the production process (ENINV5)	0.863	0.696			
	Communication and relationship with supplier (SUPREL)	The enterprise gives feedback on quality and delivery performance to their supplier (SUPREL1)	0.660	0.550	0.622	0.800	0.574
		The enterprise can depend on on-time delivery by the supplier (SUPREL2)	0.791	0.565			
		The enterprise prefers to choose a key supplier located close to it (SUPREL3)					
		The enterprise emphasises working together with the suppliers in a close relationship to gain mutual benefits (SUPREL4)					
		The enterprise has long-term agreements, in the form of formal and informal contracts, with their supplier (SUPREL5)	0.813	0.512			
	Pull system (PULSYS)	The enterprise uses a production system in which the items are produced only when called for by the customer (PULSYS1)			0.809	0.913	0.840
		Production is performed based on the shipment of goods from previous work station (PULSYS2)	0.910	0.581			
		The enterprise uses a production system in which items are produced only in necessary quantities, no more and no less (PULSYS3)					
		The enterprise uses a pull system to control the production rather than a schedule prepared in advance (PULSYS4)	0.923	0.628			
	Statistical process control or total quality management (STAPCON)	The enterprise has already used a simple statistical process control to identify and prevent quality problems by correcting the process before it starts producing defects (STAPCON1)	0.798	0.722	0.848	0.898	0.688
			0.855	0.573			

(*continued*)

Table 2.

Constructs/Dimensions		Indicators	Outer Loading for First Order	Outer Loading for Second Order	Cronbach's Alpha		Composite Reliability		Average Variance Extracted (AVE)	
		The enterprise uses graphics to make the problems visible (STAPCON2)								
		The enterprise uses a simple cause-and-effect diagram (fishbone) to identify causes of quality problems (STAPCON3)	0.903	0.757						
		When quality problems are detected, the enterprise usually traces their source and remedies them without reworking on too many units (STAPCON4)	0.754	0.573						
	Scheduling, production control and levelling (PROPLAN)	The enterprise performs a mix production on the same machines and equipment (PROPLAN1)				0.708		0.871		0.772
		Although the enterprise conducts a job–shop production process, the enterprise tries to produce each product in a relatively fixed quantity per production period (PROPLAN2)								
		The enterprise usually meets the production schedule each day (PROPLAN3)	0.907	0.736						
		The enterprise emphasises the equation of workloads in each production process (PROPLAN4)	0.849	0.588						
	Total productive maintenance (TPROMT)	The enterprise dedicates a periodic inspection and maintenance system to keep machines in operation (TPROMT1)	0.855	0.771		0.849		0.898		0.687
		The enterprise posts equipment maintenance records on the shop floor (TPROMT2)	0.835	0.792						
		The enterprise dedicates a system of daily maintenance, periodic inspection and preventive repairs to reduce the probability of machine breakdown (TPROMT3)	0.825	0.631						
		The enterprise has a policy to ensure that equipment is ready for production at all times (TPROMT4)	0.800	0.764						
OP	Cost reduction (COSTRED)	The enterprise has succeeded in reducing the cost of manufacturing in the last 3 years (COSTRED1)	0.829	0.543	0.837	0.613	0.877	0.837	0.477	0.720
		The enterprise has succeeded in reducing the external failure costs (i.e. complaints, returns, warranty claims, liability and lost sales) in the last 3 years (COSTRED2)	0.868	0.610						
	Inventory level (INVLEVEL)	The finished goods inventory level has reduced in the last 3 years (INVLEVEL1)	0.927	0.804		0.911		0.944		0.849

(*continued*)

Constructs/Dimensions		Indicators	Outer Loading for First Order	Outer Loading for Second Order	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
		The raw material inventory level has reduced in the last 3 years (INVLEVEL2)	0.871	0.671			
		The work in process inventory level has reduced in the last 3 years (INVLEVEL3)	0.963	0.817			
	Productivity (PRODUCT)	Labour productivity has increased in the last 3 years (PRODUCT1)	0.963	0.765	0.918	0.961	0.925
		Equipment productivity has increased in the last 3 years (PRODUCT2)	0.960	0.733			
	Quality (QUALITY)	Products that do not meet the quality specifications have decreased in the last 3 years (QUALITY1)			1.000	1.000	1.000
		The enterprise has superior quality of products compared with those of the competitors (QUALITY2)					
		Activities in fixing defective products to conform to the quality specifications (reworks) have reduced in the last 3 years (QUALITY3)	1.000	0.509			
		The enterprise has superior quality of service compared with those of the competitors (QUALITY4)					
BP	Customer satisfaction (CUSTSATIS)	Customers are satisfied with the overall quality of the products in the last 3 years (CUSTSATIS1)			0.863 1.000	0.895 1.000	0.551 1.000
		Customers are satisfied with the delivery lead time in the last 3 years (CUSTSATIS2)					
		Customers are satisfied with the response to sales enquiries in the last 3 years (CUSTSATIS3)	1.000	0.735			
	Profitability (PROFITA)	Profit margin has increased in the last 3 years (PROFITA1)	0.699	0.649	0.749	0.859	0.672
		The profitability has exceeded that of the competitors in the last 3 years (PROFITA2)	0.847	0.687			
		The revenue growth rate has exceeded that of the competitors in the last 3 years (PROFITA3)	0.899	0.809			
	Sales (SALES)	The market share has increased in the last 3 years (SALES1)	0.892	0.771	0.829	0.898	0.745
		The sales have increased in the last 3 years (SALES2)	0.843	0.724			
		The market share growth rate has exceeded that of the competitors in the last 3 years (SALES3)	0.854	0.804			

Table 2.

reliability (CR) and Cronbach's α of each construct, are presented in Table 2. Moreover, the result of the final discriminant validity is shown in Table 3. The discriminant validity was measured through the cross-loading criterion. The factor loading of each indicator in a certain construct should be greater than all of its cross-loadings (Chin, 1998).

As presented in Table 2, a total of 12 indicators were eliminated. After eliminating 12 indicators, the final factor loadings of the first order for all the retained indicators ranged from 0.660 to 1.000, and the final factor loadings of the second order for all the retained indicators ranged from 0.509 to 0.817. Moreover, referring to Fornell and Larcker (1981), this study still obtained a construct with an AVE value less than 0.500 if such a construct has a CR value higher than 0.6. As presented in Table 2, the construct LM practices and OP have an AVE value less than 0.500 but a CR value higher than 0.600. It means that the construct LM practices and OP are not able to explain more than half of the variance of its indicators on average. Besides the construct LM practices and OP, all the constructs have an AVE value greater than 0.500. Table 2 also demonstrates that all of the constructs have CR and Cronbach's α values above the threshold, which is 0.7 (Akter *et al.*, 2011; Bagozzi and Yi, 1988). Then, comparing the factor loading across the columns in Table 3, we can see the existence of discriminant validity between all the constructs.

Thus, based on the result of the evaluation of the measurement model, it can be inferred that the value of the final factor loading indicated an adequate convergent and discriminant validity of each indicator and that the CR and Cronbach's α values indicated the satisfactory reliability of each construct.

4.1 Descriptive statistics and Pearson's correlation

The descriptive statistics in Table 4 demonstrates that the means of implementation of LM practices ranged from 3.3457 (statistical process control) to 4.3328 (pull system), with the standard deviation ranging from 0.528 until 0.966. These results suggest that the SMEs in the wooden furniture industry implement LM practices. With regard to OP and BP, all the dimensions of OP and BP were positively correlated with each other, and most of the correlation levels are significant at 0.01 or 0.05. In terms of OP, except cost reduction, the mean values ranged from 3.7407 (productivity) to 4.0494 (quality), with the standard deviation ranging from 0.605 to 0.757. Then, as can be seen from Table 4, among the OP dimensions, employee involvement and productivity have the highest correlation (r = 0.532), followed by quality and pull system (r = 0.522). Next, in terms of BP, the mean values ranged from 3.2675 (sales) to 3.6790 (customer satisfaction), with the standard deviation ranging from 0.581 to 0.960. It can be seen that the mean value of BP dimensions is smaller than the mean value of OP dimensions. Then, as can be seen from Table 4, among the BP dimensions, customer satisfaction and pull system (r = 0.684) has the highest correlation, followed by sales and total productive maintenance (r = 0.522). Overall, although some r values between the LM practices with OP and LM practices with OB were at the low and medium levels, their correlation levels were most significant at 0.01 or 0.05. According to Cohen (1988), the r values of 0.00–009 indicated no correlation; 0.10–0.29, low correlation; 0.30–0.49, medium correlation; and 0–50–1.00, high correlation.

Table 5 demonstrates that among the six lean constructs, the pull system has the strongest correlation with the overall mean of OP (r value, 0.578), followed by total productive maintenance (r value, 0.512). Conversely, total productive maintenance has the strongest correlation with BP (r value, 0.589) followed by the pull system (r value, 0.534). This finding suggests that a pull system coupled with total productive maintenance can have a significant impact on OP and BP. Furthermore, using tolerance and the variance inflation factor (VIF) to test the multicollinearity, the result of data processing indicated no

Table 3. Discriminant validity

	COSTRED	CUSTSATIS	ENINV	INVLEVEL	PROPPLAN	PRODUCT	PROFITA	PULLSYS	QUALITY	SALES	STAPCON	SUPREL	TPROMNT
COSTRED1	0.829	0.153	0.080	0.215	0.174	0.413	0.230	−0.037	0.347	0.029	0.020	−0.021	0.077
COSTRED2	0.868	0.111	0.110	0.503	0.502	0.284	0.253	0.309	0.085	0.087	0.177	0.410	0.336
CUSTSATIS3	0.154	1.000	0.375	0.466	0.313	0.583	0.546	0.708	0.513	0.534	0.287	0.341	0.669
ENINV2	0.036	0.245	0.728	0.097	0.356	0.372	0.338	0.334	−0.052	0.152	0.522	0.389	0.469
ENINV3	0.162	0.292	0.870	0.276	0.494	0.396	0.058	0.244	0.117	0.070	0.577	0.429	0.545
ENINV4	0.223	0.220	0.844	0.034	0.415	0.570	0.098	0.044	−0.055	0.053	0.573	0.372	0.421
ENINV5	−0.038	0.468	0.863	0.068	0.317	0.423	0.230	0.341	−0.024	0.112	0.641	0.448	0.500
INVLEVEL1	0.390	0.505	0.224	0.927	0.291	0.430	0.362	0.554	0.322	0.473	0.171	0.412	0.443
INVLEVEL2	0.342	0.345	−0.072	0.871	0.087	0.241	−0.003	0.252	0.301	0.154	−0.064	0.073	0.076
INVLEVEL3	0.456	0.427	0.223	0.963	0.302	0.431	0.182	0.381	0.200	0.257	0.208	0.390	0.390
PRODUCT1	0.407	0.641	0.483	0.404	0.375	0.963	0.570	0.376	0.352	0.461	0.342	0.337	0.495
PRODUCT2	0.372	0.477	0.533	0.376	0.394	0.960	0.494	0.238	0.313	0.432	0.333	0.350	0.453
PROFITA1	−0.029	0.278	0.006	0.050	0.121	0.315	0.699	0.199	−0.082	0.570	0.126	0.247	0.277
PROFITA2	0.417	0.410	0.295	0.253	0.589	0.530	0.847	0.393	0.137	0.416	0.198	0.460	0.375
PROFITA3	0.291	0.620	0.216	0.196	0.356	0.505	0.899	0.459	0.480	0.529	0.128	0.313	0.378
PROPLAN3	0.368	0.303	0.455	0.236	0.907	0.387	0.456	0.582	0.107	0.340	0.503	0.468	0.653
PROPLAN4	0.352	0.241	0.380	0.211	0.849	0.309	0.297	0.216	−0.167	0.100	0.546	0.391	0.444
PULSYS2	0.175	0.734	0.265	0.398	0.434	0.444	0.416	0.910	0.500	0.493	0.346	0.349	0.556
PULSYS4	0.142	0.571	0.276	0.403	0.439	0.155	0.385	0.923	0.315	0.548	0.257	0.544	0.661
QUALITY3	0.245	0.513	0.000	0.295	−0.017	0.346	0.243	0.441	1.000	0.415	−0.062	0.080	0.236
SALES1	0.007	0.449	0.060	0.284	0.141	0.427	0.520	0.520	0.378	0.892	0.055	0.314	0.444
SALES2	0.099	0.424	0.018	0.270	0.074	0.288	0.477	0.400	0.479	0.843	0.004	0.337	0.361
SALES3	0.078	0.507	0.214	0.293	0.451	0.479	0.589	0.546	0.231	0.854	0.194	0.511	0.506
STAPCON1	0.050	0.296	0.587	0.215	0.485	0.304	0.135	0.287	−0.111	0.232	0.798	0.533	0.586
STAPCON2	0.275	0.123	0.552	0.137	0.441	0.265	0.087	0.148	−0.104	−0.095	0.855	0.192	0.349
STAPCON3	0.196	0.323	0.590	0.119	0.687	0.410	0.376	0.339	−0.077	0.146	0.903	0.303	0.606
STAPCON4	−0.136	0.171	0.596	−0.091	0.294	0.147	−0.059	0.287	0.111	−0.003	0.754	0.203	0.402
SUPREL1	0.284	0.337	0.367	0.416	0.418	0.334	0.147	0.408	0.195	0.126	0.275	0.660	0.530
SUPREL2	0.154	0.242	0.404	0.242	0.365	0.264	0.424	0.404	0.036	0.410	0.363	0.791	0.430
SUPREL5	0.109	0.187	0.350	0.076	0.326	0.203	0.364	0.292	−0.058	0.494	0.228	0.813	0.475
TPROMNT1	−0.052	0.530	0.562	0.113	0.405	0.238	0.216	0.597	0.195	0.398	0.569	0.502	0.855
TPROMNT2	0.454	0.323	0.498	0.220	0.715	0.416	0.251	0.395	0.081	0.217	0.620	0.587	0.835
TPROMNT3	0.376	0.610	0.354	0.489	0.378	0.382	0.375	0.630	0.252	0.480	0.262	0.443	0.825
TPROMNT4	0.080	0.772	0.510	0.355	0.579	0.596	0.564	0.605	0.268	0.612	0.497	0.555	0.800

Table 4.
Pearson's correlation analysis of all LM practices, OP and BP measures

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Employee Involvement (ENINV)	4.1759	0.612	1												
2. Communication and relationship with supplier (SUPREL)	3.7573	0.667	0.474**	1											
3. Pull System (PULSYS)	4.3328	0.528	0.439**	0.502**	1										
4.Statistical Process Control or Total Quality Management (STAPCON)	3.3457	0.747	0.701**	0.347**	0.332**	1									
5. Scheduling. production control and levelling (PROPLAN)	3.4383	0.966	0.447**	0.462**	0.357**	0.592**	1								
6. Total productive maintenance (TPROMT)	3.7573	0.612	0.577**	0.634**	0.684**	0.593**	0.604**	1							
7. Operational Performance –Inventory Level (INVLEVEL)	3.72072	0.757	0.106	0.279*	0.436**	0.113	0.240*	0.322**	1						
8. Operational Performance –Cost Reduction (COSTRED)	2.9198	0.700	0.092	0.213	0.265*	0.122	0.390**	0.238*	0.415**	1					
9. Operational Performance – Productivity (PRODUCT)	3.7407	0.699	0.532**	0.341**	0.435**	0.347**	0.388**	0.491**	0.394**	0.410**	1				
10. Operational Performance –Quality (QUALITY)	4.0494	0.605	0.137	0.164	0.522**	0.124	0.021	0.455**	0.176	0.194	0.385**	1			
11. Business Performance –Customer Satisfaction (CUSTSATIS)	3.6790	0.960	0.396**	0.326**	0.684**	0.279*	0.302**	0.667**	0.460**	0.157	0.574**	0.652**	1		
12. Business Performance –Profitability (PROFITA)	3.3332	0.581	0.211	0.389**	0.279*	0.174	0.396**	0.418**	0.181	0.266*	0.542**	0.384**	0.536**	1	
13. Business Performance –Sales (SALES)	3.2675	0.840	0.109	0.448**	0.495**	0.085	0.213	0.504**	0.314**	0.066	0.460**	0.555**	0.531**	0.620**	1

Notes: **Correlation is significant at the 0.01 level (two-tailed). *Correlation is significant at the 0.05 level (two-tailed)

	Mean	SD	OP	BP	Collinearity Statistics Tolerance	Tolerance
Employee Involvement (ENINV)	4.1759	0.61166	0.283*	0.228*	0.429	2.330
Communication and relationship with supplier (SUPREL)	3.7573	0.66654	0.357**	0.473**	0.542	1.845
Pull System (PULSYS)	4.3328	0.52811	0.578**	0.534**	0.503	1.987
Statistical Process Control or Total Quality Management (STAPCON)	3.3457	0.74746	0.236*	0.175	0.374	2.672
Scheduling. production control and levelling (PROPLAN)	3.4383	0.96625	0.367**	0.338**	0.529	1.889
Total productive maintenance (TPROMT)	3.6265	0.81118	0.512**	0.589**	0.295	3.391

Notes: **Correlation is significant at the 0.01 level (two-tailed). *Correlation is significant at the 0.05 level (two-tailed)

Table 5. Pearson's correlation between lean manufacturing dimensions, overall (mean) OP and overall (mean) BP and collinearity statistics

multicollinearity issues. Tolerance values lower than 0.20 and VIF greater than 4.0 indicate a multicollinearity issue (Hair *et al.*, 2010). The current results indicate that all the tolerance values were within acceptable limits.

4.2 Structural model assessment

Evaluation of the validity of the structural model was conducted to describe the relationships between the independent and dependent latent variables. The evaluation can be seen from the values of the determinant coefficient (R^2), Q^2, the effect size (f^2) and the goodness of fit (GoF). The R^2 value indicates the amount of variance in the dependent variables explained by the independent variables. The Q^2 value is used to evaluate the degree of goodness of observation resulting from the model and its estimation parameters (Chin, 1998). Then, the value of the effect of size (f^2) indicates the degree to which an independent latent variable contributes toward explaining another latent dependent variable with regard to R^2 (Liang *et al.*, 2007). The GoF, as recommended by Tenenhaus *et al.* (2005), is used to evaluate the global validity of PLS-based complex models. Shortly, the result of the structural model assessment is presented in Table 6.

4.3 Result of the hypothesis testing

The result of the hypothesis testing demonstrates the significant relationship between the independent variable and dependent variable if the *t*-statistic value (*t* stat) is greater than 1.96 (*t* critical) and the *p*-value is less than 5% (0.05). This condition indicates that the independent variable acts as an important predictor of the dependent variable in the hypothesised model. The detailed results of the hypothesis testing are presented in Table 7.

Table 7 demonstrates that the direct effect of the implementation of LM practices on OP is 0.397 ($t = 3.572$, p-value < 0.05). Similarly, the direct effects of the implementation of LM practices on BP and OP on BP were also 0.337 ($t = 2.984$, p-value < 0.05) and 0.397 ($t = 3.572$, p-value < 0.05), respectively. Thus, *H1*, *H2* and *H3* were supported. The results of *H1* and *H2* indicated that the direct effect of the implementation of LM practices on OP is higher than the direct effect of the implementation of LM practices on BP. Moreover, Table 7 also

Table 6.
Result of structural model assessment

Statistical test	Value	Cut-off value	Result
R^2 of operational performance	0.336	$R^2 \geq 0.19$ (weak). $R^2 \geq 0.33$ (moderate). and $R^2 \geq 0.67$ (substantial/strong) *)	Moderate
R^2 of business performance	0.401		Moderate
Q2	0.2555	$Q^2 > 0$*)	Good predictive relevance
f^2	0.145 until 4.189	$f^2 \geq 0.02$ (weak). $f^2 \geq 0.15$ (moderate). and $f^2 \geq 0.35$ (strong) effect sizes**)	Moderate until strong effect sizes
GoF	0.423	GoF $\geq$ 0.10 (small). GoF $\geq$ 0.25 (moderate). and GoF $\geq$ 0.36 (large)***)	Large of global validity of PLS-based complex model

Table 7.
The result of hypothesis testing

Hypothesis	Path Coefficient	T-stat	*P*-value	Result
H1: LM practices→ OP	0.486	5.959	0.000	*H1* supported
H2: LM practices→ BP	0.337	2.984	0.003	*H2* supported
H3: OP→ BP	0.397	3.572	0.000	*H3* supported
H4: LM→ OP→ BP	0.193	2.963	0.003	*H4* supported
H5: LM (OP)→ BP	−0.262	2.357	0.019	*H5* do not supported

demonstrates that the indirect effect of the implementation of LM practices on BP was 0.193 (t = 2.963, p-value < 0.05). The indirect effect of the implementation of LM practices on BP was also statistically significant, although the value of the path coefficient was smaller than that of the direct effect. Hence, the total effect of the implementation of LM practices on BP was 0.530 (0.337 plus 0.193). This value indicated that, when LM practices go up by one standard deviation, BP goes up by 0.53 standard deviation. This empirical evidence suggested that high levels of LM practice implementation would lead to high levels of OP and ultimately high levels of BP. Moreover, it suggested that OP partially mediates the relationship between LM practices and BP. Thus, *H4* was supported.

While the empirical evidence in this study supported the role of OP as a mediating variable between the implementation of LM practices and OB, it did not support the moderate positive role of OP in the implementation of LM practices and OB relation. Thus, *H5* was not supported. Different from Fullerton and Wempe (2009), who failed to prove the statistical significance of the interaction between LM practices and OP on BP, the empirical evidence in this study supported such an interaction in the negative direction (it should be a positive direction). In this case, an increase in the achievement of LM practices and OP caused BP to decrease since the correlation indicates a negative moderate relationship, which seems to be opposite to the result of the previous hypothesis. It could happen to SMEs as they need more capital to implement the LM practices in order to achieve better OP. In the short term, the need for more capital would reduce their BP. More specifically, in the SMEs of the wooden furniture industry, it was assumed that the moderating effects of OP would have negative moderates the mediating effects of OP to LM practices to some degree. This empirical evidence still suggested that LM practices would lead to the achievement of high levels of OP and ultimately high levels of BP; however, the high level of BP was limited to some extent. It was necessary to test the mediating and moderating effects of OP in the longitudinal context as time is an important consideration when conceptualising the relationship between OP and BP. In fact, Karazsia and Berlin (2017) suggested that when one begins to consider whether a construct serves a mediating or moderating role, by definition, one must also consider how processes unfold over time. Hayes (2013) demonstrated that it is mathematically possible for the same variable to simultaneously mediate and moderate a given predictor–criterion relation; however, the MacArthur approach to moderation precludes this possibility on temporal grounds. According to this approach, a moderator must temporally precede the predictor, whereas a mediator must come after the predictor temporally (Kraemer *et al.*, 2008)

Graphically, the empirical result of this study can be seen in Figure 2.

How the statistical results obtained in Figure 2 impact the operations of the SMEs in the wooden furniture industry are described as follows. Since BP can be increased both directly and indirectly through LM practices, the SMEs in the wooden furniture industry need to implement the LM practices. For example, the owners of the SMEs can push their employee to participate more in the production process (such as giving suggestions to solve the problems), increase the communication with suppliers to ensure the quality and delivery performance of these suppliers, use the pull system to ensure that the enterprise only produces the necessary quantity of wood products, use statistical process control to ensure the quality of wood product and reduce rework, use better scheduling and production control and levelling to ensure that the enterprises can meet the production demand each day as well as work balance, and implement total productive maintenance to ensure the availability of machine and all the required equipment.

5. Conclusion

This study applies several statistical analyses to attain the objective. The results of this study confirm that the SMEs in the wooden furniture industry implement LM practices. The total productive maintenance, statistical process control, employee involvement, production planning, supplier relationship and pull system are important for successful LM practices. Pearson's correlation coefficients among LM practices confirm that LM should be applied collectively and comprehensively as each practice is interdependent. This is theoretically proper; LM practices should not be applied individually or in a limited subset. Several

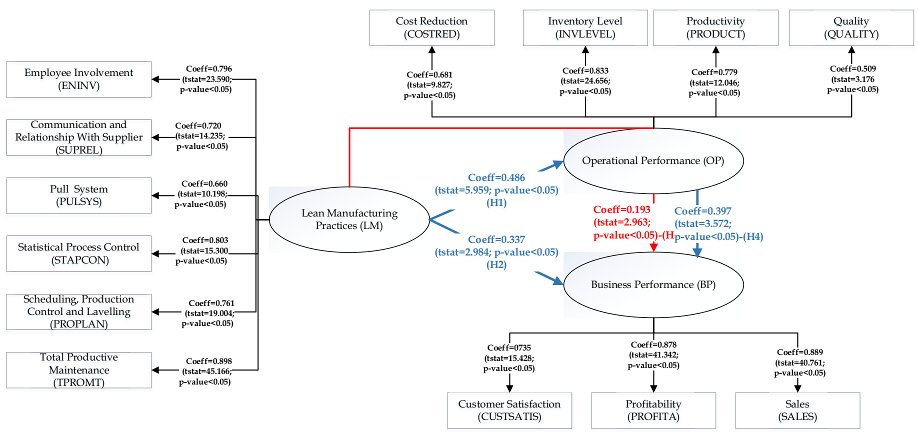

Figure 2.
Empirical result of this study

authors, such as Feld (2001), Furlan et al. (2011), Shah and Ward (2003, 2007) and White and Prybutok (2001), significantly supported this conclusion.

The results of the study also confirm that LM practices have a direct effect on OP. Several authors, such as Fullerton and Wempe (2009), Singh et al. (2010) and Taj and Morosan (2011), significantly supported this conclusion. Thus, the results of the study confirm that LM practices have a direct effect on BP. This relationship has also been investigated by Chong et al. (2001), Forrester et al. (2010), Kannan and Tan (2005) and Yang et al. (2011). They obtained somewhat similar results. The results of the study also indicated that OP can drive broad BP measures. It supported the ideas of Fullerton and Wempe (2009), Said et al. (2003) and Van der Stede et al. (2006). Finally, the results of the study confirm that LM practices can also indirectly improve BP with OP as a mediator variable. The most important thing here is that LM practices are frequently realised in the shop floor and directly affect the operating conditions.

This study has contributed both to theory and practice. Theoretically, this study contributes to the fields of LM practice implementation among SMEs. It adds to the current literature on LM practices and their impact on OP and BP among the SMEs. Moreover, it provides an insight into how to improve the OP and BP of SMEs through LM practices. Practically, we learned from this study that the traditional wooden furniture industry in Indonesia should be better off implementing LM practices if they seek to improve their OP and BP. Besides, practically, the results of this study give some recommendations for SMEs in the wooden furniture industry as well as the government. For these SMEs, as the results suggest that LM practices should be applied collectively and comprehensively, the owners of the SMEs can establish comprehensive programmes for LM practices. For the government, the results of this study can provide some guidelines to increase the performance of SMEs at the operational and business levels. First, the government can provide SMEs with workshops to increase the understanding and implementation of the LM practices. Second, it can embrace the leading SMEs (those whose level of implementation of LM practice is high) as champions and set them as examples of good practices to other SMEs. Third, the government and policymakers should support SMEs with financial aids for the implementation of better LM practices.

This study has some limitations. First, it is arguable that LM practices, OP and BP are only measured by the Likert scales, which would likely create bias and inconsistency from the owners or managers of the SMEs in expressing the level of LM practice implementation and performances achieved by such SMEs. Future research may have the benefit of using qualitative approaches to better measure the LM practices as well as OP and BP through observation and probing. Second, this study was limited geographically (limited to only the SMEs in the wooden furniture industry in Jepara; it did not cover all the regions in Central Java as well as in Indonesia). Therefore, a wider geographical area could be considered, including the other regions in Indonesia which also produce wooden furniture. This study could be a stepping stone for researchers in coping with the limited empirical studies on LM practices in SMEs.

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