Do lean manufacturing practices have negative impact on job satisfaction?

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Abstract
Purpose – Due to the increasing trend of global competitiveness, lean manufacturing has received much attention in the international literature. Although previous studies have indicated the positive effects of lean manufacturing on the performance of the manufacturing firms, the impact of lean practices on two aspects of “job”, namely, characteristics and satisfaction, as of yet remains unclear. As a result, this study aims to evaluate job characteristics to understand the effects of lean manufacturing on job satisfaction.

Design/methodology/approach – Data from a survey of 206 employees in lean manufacturing companies were gathered and analysed using the partial least squares technique.

Findings – The results indicate that customer relationship, human resources and product design practices had positive indirect effects on job satisfaction through job characteristics, whereas, process and equipment practices had a negative indirect effect.

Practical implications – The findings of the study will be useful for the companies that implement lean manufacturing practices. Companies could either adjust their lean initiatives or make a trade-off amongst job characteristics.

Originality/value – This study contributes to the advancement of knowledge on the effects of lean manufacturing practices on job satisfaction through job characteristics.

Keywords Malaysia, Job satisfaction, Job characteristics, Lean manufacturing practices

Paper type Research paper

1. Introduction
Moving towards leanness is one of the essential strategies that assist organisations to get an edge over their rivals in this ever-changing competitive environment. The lean six sigma was defined by Snee (2010, p.10) as “a business strategy and methodology that increases process performance resulting in enhanced customer satisfaction and improved bottom line results”. The lean six sigma methodology aims to improve capability in an organisation, reduce production costs (Lee and Wei, 2010; Chen and Lyu, 2009) and maximise the value for shareholders by improving quality (Antony et al., 2003; Laureani and Antony, 2012) and,
consequently, satisfy the customers (Bhasin, 2013). Lean management is a managerial approach focused on enhancing customer value through the elimination of non-value adding steps from work processes (van Dun et al., 2017). Moreover, it eliminates waste in all phases of the order–delivery process (Chavez et al., 2015). There is widespread agreement about the decisive role that human resources play in achieving the goals of the lean six sigma (Bateman, 2005; Hines et al., 2008).

Much has been written about the advantages of lean manufacturing, including market share, revenue, profitability, customer satisfaction improvement and production cost reduction (Rao, 2002; Rao and Holt, 2005; Stock et al., 2006; Zhu et al., 2007). However, the principles of lean manufacturing are controversial from the perspective of human well-being (Jackson and Mullarkey, 2000; Seppälä and Klemola, 2004; Bonavia and Marin-Garcia, 2011).

Despite the several success stories associated with the lean concept, it has some shortcomings. For instance, Dove (1999) found that the leanness in itself leads to reduced flexibility and less ability to react to new conditions and circumstances. Furthermore, researchers of sociotechnical system orientation (Berggren, 1992; Koukoulaki, 2014) have pointed out that the continuous flow of production and lack of buffers are the two key lean manufacturing features that increase time pressure and stress. Although lean implementation efforts enable companies to increase time/cost efficiency, working under these lean principles has an effect on work quality because it restricts staff from expressing themselves. Meanwhile, lean manufacturing proponents (Treville and Antonakis, 2006; Marin-Garcia and Bonavia, 2015) suggest that the lean manufacturing makes employees more challenged, fulfilled and productive. Due to the nature of the process that requires employees to get engaged in a problem-solving process and improvement of the work flow, they feel more motivated to improve the manufacturing outcomes, as well as competitiveness (Seppälä and Klemola, 2004). Consequently, lean manufacturing may positively or negatively affect the employees’ job satisfaction. However, little, if any, research has been undertaken on the impacts of lean manufacturing practices on employees’ job satisfaction. Employee satisfaction is absolutely vital for the success of the company (Hines et al., 2008).

In Malaysia, employees’ turnover and productivity are referred to as the two major problems, specifically in the manufacturing sector. Based on the report of Jabatan Tenaga Kerja Semenanjung Malaysia (2010), between October 2008 and March 2010, a total number of 11,957 employees voluntarily left organisations. Referring to the statistics, the Malaysian manufacturing sector contributes the highest number to employee turnover, that is, 75 per cent of the total turnover. Iranmanesh et al. (2012) found that job satisfaction has a negative impact on turnover intention. In addition, the business has a much better chance of delivering positive customer experiences, developing and producing innovative products and services and, undoubtedly, achieving a better bottom line by understanding employee satisfaction. It is believed that employees who experience job satisfaction are also more likely to possess a positive self-concept and greater self-determination at work, which generates higher efficiency and effectiveness (Gagné and Deci, 2005).

The possible conflicts in practicing lean manufacturing with job satisfaction, high turnover rate in Malaysia and lack of study on the potential relationship between lean manufacturing practices and job satisfaction are the motivations for investigating the impact of lean manufacturing practices on job satisfaction through job characteristics. The findings of this study will fill a knowledge gap on the influence of lean manufacturing practices on job satisfaction.
2. Conceptual framework

Lean manufacturing with the primary purpose of waste elimination can be implemented in different areas of production in companies, such as factory management, product design, customer relations and supplier aspects (Bhuiyan and Baghel, 2005). Panizzolo (1998) conceptualised lean manufacturing with a number of its best practices representing different areas of the company. He divided lean practices into six areas, namely, process and equipment, manufacturing planning and control, product design, human resources, customer relationships and supplier relationships. The present study has applied the Panizzolo framework to have a precise assessment of the extent of implementation of lean practices in manufacturing companies.

Employees are one of the primary stakeholders who have a large impact on the firm (Galbreath, 2006). Along a similar line, one must not neglect the impact of job satisfaction on the overall business performance of the companies that can create large turnover amongst the staff (Lambert et al., 2001; Ton and Huckman, 2008). Job satisfaction refers to an attitudinal construct that reflects a person's job evaluation (Ilies and Judge, 2004). Parker (2003) stated that lean manufacturing affects job satisfaction. Through creating diversified work functions which require multi-skills and abilities, better teamwork, active involvement of employees in problem-solving and decision-making and continuous learning and growth (Jørgensen et al., 2007), the practice of lean manufacturing causes huge changes in work conditions, which may positively or negatively affect employees' job satisfaction.

The job characteristic model (JCM) was developed to provide a theoretical understanding of how these characteristics influence salient worker outcomes. Moreover, the model has been used to explain job satisfaction, job involvement, organisational commitment, absenteeism and turnover intent or actual turnover (Fried and Ferris, 1987; Hackman and Oldham, 1976; Tiegs et al., 1992). According to the JCM (Hackman and Oldham, 1976), from the employee's perspective, certain core features of the job affects psychological reactions to the job. Skill variety, task identity, task significance, autonomy and feedback are amongst five core job characteristics mentioned in this model.

The previous studies have revealed the power of job characteristics to explain the effects of a particular practice on workers' behaviour. Rousseau (1978) indicated that job characteristics largely accounted for the relationship between technology and organisational behaviour. The mediating role of job characteristics in relation to practices, such as JIT (Jackson and Martin, 1996) and temporary employment status (Parker et al., 2002), were later suggested (Parker et al., 2001). However, with the exception of one study by Jackson and Mullarkey (2000), the mediating role of job characteristics has not been explicitly examined in relation to lean manufacturing. In this study, the JCM has been used to explain the impact of lean manufacturing practices on job satisfaction (Figure 1). The next section will explore the rationale behind these relationships.

The current paper has identified practicing (years of lean manufacturing experience), employee's age and employment tenure as the three control variables. Different scholars investigated the role of these variables on lean manufacturing. The study of Wong et al. (2009) revealed the importance of years of lean manufacturing experience and employment tenure on lean manufacturing implementation. Likewise, Lee and Wilbur (1985) studied the positive relationship between age and job satisfaction. The outcome of their study points out that the increase of age enhances the level of job satisfaction.

Herzberg et al. (1957) found that both employee's age and tenure in the organisation have a U-shaped relationship with job satisfaction. According to their research, job satisfaction is high when people start their first job, but it, subsequently, declines until people reach their
late 20s or early 30s; then, it begins to increase again. Similarly, satisfaction drops within the first year of work and remains low for a number of years, after which it increases.

Figure 1 represents the proposed framework for investigating the effects of the lean manufacturing practices on job characteristics and, consequently, job satisfaction. The control variables selected for this framework were age, practicing, and employee tenure. The hypotheses have been, subsequently, developed in the next section.

3. Hypothesis development

It is believed that lean manufacturing creates a highly motivating environment (Marin-Garcia and Bonavia, 2015) through transferring the maximum number of tasks and responsibilities to the workers (Bouville and Alis, 2014). By providing guidelines, lean manufacturing assists the workers to understand how to carry out their tasks; meanwhile, training them helps them to independently solve the potential problems. Lean practices lead to having diversified work functions, which require multi-skills and abilities, an increase in employee engagement and commitment, better teamwork, active involvement of employees in problem-solving and decision-making and continuous learning and growth (Jegensen, 2008; Jegensen et al., 2007).

Although different researchers have distinctly discussed the effect of lean manufacturing practices on job characteristics, there is no universal agreement on the proposed relationship. Customer’s expectation is one of the variables that has caught extra attention in lean methodologies. Along a similar line, it has been proposed that, in addition to accurate prediction of customer demand, job design should allow firms to actively involve the customers in the process (Shah and Ward, 2007). Meanwhile, a strong relationship with suppliers is another undeniable factor in moving towards leanness (Sin et al., 2015). To probe deeper into the account, work characteristics should allow employees to provide suppliers with regular feedback on quality and delivery performance and, subsequently, provide training and development for further improvement (Shah and Ward, 2007).

Noticeably, human resource management plays a critical role in supporting leanness (Jørgensen et al., 2007). Training and career development may provide employees with more diversified work functions that require them to acquire various skills and abilities.
Consequently, it increases cross-functional and inter-organisational activities (Womack et al., 1990). Data from Lewis (2000) have identified that lean methodologies are the key elements of enterprise competitive advantage. Therefore, product design, production technology, organisational planning and business assist the companies to get an edge over their competitors and, correspondingly, influence job features.

In view of these findings and the logic of our model, the following hypotheses are developed to understand whether lean manufacturing practices affect job characteristics and if so, in what direction this will take place in the context of Malaysia:

\[ H1a. \] Customer relationship practices affect job characteristics.

\[ H1b. \] Human resources practices affect job characteristics.

\[ H1c. \] Manufacturing planning and control practices affect job characteristics.

\[ H1d. \] Product design practices affect job characteristics.

\[ H1e. \] Process and equipment process practices affect job characteristics.

\[ H1f. \] Supplier relationship practices affect job characteristics.

Job characteristics contribute to employee satisfaction, which leads to organisational efficiency (Bontis and Serenko, 2007). The meta-analysis and review performed by Parker (2003) supports the claim that core job characteristics can create positive employee attitudinal outcomes (Fried and Ferris, 1987; Parker and Slaughter, 1988). The research of Panzano et al. (2002) also supports the prediction that workers’ satisfaction, motivation and performance are high amongst individuals whose jobs are important in the five core job characteristics, as in the JCM. As such, the following hypothesis was developed in the present study:

\[ H2. \] Job characteristics significantly affect job satisfaction.

The main concern of lean production is waste elimination whilst paying attention to customer needs. Hence, to be lean, firms should reduce those resources that do not add value to the customers (Kinnie et al., 1998). Subsequently, good collaboration and partnership with both customers and suppliers are required for successful implementation of lean production (Prajogo et al., 2016). It is important to recognise that employees are required to be active, innovative, multi-skilled and continuously motivated to suggest improvements in the process and production methods. Yet other studies explored that employees’ job satisfaction in association with the supplier/customer relationship is dependent on the degree to which job characteristics provide them with new opportunities to develop themselves at work (Seppälä and Klemola, 2004). Another group of studies analysed that the key success of lean manufacturing programmes also lies in engaging employees in product design with planning, tooling design and tooling manufacturing phases (Nordin et al., 2010; Parker, 2003).

Berggren (1992) argued that employee participation in decision-making is limited to lean production. But, the review of literature found that the high degree of perceived satisfaction from participation in decision-making amongst employees encourages them to accept low autonomy and narrow job scopes (Adler, 1993; Ashforth, 1989). MacDuffie (1995) stated:

\[ \ldots \] workers will only contribute their discretionary effort to problem-solving if they believe their individual interests are aligned with those of the company, and that the company will make a reciprocal investment in their well-being.
This argument was made primarily by assertion and does not seem well grounded in empirical research. As in this study, the indirect effect of human resource practices on job satisfaction was empirically tested.

Research has also been carried out by Rousseau (1978) showing that job characteristics had a considerable amount of influence on the relationship between organisational structure and technology, and the individuals’ attitudes and behaviour (e.g. job satisfaction). Moreover, in other studies, the indirect or mediating role of job characteristics has been suggested (Parker et al., 2001; Jackson and Mullarkey, 2000). Temporary employment status (Parker et al., 2002) and practices such as JIT (Jackson and Martin, 1996) are amongst recommended areas. In addition to the studies described above, there are two exceptions by Jackson and Mullarkey (2000) and Parker (2003). In the mentioned studies, the mediating role of job characteristics on employee outcomes was not been explicitly examined in relation to lean manufacturing. The available evidence seems to suggest that they did not even consider job satisfaction as the essence of the JCM. Therefore, based on the above data, the following hypotheses have been developed:

- \( \text{H3a.} \) Customer relationship practices indirectly affect job satisfaction through job characteristics.
- \( \text{H3b.} \) Human resources practices indirectly affect job satisfaction through job characteristics.
- \( \text{H3c.} \) Manufacturing planning and control practices indirectly affect job satisfaction through job characteristics.
- \( \text{H3d.} \) Product design practices indirectly affect job satisfaction through job characteristics.
- \( \text{H3e.} \) Process and equipment practices indirectly affect job satisfaction through job characteristics.
- \( \text{H3f.} \) Supplier relationship practices indirectly affect job satisfaction through job characteristics.

### 4. Research methodology

#### 4.1 Measure of constructs

The questionnaire consisted of five sections: demographic information, information concerning the organisation, lean manufacturing practices, job characteristics and job satisfaction. The measurement items in the current study were adapted from previous studies to ensure content validity. The items for the lean manufacturing practices section were adapted from the studies of Shah and Ward (2007) and Panizzolo (1998). The items for the job characteristics section were adopted from the job diagnostic survey developed by Hackman and Oldham (1975). The items for job satisfaction were adopted from Macdonald and Macntyre’s study (1997). All of the items in the questionnaire were developed on a five-point Likert scale that ranged from score 1 for strongly disagree to score 5 for strongly agree. The detailed measurements and their sources of the principal constructs are shown in the Appendix.

#### 4.2 Data collection

This study used a survey questionnaire to collect the data. The database was obtained from the 2015 Federation of Malaysian Manufacturers (FMM), which consisted of electrical,
electronic, metal, plastic, rubber and automotive practitioners. Two criteria were used for
electing the sampling frame, which are indicated as follows: first, the firm had to belong to
the FMM and, second, the firm’s minimum number of employees had to exceed 150. Shah
and Ward (2003) pointed out that larger firms are more likely to implement lean practices.
Bhasin (2012) stated that larger companies have a higher degree of lean initiative
implementation than smaller companies.

According to the SME Corporation Malaysia (2010), the number of full-time
employees in large companies of Malaysia is more than 150. The decision-making in
this study was based on the studies conducted by Shah and Ward (2007) and Bonavia
and Marin (2006). The outcome of these studies shows that the small manufacturing
firms were less likely to implement lean manufacturing concepts because of certain
limitations and barriers.

The population for the present study comprised all of the employees in lean
manufacturing companies. Based on the random sampling, 20 lean manufacturing
companies were selected. A total of 1,000 questionnaires were distributed to the
respondents. The respondents were given three weeks to complete the questionnaire. A
telephone call, which served as a reminder, was made to the respective human resource
managers at the end of the second week. By the end of the third week, 212 responses
were collected, and amongst them six responses had only been partially completed.
Hence, there was a total of 206 responses representing a response rate of approximately
21.2 per cent, which was considered to be reasonable as this rate fell within the range of
34.0 per cent (Buch and Tolentino, 2006) and 12.5 per cent (Antony et al., 2007). In
addition, in the study by Ahmed and Hassan (2003), the response rate of 11.5 per cent
was obtained in Malaysia.

4.3 Analysis
The structural equation modelling technique of partial least squares (PLS) was applied
to test the research model using SmartPLS 3. PLS is the preferred method when the
research objective is prediction (Hair et al., 2011), which matches with the objectives of
the current paper. The two-step approach was used in the data analysis as suggested by
Hair et al. (2013). The first step involved the analysis of the measurement model, and
the second step tested the structural relationships amongst the latent constructs (e.g.
Nikbin et al., 2015; Fathi et al., 2016; Zailani et al., 2015). The two-step approach
established the reliability and validity of the measures before assessing the structural
relationship of the model.

5. Results
5.1 Sample
The final sample consisted of 206 employees in lean manufacturing companies. The
majority of the respondents are male at 63.1 per cent, and 36.9 per cent are female. A total of
34 per cent are single, and 66 per cent are married. Most (52.4 per cent) of the respondents
had practiced lean manufacturing for less than six years, followed by 29.1 per cent who had
practiced lean manufacturing for more than 15 years and 18.4 per cent between 6 and 10
years. In terms of the academic qualifications of the respondents, the sequence in descending
order is bachelor’s degree (79.6 per cent), master’s degree (13.6 per cent), certificate/diploma
(4.8 per cent), PhD/doctorate (1.0 per cent) and secondary school (1.0 per cent).
Approximately 46.6 per cent of respondents are attached to the production department, 33
per cent in research and development, 11.7 per cent in planning, procurement and logistics,
5.8 per cent from IT, finance and administrative, 1.9 per cent from sales and marketing and 1 per cent from other departments.

5.2 Measurement model results

Reflective measurement models should be assessed in connection with their reliability and validity. Internal reliability was assessed via composite reliability (CR). All the CR values for the constructs exceed the recommended 0.7 (Hair et al., 2010). Individual item reliability was examined by measuring the factor loadings of each item on its corresponding construct. The standardized factor loadings ranged from 0.621 to 0.939 (Table I). Hair et al. (2010) suggested accepting items with loadings of at least 0.6. Given that the loadings associated with each of the scales were all greater than 0.6, individual item reliability was considered acceptable. For convergent validity, the average variance extracted (AVE) should be examined; AVE values of 0.5 and higher imply that the latent construct explains more than half of its indicators’ variance. Table I shows that all the AVE values exceeded the threshold of 0.5, signifying a satisfactory degree of convergent validity (Fornell and Larcker, 1981).

We then proceeded to test the discriminant validity of the constructs by using two approaches (e.g. Zailani et al., 2016; Gilani et al., 2017; Iranmanesh et al., 2017). First, the cross-loadings of the indicators were examined, which revealed that no indicator loaded higher on an opposing construct (Hair et al., 2012). Second, following the criterion of Fornell and Larcker (1981), each construct’s square root of AVE exceeded the intercorrelations of the construct with the other constructs in the model (Table II). Both analyses confirmed the discriminant validity of all constructs.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Items</th>
<th>Factor loadings</th>
<th>CR</th>
<th>Cronbach’s alpha</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer relations</td>
<td>4</td>
<td>0.805-0.893</td>
<td>0.915</td>
<td>0.878</td>
<td>0.730</td>
</tr>
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<td>Human resources</td>
<td>4</td>
<td>0.727-0.898</td>
<td>0.893</td>
<td>0.866</td>
<td>0.677</td>
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<tr>
<td>Manufacturing, planning and control</td>
<td>3</td>
<td>0.826-0.896</td>
<td>0.899</td>
<td>0.831</td>
<td>0.749</td>
</tr>
<tr>
<td>Product design</td>
<td>4</td>
<td>0.736-0.939</td>
<td>0.935</td>
<td>0.905</td>
<td>0.784</td>
</tr>
<tr>
<td>Process and equipment</td>
<td>5</td>
<td>0.712-0.837</td>
<td>0.875</td>
<td>0.886</td>
<td>0.584</td>
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<tr>
<td>Supplier relationship</td>
<td>3</td>
<td>0.621-0.849</td>
<td>0.782</td>
<td>0.662</td>
<td>0.548</td>
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<tr>
<td>Job characteristics</td>
<td>9</td>
<td>0.703-0.842</td>
<td>0.932</td>
<td>0.921</td>
<td>0.603</td>
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<td>Job satisfaction</td>
<td>6</td>
<td>0.650-0.916</td>
<td>0.921</td>
<td>0.902</td>
<td>0.665</td>
</tr>
</tbody>
</table>

**Table I.** Results of testing convergent validity and reliability

**Notes:** CR = composite reliability; AVE = average variance extracted

<table>
<thead>
<tr>
<th>Constructs</th>
<th>CR</th>
<th>HR</th>
<th>JC</th>
<th>JS</th>
<th>MPC</th>
<th>PD</th>
<th>PE</th>
<th>SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer relations</td>
<td>0.854</td>
<td></td>
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<tr>
<td>Human resources</td>
<td>0.402</td>
<td>0.823</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Job characteristics</td>
<td>0.514</td>
<td>0.595</td>
<td>0.776</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>0.308</td>
<td>0.433</td>
<td>0.616</td>
<td>0.815</td>
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<tr>
<td>Manufacturing, planning and control</td>
<td>0.221</td>
<td>0.665</td>
<td>0.399</td>
<td>0.236</td>
<td>0.865</td>
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<tr>
<td>Product design</td>
<td>0.355</td>
<td>0.682</td>
<td>0.552</td>
<td>0.383</td>
<td>0.630</td>
<td>0.885</td>
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<tr>
<td>Process and equipment</td>
<td>0.517</td>
<td>0.646</td>
<td>0.387</td>
<td>0.198</td>
<td>0.663</td>
<td>0.613</td>
<td>0.764</td>
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<tr>
<td>Supplier relationship</td>
<td>0.405</td>
<td>0.684</td>
<td>0.432</td>
<td>0.468</td>
<td>0.562</td>
<td>0.642</td>
<td>0.507</td>
<td>0.740</td>
</tr>
</tbody>
</table>

**Table II.** Discriminant validity using AVE

**Note:** Diagonals (in italic) represent square root of the AVE
5.3 Assessment of the structural model

With the satisfactory results in the measurement model, this study subsequently evaluated the structural model to confirm the relationships among the constructs via the PLS method. The explanatory power of the research model was examined in terms of the portion of variance explained (see Nikbin et al., 2014; Soltanian et al., 2016; Kurniawan et al., 2017). The results suggested that the model is capable of explaining 41.6 per cent of the variance in job satisfaction and 50.3 per cent in job characteristics. Besides estimating the magnitude of $R^2$, researchers have recently included predictive relevance, which was developed by Stone (1974) and Geisser (1975), as an additional model fit assessment. This technique represents the model adequacy to predict the manifest indicators of each latent construct. The Stone–Geisser $Q^2$ (cross-validated redundancy) was computed to examine the predictive relevance using a blindfolding procedure in PLS. Following the guidelines suggested by Chin (2010), a $Q^2$ value of greater than zero implies that the model has predictive relevance. In the present study, a value of 0.286 was obtained as an average cross-validated redundancy (for both endogenous variables), which is far greater than zero. In sum, the model exhibits an acceptable fit and high predictive relevance.

We applied nonparametric bootstrapping (Wetzels et al., 2009) with 2,000 replications to test the structural model (e.g. Yusof et al., 2016; Nikbin et al., 2016; Kamal et al., 2016). The significance and relative strength of direct effects specified by the research model were evaluated (Table III). Except two paths ($H1c$ and $H1f$), all the paths are significant. The results indicate that the effects of customer relation practices ($\beta = 0.429, p < 0.01$), human resource practices ($\beta = 0.460, p < 0.01$) and product design practices ($\beta = 0.289, p < 0.01$) on job characteristics are significant and positive. By contrast, the effect of process and equipment ($\beta = -0.292, p < 0.05$) on job characteristics is significant and negative. Job

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Relationship</th>
<th>Path coefficient</th>
<th>Decision</th>
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<tr>
<td><strong>Direct effect</strong></td>
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<td>$H1a$</td>
<td>CR $\rightarrow$ JC</td>
<td>0.429***</td>
<td>Supported</td>
</tr>
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<td>$H1b$</td>
<td>HR $\rightarrow$ JC</td>
<td>0.460***</td>
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<td>MPC $\rightarrow$ JC</td>
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<td>$H1d$</td>
<td>PD $\rightarrow$ JC</td>
<td>0.289***</td>
<td>Supported</td>
</tr>
<tr>
<td>$H1e$</td>
<td>PE $\rightarrow$ JC</td>
<td>$-0.187$</td>
<td>Not supported</td>
</tr>
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<td>$H1f$</td>
<td>SR $\rightarrow$ JC</td>
<td>0.593***</td>
<td>Supported</td>
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<td>$H2$</td>
<td>JC $\rightarrow$ JS</td>
<td>0.254***</td>
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<td>0.273***</td>
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<table>
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<th>Control variables</th>
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</tr>
<tr>
<td>Practicing $\rightarrow$ JS</td>
<td>0.112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee Tenure $\rightarrow$ JS</td>
<td>$-0.049$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** $t$-values are computed through the bootstrapping procedure with 206 cases and 2,000 samples; $*p < 0.05$; $**p < 0.01$ (two tail)
characteristics \((\beta = 0.593, p < 0.01)\) are also positively significant towards job satisfaction. As such, \(H1a, H1b, H1d\) and \(H2\) are supported, whereas \(H1c, H1e\) and \(H1f\) are not.

Bootstrapping procedure was used to test the indirect effects (Hayes, 2009). The \(t\)-values for the indirect effect were obtained by dividing the indirect effect \((ab)\) by the standard error (SE) of the indirect effect. The SE is the standard deviation of the repeated bootstrap estimates of the indirect effect. Table III shows that all the \(t\)-values of the indirect effects, except the \(t\)-values of \(H3c\) and \(H3f\), are greater than 1.96 and significant. The results indicate that the effects of customer relation practices \((\beta = 0.254, p < 0.01)\), human resource practices \((\beta = 0.273, p < 0.01)\) and product design practices \((\beta = 0.171, p < 0.01)\) had a positive significant indirect effect on job satisfaction through job characteristics. By contrast, process and equipment \((\beta = -0.173, p < 0.05)\) had a negative significant indirect effect on job satisfaction through job characteristics. Therefore, the results supported \(H3a, H3b, H3d\) and \(H3e\).

6. Discussion and implications

This study evaluates the impact of lean manufacturing strategies on the satisfaction of workers. The findings indicate that job characteristics had a positive effect on job satisfaction amongst the manufacturing practitioners in Malaysia. From the theoretical perspective, this finding empirically proves the nature of Hackman and Oldham’s (1976) JCM, in which the core job characteristics (i.e. autonomy, skill variety, task identity, task significance and feedback) would eventually contribute to work outcomes, such as job satisfaction. From the empirical perspective, the result is parallel to the studies conducted by Panzano et al. (2002) and Bontis et al. (2007). Individuals who are provided more job autonomy and skill utilisation are more likely to have a higher level of satisfaction. In addition, having favourable job characteristics motivates staff to actively engage in the job and leads to an increase in job satisfaction and, respectively, their performance. However, job characteristics would define job satisfaction as having a job with favourable features that directly reduces the turnover intention rate Samad (2006). Understanding the positive effect of job characteristics on job satisfaction is quite important in the context of Malaysia, where 36,392 employees in the manufacturing sector are involved in the job turnover, according to Jabatan Tenaga Kerja Semenanjung Malaysia (2010).

According to the finding of this research, process and equipment practices had a negative effect on job satisfaction through job characteristics. Nordin et al. (2010) pointed out that process and equipment practices, extremely restrict both the autonomy and skill utilisation of the employees. Workflow formalisation and standardisation are the two fundamental mechanisms of process and equipment practices that pertain to all the operative stages from upstream to downstream levels (Lamming, 1993; Jørgensen et al., 2007; Panizzolo, 1998). As process standardisation restricts employee autonomy for participation and results in a high level of stress regarding the timely completion of the task, the lean process and equipment practices are more likely to negatively influence the employee. According to Parker (2003), lean practices amplify different consequences, depending on the degree that the nature of the manufacturing area allows firms to standardise its elements. This situation is caused by the fact that process and equipment standardisations make the job more specified and predetermined. Theoretically, the motivational effects of “ideal” and “too’ lean implementations are different. Recognising the two-edged nature of leanness can help to prevent the motivational and ethical pitfalls, which are inherent in the searching process for greater efficiency (Treville and Antonakis, 2006). Therefore, companies should consider the negative effect of high standardisation on employees’ job satisfaction whilst employing process and equipment practices.
Moreover, the results indicate that human resource practices had a positive effect on job satisfaction through job characteristics. Human resource is considered as a vital element in moving towards the improvement in lean manufacturing. Job design characteristics over employee participation, involvement and innovation result in job enlargement, cross-training and challenges (Womack et al., 1990). In particular, moving towards the “minimal critical specifications” and removing “boundaries” are the two solutions in promoting employee motivation, involvement and empowerment. The mentioned practices would result in an increase in task identity and meaningfulness of the work (Panizzolo, 1998; Jørgensen et al., 2007). In addition, assessment is another human resource lean practice that not only identifies technical opportunities for improvement but also provides employees with feedback as a response to deviation from the organisational norms (Doolen and Hacker, 2005; Karlsson and Åhlström, 1996). When companies implement human resource lean practices that are matched with organisational and environmental contingencies, these processes would effectively influence employees’ outcomes as a result of an increase in the participation and involvement of the employees (Womack et al., 1990; Panizzolo, 1998). Considering that Malaysia suffers from a shortage of skilled manpower, executing any human resource programme would improve employees’ skills. Therefore, companies should bridge between individual interests and organisational goals to successfully implement lean principles.

Another valuable outcome of this study indicates that product design and customer relationship practices had positive effects on job satisfaction through job characteristics. Richards (2010) referred to the increase in employee involvement through their participation in the decision-making process as one of the benefits arising from lean practices. As an example, process improvement teams were designed to help them improve products and increase value for their customers. As such, product design and customer relationship provide higher job authority and cause higher employee involvement in decision-making. Apparently, employees’ involvement in implementation of the process improvement programmes will lead them to receive greater appreciation on what they basically perform on the bottom line of the business. Therefore, companies should consider the positive value of product design and customer relationship practices on job satisfaction to strengthen the advantages of lean practices towards employee job satisfaction improvement.

According to the results, it also can be concluded that manufacturing, planning and control practices and human resource processes have no effect on job characteristics and job satisfaction. On one hand, implementing lean methods, such as supplier management and levelling the production schedule, reduces the variability in performance because of the reduced chance of worker error. On the other hand, these practices negatively affect the employee as the work is extremely simplified. Another potential reason for the insignificant effect of these two actions is the lowering of the level of adoption more than with other lean manufacturing practices as stated by Panizzolo (1998), which would suggest that these two practices are only adopted to a limited extent in the context of Malaysia.

In terms of the theoretical contribution, this study is the first to empirically investigate the effects of lean manufacturing practices on job satisfaction through job characteristics. Several researchers (Babson, 1993; Delgado et al., 2010; Parker, 2003) observe lean manufacturing as having negative consequences for employees’ and their job quality; but, others (Jørgensen et al., 2007; Richards, 2010) consider lean manufacturing as an approach for achieving world-class performance in humane ways with positive effects on the employees. The results of this study have demonstrated that some of the lean manufacturing practices had negative effects on job satisfaction (e.g. process and equipment), whereas others had positive effects (e.g. customer relationship, human
resources and product design). From the managerial point of view, the findings introduce a degree of caution to those companies that implement lean manufacturing practices. This warning has received much attention for those firms that prioritise employee outcomes, such as mental/physical health, self-efficacy, satisfaction and commitment. According to Axtell et al. (2000) and Mathieu and Zajac (1990), psychological strain might influence the long-term performance consequences, including contextual performance, turnover and innovation. Therefore, companies should consider the consequences of lean initiatives on every single aspect of job characteristics if they aim at pursuing psychological strains. Companies could either adjust their lean initiatives or make a trade-off amongst the job characteristics.

7. Limitations
Like any other study, this paper comes with some limitations that must be pointed out. First, the data were collected at a single point in time; hence, considering the cross-sectional nature of the study, the findings only reflect the situation at a particular point regarding the relationship between lean practices and job characteristics or “job”. For that reason, a longitudinal study should be attempted to examine lean practices in a manufacturing firm for an extended period of time. Second, this research did not differentiate companies with different manufacturing strategies (i.e. make to order and assemble to order). In addition, this study used a survey sample limited to the employees of Malaysian Manufacturers. However, the impact of lean manufacturing practices on employees’ job satisfaction might be different between countries. Thus, future research could test the proposed theoretical model of this study in different countries. Furthermore, the lean practices were identified in this paper with reference to the frequency of areas in the literature. Today, there are numerous available lean practices that are continuously evolving; hence, other areas of lean practice that might have a significant effect on job satisfaction must be considered. The potential moderating factors that may minimise the negative impact of process and equipment practices on job characteristics should be investigated in the future studies.

8. Conclusion
Although managers refer to human resources as the companies’ vital assets, the effects of lean manufacturing practices on employees’ job satisfaction as of yet remain unclear. Respectively, to enhance employees’ satisfaction and their performances, it is key to understand the impact of lean manufacturing strategies on the satisfaction of workers. Based on the outcomes of our research, it is evident that customer relationship, human resource and product design practices had positive indirect effects on job satisfaction through job intensity, whereas process and equipment practices had a negative indirect effect.

References


Herzberg, F., Mausnes, B., Peterson, R.O., and Capwell, D.F. (1957), “Job attitudes; review of research and opinion”.


Lean manufacturing practices


**Further reading**


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### Appendix

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Measurement items (1-5 Likert scale)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer relations</td>
<td>We are in close contact with our customers</td>
<td>Shah and Ward (2007)</td>
</tr>
<tr>
<td></td>
<td>Our customers are actively involved in product design development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our customers frequently share current and future demand information with marketing department</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our customers frequently give us feedback on quality and delivery performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In my firm, we have expansion of autonomy and responsibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In my firm, workers are involved in continuous improvement efforts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In my firm, shop floor employees are key to problem-solving teams</td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>Planning and scheduling strategies</td>
<td></td>
</tr>
<tr>
<td>Product design</td>
<td>Lot size reduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>My firm do implement parts standardization</td>
<td>Panizzolo (1998)</td>
</tr>
<tr>
<td></td>
<td>My firm do implement product modularization</td>
<td></td>
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<td></td>
<td>My firm do implement design for manufacturability</td>
<td></td>
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<tr>
<td></td>
<td>My firm has multifunctional design teams</td>
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<tr>
<td>Process and equipment</td>
<td>Total preventive maintenance (TPM)</td>
<td>Panizzolo (1998)</td>
</tr>
<tr>
<td></td>
<td>Continuous flow of production</td>
<td>Shah and Ward (2007)</td>
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<tr>
<td></td>
<td>Order and cleanliness (GS)</td>
<td></td>
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<tr>
<td></td>
<td>Error proofing techniques/Pokayoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>New process equipment or technologies</td>
<td></td>
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<tr>
<td>Supplier relationship</td>
<td>Our key suppliers are directly involved in new product development process</td>
<td></td>
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<tr>
<td></td>
<td>We take active steps to reduce the number of suppliers in each category</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our key suppliers are located in close proximity to our plant</td>
<td></td>
</tr>
<tr>
<td>Job characteristics</td>
<td>My job allows me the opportunity to complete the work I start</td>
<td>Hackman and Oldham (1975)</td>
</tr>
<tr>
<td></td>
<td>While performing my job I get the opportunity to work on many interesting projects</td>
<td></td>
</tr>
<tr>
<td></td>
<td>My job is arranged so that I have a chance to talk with customers/clients/end users</td>
<td></td>
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<tr>
<td></td>
<td>My job has the ability to influence decisions that significantly affect the organization</td>
<td></td>
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<td></td>
<td>My job provides me with the opportunity to both communicate with my supervisor and to receive recognition from them as well</td>
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<tr>
<td></td>
<td>My job is arranged so that I have an understanding of how it relates to the business mission</td>
<td></td>
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<tr>
<td></td>
<td>My job influences day-to-day company success</td>
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<tr>
<td></td>
<td>I am able to act independently of my supervisor in performing my job function</td>
<td></td>
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<tr>
<td></td>
<td>I receive feedback from my co-workers about my performance on the job</td>
<td></td>
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<tr>
<td>Job satisfaction</td>
<td>I believe management is concerned about me</td>
<td>Macdonald and Machtyre (1997)</td>
</tr>
<tr>
<td></td>
<td>I believe work is good for my physical wealth</td>
<td></td>
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<tr>
<td></td>
<td>My wages are good</td>
<td></td>
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<tr>
<td></td>
<td>All my talents and skills are used at work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I get along with my supervisors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I feel good about my job</td>
<td></td>
</tr>
</tbody>
</table>

**Table AI.**

Measurement of constructs