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The Impact of Manufacturing Strategy Dimensions on JIT Practices in Some of the Egyptian Companies

Abstract

Just-in-Time (JIT) practices have long been, and continue to be, a topic of great interest in the literature and practice of operations strategy and the link between manufacturing strategies remains incomplete. This research aims to examine the impact of four dimensions of the manufacturing strategy namely, achievement of functional integration, formal planning of manufacturing strategy, the link between manufacturing strategy and business strategy, and the anticipation of new technology and three JIT practices: the setup time reduction, the use of Kanban system, and the daily schedule adherence. Data were collected through a questionnaire on a sample of 25 Egyptian industrial companies from 233 managers with a response rate of 82.40 %.The statistical methods; factor analysis, descriptive analysis, and multiple regressions were applied to examine four hypotheses.The results revealed that not all the hypotheses were supported. Implications for theory and practice were discussed and possible directions for future research are presented.

Keywords: *Manufacturing Strategy Dimensions MSD, Just in Time JIT,Achievement of Functional Integration AFI, Formal planning of manufacturing strategy FPMS*

ملخص البحث

تسعي الدراسة الحالية إلى التعرف على تأثير أربعة أبعاد لإستراتيجية التصنيع (تحقيق التكامل الوظيفي والتخطيط الرسمي لإستراتيجية التصنيع والربط بين إستراتيجية التصنيع واستراتيجية الأعمال وتوقع التكنولوجيا الجديدة) على تخفيض وقت التهيئة لتجهيز وإعداد الماكينات، واستخدام نظام كانبان، والالتزام بجدول الإنتاج اليومي باعتبارهم أكثر الممارسات الشائعة لتطبيق JIT في أنظمة التصنيع.

وفي ضوء الدراسات السابقة قام الباحث بتطوير أداة الدراسة لغرض جمع البيانات من مفردات عينة الدراسة، وقد طبقت الدراسة على عينة قوامها25 شركة صناعية مصرية من 233 مديرا بمعدل استجابة 82.40٪. واستخدم تحليل الانحدار المتعدد لاختبار فرضيات الدراسة وتوصلت إلى عدد من النتائج أهمها- : أكدت نتائج التحليل وجود تأثير إيجابي بين جميع أبعاد إستراتيجية التصنيع: تحقيق تكامل الوظيفي والتخطيط الرسمي لاستراتيجية التصنيع والربط بين استراتيجية التصنيع واستراتيجية الأعمال وتوقع التكنولوجيا الجديدة على تخفيض وقت التهيئة لتجهيز وإعداد الماكينات لإنتاج منتج آخر. أشارت نتائج الدراسة إلى وجود تأثير إيجابي بين تحقيق التكامل الوظيفي والربط بين استراتيجية التصنيع واستراتيجية الأعمال وتوقع التكنولوجيا الجديدة التصنيع باستثناء التخطيط الرسمي لإستراتيجية التصنيع على استخدام نظام كانبان لإبلاغ المورد أو المركز بإرسال كمية من مادة ما، وتجهيز كمية أخرى من تلك المادة. كما أشارت نتائج التحليل تحقيق التكامل الوظيفي واستباق التكنولوجيا الجديدة يؤثران إيجابًا على الالتزام بالجدول اليومي. أظهرت النتائج أنه لم يتم دعم جميع الفرضيات.

بناءً على نتائج البحث، هناك مساهمات مختلفة مقدمة على مستوى النظرية والتطبيق والجوانب الإدارية. أولاً: سلط البحث الضوء على أهمية الجوانب النظرية في مجال استراتيجية التصنيع لدعم الإطار المفاهيمي للنموذج المقترح. ثانياً: ركزت الدراسة على أبعاد إستراتيجية التصنيع التي كان لها الأثر الأكبر في تطبيق ممارسات JIT في بعض الشركات الصناعية المصرية. وأخيرا، على المستوى الإداري: تم تحليل العديد من الآثار المترتبة على تنفيذ هذا النموذج في بيئة أخرى، وتمت مناقشة بعض التوصيات والتوجيهات الممكنة للبحوث المستقبلية

1. Introduction

The management literature ignored the importance of manufacturing strategy and it has begun to gain the attention of researchers after the work provided by Skinner in 1969 (Ocampo and Clark 2015). MS became a part of a company's strategy and it has its effect on the pattern of taking the strategic decisions, and the actions required for realizing the plant's objectives in the industrial companies (Jia and Bai 2011). During the last two decades, large number of researchers concentrated on exploring the content of the manufacturing strategy and a few studies focused on investigating the dimensions of manufacturing strategy (Löf-ving, Säfsten, and Winroth 2014). Abdallah and Matsui (2007) mentioned that the relationship between JIT practices and MS is rarely debated in the literature and there were two studies only made by (Sakakibara, Flynn, Schroeder, and Morris 1997; Ahmad, Schroeder, and Sinha 2003). Moreira and Alves (2008) stated that several studies have been conducted in some of developed countries such as United States, United Kingdom, Japan, and Canada. Later other studies have been conducted in some developing countries such as Mexico, Egypt, Ghana, India, Malaysia, Jordan, and Saudi Arabia. However, compared to other parts of the world, the empirical studies are considered very limited particularly in Egypt (Salaheldin 2005; Hashim 2010). Manufacturing companies are searching for new ways to optimize their manufacturing practices in today's fast changing market and found that manufacturing function has been changed because of it's influenced by adopting new philosophy called JIT (Chen and Tan 2013 ; Khaireddin, Abu Assab, and Nawaf-leh 2015; Patil, Narkhede, and Akarte 2012a,2016b; Phogat and Gupta 2017). In many of the aforementioned studies, the relationship between MSD and JIT practices have not received much attention in manufacturing strategy research.This supports the need for further testing and replication the research in the field of manufacturing strategy (Grant 2013) .This gap in the literature is more profound in Egypt.The current research intends to rely on contingent perspective to provide a finer-grained understanding of MSD taken into consideration their impact on JIT practices. MSD are hypothesized as an integration of four dimensions of manufacturing strategy, namely, achievement of functional integration, formal planning of manufacturing strategy, the linkage between manufacturing and business strategy and anticipating of new technology to highlight their impact on JIT practices in some Egyptian manufacturing companies. For this, **this research seeks to answer the following questions:**

1-Do the manufacturing strategy dimensions significantly impact on set uptime reductions in the research sample?

2-Do the manufacturing strategy dimensions significantly impact on using the kanban system in the research sample?

3-Do the manufacturing strategy dimensions significantly impact on the adherence of the daily schedule in the research sample?

The following section will provide the literature review on the conceptualizations of both of the MSD and JIT, prior that studied the link between each of the four MSD and JIT practices.

This is followed by a description of the research methodology, data analysis and the discussion of the research results.The current research concludes the implications for managers and the directions for future research.

2. Literature Review

Since early 1980, some practitioners and researchers such as (Sakakibara et al. 1997; Ahmad et al. 2003; Phan and Matsui 2006; Hashim 2010; Hou, Chan, and Wang 2011; Yuan 2015; Al Haraisa 2017) discussed the importance of JIT practices as a powerful tool to achieve the continuous improvement in all phases of manufacturing processes.

2.1 Conceptualization of the Manufacturing Strategy Dimensions

Based on an extensive review of MS, pioneer scholars defined it with some variations (Aboutalebi 2016). For example, MS is defined from the production perspective as a function to create a competitive advantage (Skinner 1969). Hill (1989) believed that it is a systematic process required for supporting production departments to achieve higher performance. The work provided by McGrath and Hoole (1992) revealed that there was no formal MS at all; only a series of manufacturing decisions made at different times and found a poor match between MS and business strategy. Prior researches such as (Schroeder et al. 1986; Miller and Hayslip 1989) focused on developing the link between corporate, manufacturing and business strategies to achieve the corporate objectives (Jia et al. 2011; Wang, Chen, and Wang 2016). The review of the extant literature on MSD pointed out the most common dimensions in the absence of clear universal determinants (Grant 2013). Aboutalebi (2016) reported that less number of relevant publications regarding MSD has been made in recent time. For example, Ahmad et al. (2003) suggested four MSD namely, MS strength, communication of manufacturing strategy, formal planning of manufacturing strategy, and the link between manufacturing and business strategy.Dangayach and Deshmukh (2004a, 2006b) suggested four dimensions namely, functional integration of manufacturing, formal planning alignment of manufacturing with business units, communication of MS and developing proprietary of manufacturing equipment. Abdallah et al. (2007), Nayebzadeh (2010) and Garrido-Vega, Ortega Jimenez,Díez Pérez, and Morita (2015) are consistent in four MS dimensions namely, anticipating new technology, the link between manufacturing and business strategy, formal planning of manufacturing strategy and the communicating with manufacturing strategy, except for proprietary equipment, and achievement of functional integration. While, the work of Thun (2008) focused on the integration between manufacturing strategy dimensions and supported the link between MS and business strategy of the corporation. Amoako-Gyampah and Acquaah (2008) and Patil et al. (2012a, 2016b) suggested four dimensions namely, competitive force to manufacturing strategy, functional integration, formal planning of manufacturing strategy, communication with manufacturing strategy, and integrating manufacturing strategy within business strategy. However, the finding from Abdallah et al. (2007)

posited that formal planning of manufacturing strategy is considered as one of the important dimension to measure MSD.The results of Ocampo et al. (2015) are consistent with the findings of Dombrowski, Intra, Zahn, and Krenkel (2016) and Shavarini, Salimian, Nazemi, and Alborzi (2013) to support the role of plant manager in preparing the formal manufacturing plan to be consistent with the corporate strategy, to be aware of MS, and to facilitate translating it into the manufacturing strategy. Meanwhile, few researches such as (e.g., Pisano 1996; Pun 2004; Hallgren and Olhager 2006) studied the influence of MS on achieving the objectives of both of the corporate strategy and the other functional divisions.

The review of the extant literature on anticipating new technology as one of MSD, Saukkonen, Vasamo, Ballard, and Levie (2016) concluded that anticipating technology as a strategic action was started in the 1960 by large corporations in the field of technology such as Motorola company. Matsui (2002) found manufacturing strategies have positive and significant impact on developing new technologies. Hallgren (2007) is consistent with Ward et al. (1996) who concluded that MS can assist the plant manager to understand the manufacturing capabilities and to determine the essential investments matching with the corporate objectives. Finger, Flynn, and Paiva (2014) found a significant impact of anticipating new technology on the firm's ability to provide its manufacturing needs in advance and to think of the next generation of manufacturing technology. Saukkonen et al. (2016) stated that today, the industrial companies are forced to re-examine their process for improving product quality and reducing the cost of production faster than their competitors by adopting new manufacturing technology. Adopting JIT manufacturing and integrating the manufacturing strategies can improve the operational performance (Fullerton and McWatters 2001; Singh and Ahuja 2012).

2.2 Conceptualization of JIT Practices

From a theoretical perspective, Monden (1981) was the first who provided a thorough overview of JIT philosophy including Kanban system, and setup time reduction (Ahmed et al. 2003). While, Singh and Ahuja (2014) reported that JIT started by Bicheno (1987) who defined it as a system of production control for achieving perfection in a manufacturing system. JIT manufacturing has become one of the most research topics in the area of operations management and there is different conceptuality in the extant literature (Mackelprang and Nair 2010). For example, Upton (1998) defined JIT as a managerial philosophy, while other researchers such as (Flynn, Sakakibara, and Schroeder 1995; Shah and Ward 2003) defined JIT as a set of practices that should be used in manufacturing systems to improve the processes. Egyptian manufacturing companies consider JIT as a strategic philosophy, not as a temporary solution for dealing with the operational problems (Hashim 2010). JIT is considered the lost time between the productions of the last item until the production of the new item is made (Fateha, Nafrizuan, and Razlan 2012). JIT is a philosophy of manufacturing that helps to eliminate both of the waste-over production, ineffective processing, and to reduce the setup time (Chen et al. 2013; Van Wyk and Naidoo 2016).

Prior researchers argued the key elements that needed to implement JIT practices in manufacturing system. Sakakibara, Flynn, and Schroeder (1993) suggested layout of equipment, producing based on a pull system, and a Kanban system. Flynn, Schroeder, Flynn, Sakakibara, and Bates (1997) linked between a kanban system, JIT scheduling and manufacturing performance. Meanwhile, Swink, Narasimhan, and Kim (2005) concluded several key elements of JIT practices that reported in many researches. For instance, small lot size, production scheduling, and setup time reduction (Flynn et al. 1995); lot size, setup time reduction, and production flow (Shah et al. 2003). Kootanaee, Babu, and Talari (2013) reported that the prime motivating factor for the plant managers is to avoid delays in the production schedule, and to use a Kanban system in order to link the different production processes together. Obamiro (2009) found positive relationship between production schedule, and manufacturing performance. Cua, McKone, and Schroeder (2001) found positive relationship between reducing setup times, adherence of daily schedule and time needed to deliver quality products to customers. Ahmad, Mehra, and Pletcher (2002) found positive relationship between production strategy, setup time reduction, and Kanban system. Results of Shah et al. (2003) found significant positive relationship between operational performance at the level of the plants and Kanban system, scheduling planning. Abdallah et al. (2007) investigated the impact of MSD on production scheduling, and reducing setup times. Diaz and Ardalan (2010) showed that production systems have significant and positive relationship with the average of setup times per operation and a kanban system has the highest significant impact on the stability of the master production schedule. Khaireddin et al. (2015) found positive impact of improving strategic performance and adherence of daily schedule, layout of equipment, and reducing setup time. The results of A-Zu'bi (2015) showed setup time reduction explained (59.64%) of the variance for improving flexibility of plant performance. According to Singh et al. (2012) reducing setup times, using Kanban system, and eliminating equipment downtime should be enough to ensure the stability of production schedule. Mackelprang et al. (2010) concluded the most JIT practices widely used in some of previous literature (e.g., Flynn et al. 1995a, 1997b; Fullerton et al. (2001); Challis et al. (2005); Matsui 2007) namely reduction setup times, then daily schedule adherence and Kanban system. Phan and Matsui (2010) suggested the more popular JIT elements for smoothing production flow, completing the daily schedule as time planned, and minimizing the variations in the daily workload are setup time reduction, and daily production schedule. This result contradicted with the findings of Salaheldin (2005) who revealed that in Egyptian companies, the least important element in JIT practices was to work overtime to complete daily schedules. Motwani (2003); Qureshi, Iftikhar, Bhatti, Shams and Zaman (2014); Al Haraisa (2017) found the most critical elements of JIT practices namely, setup time reduction, and using a Kanban system. Based on the above literature which argues that the common JIT practices are composed of three sub-constructs including setup time reduction, Kanban system and daily schedule adherence. The current study will depend on these three JIT practices.

2.3 Research Framework

2.3.1The relationship between MSD and setup time reduction

MS is consistent objectives and action programs related to manufacturing function that aims to enhance the firm's capabilities as one of a firm's manufacturing strategy components which integrates with the firm's business strategy (Hallgren, 2007). Moreira et al. (2008) stated that based on an extensive review, implementing this strategic dimension help the employees to learn how reducing setup times. Yuan (2015) is consistent with the findings provided by (Prasad 1995) in preparing a formal planning of MS according with the targets of the corporate strategy and reducing setup times. Ditto, Phan et al. (2006); Ward, McCreery and Anand (2007) and Abdallah et al. (2007) found significant and positive relationship between formal planning of MS and setup time reduction at the level of plant. Qureshi et al. (2014) found that minimizing setup time comes in the third rank that provides a continuous material flow between the plants in the manufacturing system. Sw-ink et al. (2005); Abdallah et al. (2007); Obamiro 2009; Rahmani, and Nayebi (2014) found positive relationship between the integration between business strategy and manufacturing strategy and setup time reduction. Al Haraisa (2017) proved the integration between the plant functions has a positive and significant impact on set up time reduction. Meanwhile, Dangayach et al. (2006) found negative relationship between the alignments of MS with business strategy to reduce setup times.Consequently, Gupta (2012) concluded that Gilgeous (2001) found significant relationship between adopting new technology and reducing setup times. Ortega Jimenez, Machuca, Garrido-Vega, and Díez Pérez (2009) found that adopting new technology will help the plant manager to focus on short setup times in order to avoid stopping the production lines. Dangayach et al. (2006) and Abdallah et al. (2007) found strong positive relationship between investing in several modern manufacturing technologies and setup time reduction. Cakmakci (2009); Gupta (2012); Kootanaee et al. (2013) supported the relationship between providing the workforce multiple skills and dealing with the new technology, the level of equipment utilization, and the frequency of machine breakdowns. This result is contradicted with the finding of Patil et al. (2016). Particularly in huge plants, educating managers is considered more important than educating the employees (Netland, 2016). Furthermore, manufacturing management should has enough ability to link between the commitment of implementing manufacturing strategic dimensions and the benefit derived from implementing JIT practices for improving the manufacturing performance (Singh et al. 2014).

2.3.2 The relationship between MSD and Kanban system

Results of Abdallah et al. (2007) found achievement of functional integration explain 14.2 percent of a total variance in JIT practices. Patil et al. (2012) found achievement of functional integration is in the second rank of JIT practices. Amoako-Gyampah et al. (2008) reported that MS became more interested toward continually learning, increasing knowledge, and developing skills for all employees and team work. Gupta (2012) and Phogat et al (2017) found significant influence of the integration between different functional areas in the organization on using Kanban system. Meanwhile, Van Wyk et al. (2016) found a shortage of empirical researches that examined the concept of achievement of functional integration from the perspective of manufacturing**.** Abdallah et al. (2007) showed positive and significant relationship between formal planning of MS and Kanban system. Fateh et al. (2012) stated that plant managers should focus on participating workers in problem solving, coordinating between all the functions based on using a Kanban container to control the production system and to avoid conflicts between them. Kumar and Panneerselvam (2006) found Kanban system contributes to help suppliers to deliver kanban containers to the plants without using separate packaging. However, Garrido-Vega et al. (2015) found no significant impact of formal planning of MS on adopting new technology. Fateha et al. (2012) proved that using Kanban system is required when writing the formal strategic planning processes. While, the study of Löfving et al. (2014) showed that till now there is no a proper framework of manufacturing strategy can be used in the empirical studies. Swink et al. (2005) and Abdallah et al. (2007) found positive relationship between the integration between business strategy, manufacturing strategy and Kanban system. Meanwhile, Dangayach et al. (2006) found negative relationship between them. Wang and Cao (2008) found a consistency among MS, business strategy, and the cooperation between other functional strategies with Kanban system. Obamiro (2009); Gupta (2012) and Garrido-Vega et al. (2015) found positive correlation between operations strategy and adopting Kanban system, but there is no significant impact of formal planning of MS on adopting new technology. However, Singh et al. (2012); Saukkonen et al. (2016) supported that plant managers should prepare the MS that allows to improve technical and managerial skills and to reconfigure the factory layout using Kanban system. Dangayach et al. (2006) found strong positive relationship between investing in manufacturing technologies and adopting Kanban system. These results is similar to the finding provided by Kumar et al. (2006) and Abdallah et al. (2007) which supported the relationship between factory automation using advance technology and using Kanban system in facilitating the flow of production system.

2.3.3 The relationship between MSD and daily schedule adherence

Anticipating new manufacturing technology is required to facilitate the flow of product lines and to allow inserting the time of machines' breakdowns in the daily schedule (Furlan, Dal Pont, and Vinelli 2011; Zhao et al. 2011). Furthermore, manufacturing management should has enough ability to link between the commitment of implementing manufacturing strategic dimensions and the benefit derived from implementing JIT practices to adhere the plant schedule on a daily basis (Singh et al. 2014). Abdallah et al. (2007) showed positive and significant relationship between formal planning of MS and daily schedule adherence. This result is consistent with the finding of Patil et al. (2012). Qureshi et al. (2014) found that adherence of daily schedule provides a continuous material flow between the plants in the manufacturing system for utilizing time buffers to guard against unexpected stoppages in production. In addition, daily schedule adherence has the highest rank to impact on planned strategic performance, and equipment layout is in the second rank. Kumar et al. (2006) found that daily production schedule contributes to complete it as planned, and to insert extra time accommodating the breakdowns of machines. According to Matsui (2007), there is a significant difference between daily schedule adherence and the master schedule of production at the level of each industry. Phan et al. (2006) noted that formal manufacturing plan has a positive effect on completing the schedule of production and designing the layout of equipment. However, this result is contradicted with the findings of a study provided by (Salaheldin 2005) who found the lack of preparing formal strategic planning was the most common problem to implement JIT in Egyptian manufacturing companies. Swink et al. (2005) found positive relationship between the integration between business strategy and manufacturing strategy and daily schedule adherence. Meanwhile, Dangayach et al. (2006) found negative relationship between them. This result is not consistent with the finding of Abdallah et al. (2007) and Garrido-Vega et al. (2015) who found that MS and business strategy have positive and significant impact on the adherence of daily production schedule to meet the production schedule each day, to build extra slack time into the daily schedule and to cover the unexpected production stoppages. Shavarini et al. (2013) and Rahmani et al. (2014) found the link between business strategy and functional strategies have positive and significant influence on the plant operational performance to complete the schedule on time. Brettel, Klein, and Friederichsen (2016) concluded that Swamidass and Newell (1987) supported the importance of using MS for achieving corporate goals and for meeting production schedule as planned. The findings of González-Benito and Suarez-González (2010) are consistent with the results of Nayebzadeh (2010) which proved the relationship between the role of manufacturing managers in assessing the alignment between MS and business strategy, and building reasonable daily production schedule. Finger et al. (2014) is consistent with the work provided by Porter (1985) who stated that most firms are needed to extensive technology to develop their manufacturing capabilities. In addition, the plant management should concern on continually training even for the highly skilled workers in order to match with the advanced manufacturing technology. Meanwhile, the finding of Ward et al. (2007) and Wang et al. (2008) revealed that previous literature were limited emphasis on assessing the relation between business strategies and manufacturing decisions about inve-sting in advanced technology for covering the production schedules. Abdallah et al. (2007) found that plant managers should focus on daily production schedule to avoid stopping the production lines. Besides, Dangayach et al.(2006) and Cakmakci (2009) found positive relationship between adopting different manufacturing technologies and both training and educating the employees to increase equipment utilization and to adhere daily production schedule. These results are similar to the finding provided by Kumar et al. (2006) which supported the relationship between using advance technology and scheduling multistage production system. This result of Ortega Jimenez et al. (2009) confirmed with the view of Sun and Hong (2002) who revealed that MS can link between business strategies and internal functions to maintain streamline of machines and to permit the organization to faster the response rate in order to meet customer needs. Patil et al. (2016) and Netland (2016) revealed that the plant management should have well defined formal strategy, and routinely reviewed it to support implementing daily production schedules in the multinational corporations, and considered Egypt was one of them.

2.3.4Framework and Research Hypotheses

The framework of the current research was based on an empirical research which conducted by Abdallah et al. (2007). It was therefore important aim to identify the effects of the four dimensions of manufacturing strategy on JIT practices in some of Egyptian industrial companies. The framework of the current research depicted in figure 1 (see Appendix 2).

2.3.5 Research Hypotheses

Based on the aforementioned literature review and above discussion, the current research establishes the following hypotheses:

H1: There is a significant positive impact of manufacturing strategy dimensions on set-up time reductions.

H2: There is a significant positive impact of manufacturing strategy dimensions on using the of kanban system.

H3: There is a significant positive impact of manufacturing strategy dimensions on the adherence of the daily schedule.

3. Methodology

3.1 Sample and Data Collection

Survey respondents at managerial positions had titles equivalent to manufacturing plant manager, assistant manager, or director of manufacturing plant, and dapartment managers include a wide range of functional areas (e.g., finance, accounting, marketing, production, human resources) are targeted to fill the questionnaire. Data was collected from 25 companies, and 233 managers have been participated in the study.The sampling frame included engineering and electronic, chemicals and food manufacturing companies in public sector. Out of the 41 respondents surveyed, 192 returned completed survey instruments for an overall response rate of 82.40 %. A stratified design was used to randomly select an approximately equal number of firms in each three industrial sector. Therefore most of respondents are expected to be aware of JIT practices and have already implemented JIT techniques such as daily scheduling adherence, Kanban system, setup time reduction, cellular manufacturing as a subset of JIT practices (Salaheldin, 2005). Table 1 (see Appendix 2) presents the distribution of the sample according to industrial sector.

3.2 Measures

This research will explore the application of the four dimensions of MS, and three practices of JIT in some Egyptian industrial companies, and then examines the effect of these dimensions on JIT practices. This research consists of seven variables: four variables for the MSD (manufacturing strategy namely, achievement of functional integration, formal planning of manufacturing strategy, the link between manufacturing strategy and business strategy, and anticipating of new technology) and three of JIT practices (setup time reduction, Kanban system, and daily schedule adherence).

The questionnaire was developed after conducting an extensive review of relevant literature and included scales that were considered to have high content validity (e.g., Ahmad et al. 2002; Dangayach et al. 2004a, 2006b; Abdallah et al. 2007; Thun, 2008; Patil et al. 2012a, 2016b). The questionnaire (see appendix 1) contained two sections.The first consisted of 18 items that used to measure the construct of MSD as independent variable. Four items to measure achievement of functional integration, four items to measure formal planning of manufacturing strategy, six items to measure the link between manufacturing strategy and business strategy and items items to measure anticipating of new technology.The respondents were asked to assess it using five-point Likert scale. The second consisted of 17 items to measure JIT practices as dependent variable. Six items used to measure setup time, 4 items to measure Kanban system, and seven items to measure daily schedule adherence. In the context of avoiding the current research of the differences related to the environment of the study sample in order to ensure clarity of meaning and equivalency, the original questionnaire was translated into Arabic language and was reverse translated into English again. Two academic researchers and two experts of operations management were asked to revise the translated questionnaire; and no changes were done to any of the questions. A pilot study is conducted to identify potential problem areas and deficiencies in the research instruments prior to implementation the full study. As well as to check whether respondents understand all the questions, whether any questions have a double meaning, and whether any useful ideas arise to develop the survey instrument (Hair, Money, Samouel, and Page 2007).

3.3 Data Analysis

Factor analysis was used to test the construct validity of the questionnaire to ensure that allitems that measure one variable are well correlated. According to Hair et al. (2007) rotation analysis is usually necessary to facilitate the interpretation of the extracted factors and suggested that factor loadings greater than 0.50 should be considered to be significant.

Convergent was checked by factor analysis using the principal component analysis method with varimax rotation through Kaiser–Meyer–Olkin (KMO) test to predict if the questionnaire items were likely to be well factored or not (Nunnally 1978) and the overall value should be .6o or higher to proceed with factor analysis. Factors with eigenvalues greater than 1.0 were considered to determine the number of factors to be extracted (Hair et al. 2007).Cronbach's Alpha was used to test the inter-consistency of the questionnaire (Nunnally 1978). Multiple regressions was used to understand the causal relationship between one dependent variable and several independent variables (Hair et al. 2007) in order to test the second set of hypotheses by indicating the proportion of variance of each MSD process accounting for the JIT variances.

4. Results

4.1Convergent validity analyses

The convergent validity was evaluated by examining the factor loadings of indicators.Using the criteria of an eigenvalue greater than one, the results indicated that there were four factors extracted to represent MSD items and one factor for JIT items. These factors accounted for 69.912% and 55.294%, respectively, of the total variance and the KMO measure of sampling adequacy test accounted for 83.7% and 84.1%, which were greater than the 60% as required by (Hair et al, 2007) which indicated above (see Tables 2, 3 and 4 in appendix 2).

These results considered to be satisfied for factor analysis as presented in table 5 and 6 in appendix 2. The results showed that 17 item loadings on the four extracted factors were indicated (with loadings of more than .50) and one item was excluded (less than .50). The excluded item was: NT3. The results showed that 12 item loadings on the one extracted factor were indicated (with loadings of more than .50) and five items were excluded (less than .50). The excluded items were: STR3, STR5, DSA5, DSA6 and DSA7.

The items were aggregated by a factor analysis. Scales were tested for internal consistency reliability and construct validity as depicted in table 7 (see appendix 2). All coefficients of alpha range were between 0.751-0.809 which exceeded the standard of 0.70 according to Nunnally (1978), so the internal consistency of all constructs were considered to be sufficient.

4.2 Descriptive Statistics

Table 8 (see appendix 2) depicted a summary of descriptive statistics for the variables in the study. Mean standard deviations and Pearson correlation for the constructs. The results showed that all the variables have positive and significant relationships with the three indicators of JIT practices at 0.01 level, with exception of the relationship between formal planning of manufacturing strategy and daily schedule adherence which is positive but not significant (*r*=.08). From the foregoing, Pearson's coefficients reveled that there is a linear relationship between the four MSD and the three indicators of JIT practices. These results supported to accept hypothesis H1 and provided more ground to perform multiple regression analysis.

4.3 Regression Analysis

The model depicted in Figure 1 was tested using regression analysis with SPSS 21 program. The research hypotheses were tested using regression analysis. Table 9, 10 and 11show a summary of the hypotheses testing results.
As for the effects of the four dimensions of MSD, the statistics in model 1 in table 9 (see appendix 2) signify that achievement of functional integration, formal planning of manufacturing strategy, the link between manufacturing and business strategy, and anticipating of new technology present positive impact on setup time reduction. By looking at the β coefficients, achievement of functional integration tends to give higher impact (β=0.48, t=7.127), the link between manufacturing and business strategy (β=0.43, t=5.157), formal planning of manufacturing strategy (β=0.41, t=3.175), and anticipating of new technology (β=0.32, t=2.591). The explained variance of the overall model is 53%. The previous evidence revealed the effect of these four MSD is verified. These results supported hypothesis H1.

Table 10 (see appendix 2) exhibits that 31% of the variance in the Kanban system as a dependent variable is explained by model 2. The results show that only three out of four MSD, achievement of functional integration, the link between manufacturing and business strategy, and anticipating of new technology have significant and positive impact on Kanban system. By observing the Beta coefficient, the effect of linking between manufacturing and business strategy exhibits to be higher impact (β=0.35, t=4.599), then the effect of anticipating of new technology (β=0.33, t=3.794), and the effect of achievement of functional integration is relatively weak (β=0.28, t=4.203).While the effect of formal planning of manufacturing strategy fails to significantly explain the impact on Kanban system (β=0.18, t=1.022). Hence, the effect of formal planning of manufacturing strategy is not revealed. These results supported partially hypothesis H2.

As shown in table 11 (see appendix 2), R^2 0.44 indicates that 44% of the variance in the daily schedule adherence is explained by model 3 (F=27.468 , P< .01). The results show that both of the achievement of functional integration (β=0.44, t=7.382), and anticipating of new technology (β=0.42, t= 6.135) have positive and significant impact on daily schedule adherence. These finding proved that these two dimensions seem to be only responsible for predicting daily schedule adherence. Whilst, the impact of both of the linking between manufacturing and business strategy (β=0.19, t=1.193) and formal planning of manufacturing strategy (β=0.12, t=1.051) exhibited positive but not significant effect on daily schedule adherence. These results supported partially hypothesis H3.

5.Discussion and Conclusions

The results of testing the hypotheses suggest the acceptance of H1 and partially acceptance of H2 and H3 regarding to the proposed influence of four MS dimensions on three indicators of JIT practices. The results of this study confirmed the importance of achievement of functional integration to reduce the setup time in the sample of Egyptian companies. Based on this result, the plant managers aware of the importance of the integration of the plant functions and have abilities to solve the problems to reduce the setup times. In particular, these results confirmed with similar findings from prior research such as Abdallah et al (2007); Patil (2012); and Al Haraisa (2017).

The findings highlighted the high relatively influence of formal planning of MS on setup time reduction. This indicates that plants' managers can better understand the factors that may have significant influence on reducing setup time in Egyptian companies. This result is consistent with the work of Phan et al (2006); Ward et al (2007); Abdallah et al (2007); Cakmakci (2009) ; Qureshi et al (2014) which suggested that formal planning of MS and the link between manufacturing and business strategy have strong positive and significant impact on setup time reduction. However, this result is not consistent with the work of Dangayach et al (2006); Patil et al (2012a, 2016b) which found negative impact of linking between manufacturing and business strategy on setup time reduction. The positive empirical results justify that the theoretical bases of anticipating of new technology dimension provides positive impact on setup time reduction. This finding is more consistent with the work of Gupta (2012). The finding of current research is consistent with many previous researches (Diaz et al. 2010; Singh et al. 2012a, 2014; Van Wyk et al. 2016; Phogat et al. 2017) which revealed that achievement of functional integration is an important factor to implement Kanban system. This result indicates that by coordinating the work system between the functions, any problems done with their suppliers regarding the orders can be solved easily. As regards formal planning of MS, the results found positive but not significant impact on Kanban system. This finding is not totally surprising given that support the observations of Salaheldin (2005) who found that this dimension is the most important problem which is not well defined in Egyptian companies. This result also reflects that the Egyptian companies have a lack of formal planning of MS, or may be their plant managers needed to continuously review and update their strategic plans, or may be their suppliers used separate packaging in order to fill and deliver their orders rather than using Kanban containers. The results showed that the link between manufacturing and business strategy is the highest relatively influence on implementing Kanban system in the Egyptian companies. This result is confirmed with the results of empirical studies provided by the work of Abdallah et al (2007); Obamiro (2009); Rahmani et al (2014). Furthermore, this finding supports argument provided by Kumar et al (2006) ; Abdallah et al (2007); Furlan et al (2011); Saukkonen et al (2016) which found a relationship between pursuing the plant's manager for implementing the new manufacturing practices depending on long-range programs of technology, and controlling the manufacturing plans by using a Kanban system.

In addition to previous studies (Fateh et al. 2012; Finger et al. 2014; Phogat et al. 2017), this research provides another piece of evidence that achievement of functional integration is one of the most important dimension that have strong impact on daily schedule adherence. This result indicated that the plant's managers are keen on the importance of meeting the daily production schedule as planned. However, the present research failed to prove significant impact of a formal planning of MS on daily schedule adherence which is consistent with the previous work of Ortega Jimenez et al (2009). This result indicated that the plant managers in the sample of Egyptian companies should assess their strategic plans and define well the targets of their strategic planning process that enable them to build reasonable production schedules for completing them on time. Meanwhile, this result is contradicted with some studies (Abdallah et al. 2007; Cakmakci 2009; Qureshi et al. 2014; Khaireddin et al. 2015). As for the effects of linking between manufacturing and business strategy, the present research failed to prove significant impact on daily schedule adherence which is similar with the finding of Patil et al (2012). It is not surprisingly to find this result, may be because of the barriers in Egyptian companies with suppliers which impact on having reasonable daily schedules. For instance, potential investments needed for restructuring manufacturing companies, limited financial resources, and lack of information required to translate business strategy into manufacturing terms. However, this result is contradicted with the theoretical basis that built on the previous work of Dangayach et al (2006); Abdallah et al (2007); Garrido-Vega et al (2015); Brettel et al (2016). The current research provides evidence on the impact of anticipating of new technology on daily schedule adherence. This finding is consistent with Kumar et al (2006); Cakmakci (2009); Saukkonen et al (2016) who focused on the importance of this dimension to support the manufacturing capabilities that required to complete the production schedules on time. Nevertheless, this finding is contradicted with the work of Ward et al (2007) who stated this dimension is not a key factor to impact on the effectiveness of production schedules.

The motivation of this study was the lack of empirical evidence regarding the influence of MS dimensions on JIT practices. Using a more recent data set of Egyptian industrial companies, the results of this research validate the importance of MS dimensions in explaining JIT practices. The model that has been presented in this research has a theoretical basis and highlights the key components of MS and JIT practices reported by Abdallah et al (2007). While, through the empirical validation its results provide contribution to the growing empirical base of literature in the operations management area, and several useful points are revealed. It also helps plant managers to adopt proper dimensions of MS with regard to achievement of functional integration, formal planning of MS, the link between manufacturing and business strategy, and anticipating of new technology for implementing JIT practices.

The results of regression analysis accounted for less total variance in Kanban system than in daily schedule adherence and setup time reduction (.31 as opposed to .44, and .53 respectively), although the same four MS dimensions seem to be responsible for predicting the practices of setup time reduction, Kanban system, and daily schedule adherence.The findings suggested that achievement of functional integration, the link between manufacturing and business strategy, and formal planning of MS showing higher impact than anticipating of new technology on implementing setup time reduction.The results highlighted the importance of linking between manufacturing and business strategy, anticipating of new technology, and achievement of functional integration to be an important infrastructure for implementing the practices of Kanban system. The results revealed that policy makers at the level of each plant should review its missions, modify their long-range visions to consider formal planning of MS as a key determinant to adopt Kanban system. The findings also pointed out that, achievement of functional integration, and anticipating of new technology can contribute to the plant capability in implementing daily production schedule practices (Fateha et al. 2012). The link between MS and business strategy does not contribute to impact on preparing and adhering proper production schedules. Top management in Egyptian companies requires removing the barriers as a result of the weakness of managerial practices that prevent coordinating between MS and business strategy. Egyptian plant managers needed to be involved in preparing the manufacturing strategy, to insert their requirements into the business strategy considering it as a part of corporate strategy and to achieve better understanding the key elements of translating their business strategy into manufacturing terms.

Limitations and Future Research

Reexamining the hypothesized relationships in this study will contribute to the building of a consistent body of knowledge, particularly if researchers investigate other MS dimensions including communication of manufacturing strategy (Abdallah et al., 2007); manufacturing as a competitive force (Patil et al., 2012) to investigate their possible impact on JIT practices between the industries in Egyptian environment and in other different environments. Researchers in Arabian countries need to give more attention to validate research instruments used in this reseach (e.g., Salaheldin 2005, conducted in Egypt; Khaireddin et al. 2015, conducted in Jordan). The replication of this research is needed to execute more research in this field and to identify other than variables investigated can explain more variance in explaining JIT practices .

Future research should investigate other types of indicators to measure JIT practices such as JIT delivery by suppliers, JIT link with customers, the use of MRP at the time of production, information system and equipment layout (Abdallah et al. 2007; Phan et al. 2010, Rahmani et al. 2014) because these may be have more direct affect the dimensions of manufacturing strategy.

In addition, the possibility to generalize the findings of this research in other Egyptian industrial sector can be made cautiously. Because data collected to analyze this research was only in companies from three public industrial sectors. Replication of this research can enable the researchers collect data from other sectors to attempt comparison between the public and private Egyptian companies. This can generate new findings to enhance widely understanding the relationships between the MS dimensions and JIT practices.

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Appendix 1:

Measures of manufacturing strategy Dimensions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1-Achievement of Functional Integration (AFI) AFI1 The functions in your plant are well integrated. AFI2 Problems between functions are solved easily, in this plant. AFI3 Functional coordination works well in your plant. AFI4 Your business strategy is implemented without conflicts between functions.					
2-Formal planning of manufacturing strategy (FPMS) FSP1 plant management has a formal strategic planning process, which results in a written mission, long-range goals and strategies for implementation FSP2 plant management has a strategic plan, which is put in writing. FSP3 Plant management routinely reviews and updates a long-range strategic plan. FSP4 The plant has an informal strategy, which is not very well defined					
3-The link between manufacturing strategy and business strategy (LMBS) LMBS 1 You have a manufacturing strategy that is actively pursued. LMBS 2 your business strategy is translated into manufacturing terms. LMBS 3 Potential manufacturing investments are screened for consistency with your business strategy. LMBS 4 At your plant, manufacturing is kept in step with our business strategy. LMBS 5 Manufacturing management is not aware of your business strategy. LMBS 6 Corporate decisions are often made without consideration of the manufacturing strategy.					
4-Anticipating of New Technology (ANT) NT1 You pursue long-range programs, in order to acquire manufacturing capabilities in advance of your needs. NT2 You make an effort to anticipate the potential of new manufacturing practices and technologies. NT3 Your plant stays on the leading edge of new technology in your industry NT4 You are constantly thinking of the next generation of manufacturing technology.					

Measures of JIT Practices	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1-Setup Time Reduction (STR)					
STR1 You are aggressively working to lower setup times in your plant.					
STR2 You have converted most of our setup time to external time, while the machine is running.					
STR3 You have low setup times of equipment in your plant.					
STR4 Your crews practice setups in order to reduce the time required.					
STR5 Your workers are trained to reduce setup time.					
STR6 Your setup times seem hopelessly long.					
2-Kanban System (KS)					
KS1 Suppliers fill your kanban containers, rather than filling purchase orders.					
KS2 Your suppliers deliver to us in kanban containers, without the use of separate packaging.					
KS3 You use a kanban pull system for production control.					
KS4 You use kanban squares, containers or signals for production control.					
3-Daily Schedule Adherence *(DSA)*					
DSA1 You usually meet the production schedule each day.					
DSA2 Your daily schedule is reasonable to complete on time.					
DSA3 You usually complete your daily schedule as planned.					
DSA4 You build time into your daily schedule to allow for machine bre-akdowns and unexpected production stoppages					
DSA5 You build extra slack into your daily schedule, to allow for catching up.					
DSA6 You cannot adhere to your schedule on a daily basis.					
DSA7 It seems like you are always behind schedule.					

Appendix 2:

Table 1: Description of the sampled companies according to industry type

Manufacturing sector	No. of firms	Percent
Engineering and Electronics	8	32%
Chemicals	9	36%
Food	8	32%
Total	25	100

Table 2: Total variance explained

Component	Initial Eigenvalues (MSD)			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.538	41.879	41.879	7.538	41.879	41.879	4.190	23.281	23.281
2	2.400	13.332	55.211	2.400	13.332	55.211	3.299	18.325	41.606
3	1.471	8.172	63.384	1.471	8.172	63.384	2.776	15.422	57.028
4	1.175	6.528	69.912	1.175	6.528	69.912	2.319	12.884	69.912

Extraction Method: Principal Component Analysis.
MSD: Manufacturing strategy Dimensions

Table 3: variance explained

Total Variance Explained						
Component	Initial Eigenvalues (JIT)			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.212	55.294	55.294	2.212	55.294	55.294

Extraction Method: Principal Component Analysis.
JIT: Just in Time

Table 4: KMO and Bartlett's Test

		MSD	JIT
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**.837**	**.841**
Bartlett's Test of Sphericity	**Approx. Chi-Square**	**1608.856**	**1169.592**
	df	153	91
	Sig.	.000	.000

KMO: Kaiser-Meyer-Olkin

Table 5: Rotated Component Matrix of MSD

MSD items	Component			
	1	2	3	4
Functions well integrated.	.663			
Problems are solved easily.	.740			
Functional coordination.	.778			
Business strategy.	.721			
Strategic planning process		.820		
Put strategic plan in writing.		.809		
Review and update		.845		
informal strategy		.803		
Pursue manufacturing strategy			.768	
Translated business strategy.			.772	
Potential manufacturing investments.			.789	
Manufacturing strategy is kept in business strategy			.738	
Awareness of business strategy.			.679	
Corporate decisions.		.786		
Long-range programs.				.548
Manufacturing practices				.850
Technology in the industry.				
Next generation technology.				.906

Extraction Method: Principal Component Analysis. Rotation converged in 6 iterations
MSD: Manufacturing Strategy Dimensions

Table 6: Rotated Component Matrix of JIT

JIT items	Component
	1
working to lower setup times	.623
Converting to external time	.657
Setup times of equipment	
Crews practices	.693
Training workers	
Seems hopelessly	.762
Filling the kanban containers	.693
Separate packaging	.756
production control	.792
kanban squares, containers or signals	.788
Production schedule	.690
Completed on time.	.669
Completed as planned.	.705
Building time	.746
Extra slack time	
Adhere to the schedule	
Behind schedule	

JIT: Just in Time

Table 7: Internal reliability of the questionnaire items: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
(AFI)	22.29	18.571	.577	.764
(FPMS)	22.42	18.683	.587	.762
(LMBS)	22.21	18.966	.652	.751
(ANT)	22.71	19.880	.562	.768
(STR)	22.00	20.236	.567	.768
(KS)	22.79	19.602	.381	.809
(DSA)	21.90	21.181	.448	.787

Extraction Method: Principal Component Analysis.a.1 component extracted.
(AFI) : Achievement of functional integration
(FPMS) : Formal planning of manufacturing strategy
(LMBS) : The link between manufacturing and business strategy
(ANT) : Anticipating of new Technologies
(STR) : Setup time reduction
(KS) : Kanban system
(DSA) : Daily schedule adherence

Table 8: Descriptive Statistics

Research Variables	Mean	S.D.	Correlations						
			1	2	3	4	5	6	7
1- Achievement of functional integration	4.03	.62	1.00						
2- Formal planning of manufacturing strategy	3.75	.76	.54**	1.00					
3- The link between manufacturing and business strategy	3.96	.71	.57**	.50**	1.00				
4- Anticipating of new Technologies	3.89	.67	.44**	.56**	.61**	1.00			
5- Setup time reduction	3.62	.79	.36**	.45**	.39**	.28**	1.00		
6- Kanban system	3.81	.77	.37**	.35**	.47**	.67**	.59**	1.00	
7- Daily schedule adherence	4.16	.65	.08	.58**	.42**	.43**	.48**	.24**	1.00

**Correlation is significant at 0.01 level (1-tailed)

Table 9: Summary of Regression analyses (Model 1)

Variables	β	t value
Achievement of functional integration	.48**	7.127
Formal planning of manufacturing strategy	.41**	3.175
The link between manufacturing and business strategy	.43**	5.157
Anticipating of new technology	.32**	2.591
F value= 32.274** *Adjusted* R^2 value=.53		

Notes: dependent variable: setup time reduction; **p<.01

Table 10: Summary of Regression analyses (Model 2)

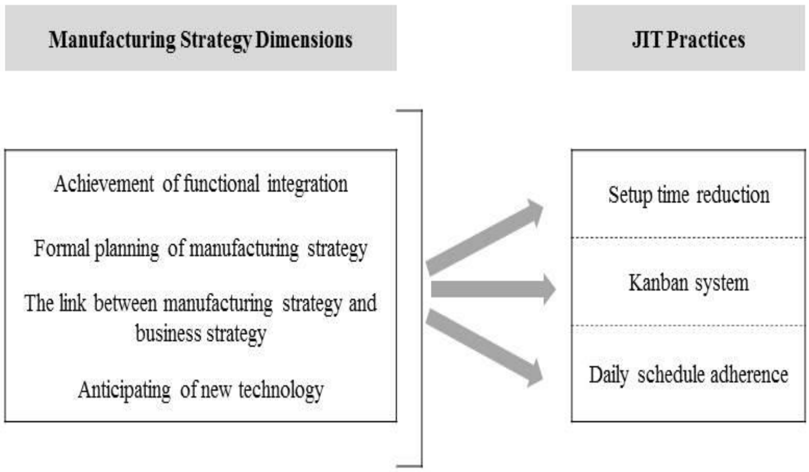
variables	β	t value
Achievement of functional integration	.28**	4.203
Formal planning of manufacturing strategy	.18	1.022
The link between manufacturing and business strategy	.35**	4.599
Anticipating of new technology	.33**	3.794
F value= 18.412** *Adjusted* R^2 value=.31		

Notes: dependent variable: Kanban system; **p<.01

Table 11: Summary of Regression analyses (Model 3)

variables	β	t value
Achievement of functional integration	.44**	7.382
Formal planning of manufacturing strategy	.12	1.051
The link between manufacturing and business strategy	.19	1.193
Anticipating of new technology	.42**	6.135
F value= 27.468** *Adjusted* R^2 value=.44		

Notes: dependent variable: Daily schedule adherence; **p<.01



Source: Abdallah et al.(2007)

Figure 1: Manufacturing strategy Dimensions and JIT Practices