

تاريخ الـبرسال (2019-05-27). تاريخ قبول النشر (2019-06-29)

## ERP business process attributes and management control to create competitive advantage

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### Abstract:

The current study extends existing research on enterprise resource planning systems by exploring the effects of enterprise system on Management Control (MC) and firm competitive advantage. Specifically, the study investigates the role of business process attributes in assessing Enterprise Resource Planning (ERP) systems toward competitive advantage mediated by forms of control. The data was analyzed based on a survey and was drawn from 114 Malaysia manufacturing companies. Overall, the findings confirm that forms of control act as dominant variables mediating the positive effect between ERP systems and firm competitive advantage. Moreover, the results show a significant effect of ERP on forms of control and competitive advantage after the proper assessment of ERP systems using business process attributes. Contrary to previous limited research on ERP and MC, our results provide significant empirical evidence on the role of ERP systems and MC on improving the firm competitive advantage. The results also show that the use of ERP systems results in a sustained competitive advantage in the long run and that more forms of control help firms achieve future firm goals.

**Keywords:** Enterprise Resource Planning System; Forms of control; Technocratic control; Socio-ideological control; Competitive advantage.

### سمات عملية تخطيط موارد المؤسسات والرقابة الإدارية لخلق ميزة تنافسية

#### الملخص:

تهدف الدراسة الى توسيع الأبحاث الحالية حول أنظمة تخطيط موارد المؤسسة من خلال استكشاف تأثيرات نظام المؤسسة على التحكم الإداري (MC) والميزة التنافسية للشركة. على وجه التحديد ، تبحث الدراسة دور سمات العملية التجارية في تقييم أنظمة تخطيط موارد المؤسسات (ERP) نحو ميزة تنافسية بوساطة أشكال التحكم. تم تحليل البيانات بناءً على دراسة استقصائية وتم استخلاصها من 114 شركة تصنيع في ماليزيا. بشكل عام ، تؤكد النتائج أن أشكال التحكم تعمل كمتغيرات مهيمنة تتوسط في التأثير الإيجابي بين أنظمة ERP والميزة التنافسية للشركة. علاوة على ذلك ، تظهر النتائج تأثيراً كبيراً لتخطيط موارد المؤسسات على أشكال التحكم والميزة التنافسية بعد التقييم المناسب لأنظمة تخطيط موارد المؤسسات باستخدام سمات العمليات التجارية. على عكس الأبحاث المحدودة السابقة حول ERP و MC ، فإن نتائجنا تقدم دليلاً تجريبياً كبيراً على دور أنظمة ERP و MC في تحسين الميزة التنافسية للشركة. توضح النتائج أيضاً أن استخدام أنظمة ERP ينتج عنه ميزة تنافسية مستدامة على المدى الطويل وأن المزيد من أشكال التحكم تساعد الشركات على تحقيق أهداف الشركة المستقبلية.

**كلمات مفتاحية:** نظام تخطيط موارد المؤسسة، أشكال الرقابة، الرقابة التكنولوجية، والرقابة الإيديولوجية الاجتماعية ؛ ميزة تنافسية.

## 1. INTRODUCTION

Peripheral to technology development, business competition has increased hence expanding the scope of managerial accounting from archival value to more real-time reporting (Cokins, 2013). To date, big data and business analytics which involve large or unstructured data sets play crucial role in every aspect of major companies' decision-making, strategic analysis, and forecasting. This allows millions of data elements to be created, purchased, extracted, collected, processed, and analyzed from external and/or internal sources to maintain a competitive edge (Griffin & Wright, 2015). The ERP systems are integrated information systems within an organization playing important role in overseeing and coordinating all company resources, functions and information in one shared database, hence improving management accountants capabilities by fulfill the mentioned roles by providing them with the access to real-time and relevant operational data for supporting management control and decision making rendering increased organization's efficiency (Kallunki et al., 2011; Appelbaum et al., 2017). ERP plays a vital role in the analysis of large and unstructured datasets which are not easy to analyze using database management systems and software programs (Warren et al., 2015) as high-quality data needed to be complete, precise, valid, accurate, relevant, consistent, and timely (Redman & Thomas, 2012). This has resulted in the implementation of ERP systems which dates back to the 1990s.

As an essential resource for companies, ERP systems can combine corporate transactions and information into one shared database which allow information to be retrieved to different organizational departments and divisions and thereby improve the capability of management accountants to fulfill their roles providing management with real-time, applicable and operational data in the support of MC and decision marking (Appelbaum et al., 2017; Alomari et al., 2018). Previous studies indicate that ERP systems are the main factor for management accounting changes due to an increase in ERP centralization (Granlund & Malmi, 2002). This renders ERP systems an important resource of the companies to be adopted (Chae and Olson, 2013; Redman 1996) which would have a great effect on company's performance (Forsslund & Jonsson, 2007; Gorla et al., 2010). Additionally, ERP systems are considered to be the solution of unstructured data and information, although ERP implementation can be challenging because of expensive, time-consuming and huge cost stress on corporate time and resources. Due to these barriers, almost 66 to 70 percent of ERP implementation projects were unsuccessful in achieving the implementation objectives in some way (Shores, 2005; Zabjek, 2009). Studies have shown that ERP implementation failure is common even in projects with the most favorable conditions. Shachez and Spraakman, (2012) argue that lack of understanding ERP systems in supporting business process is a potential reason for ERP systems failure. The literature has concentrated on hardware and software design of ERP systems while little knowledge has discovered to what extent these systems attributes facilitate business decisions. The discussion remains inconclusive on this issue and the topic from the perspective of management accounting area has been an underdeveloped, specifically in term of ERP business process attributes assessment.

In achieving a firm competitive advantage in an ERP environment, MC has been identified as the main factor toward ERP success and value (Granlund, 2011; Ruivo et al., 2014). Chenhall (2003) defined MC as an approach designed to assist in management decision making. MC has been recognized as one of the most significant factors in the success of ERP implementation (Kullunki et al., 2011; Ruivo et al., 2014). In addition, MC serves as a prerequisite in assisting manager's decision-making throughout the organization and guiding employee behavior in right ways in order to raise the chances of achieving organization objectives and performance (Bhimani et al., 2008). Previous studies showed that there is increased centralization and integration of system coordination and homogenization of control practices and changes in MC due to ERP (Granlund & Malmi, 2002). It was suggested by Chapman and Kihn (2009) MC, especially in terms of

budgeting, showed the mediation effect of ERP on performance. Although some effects are known inadvertently, information technology (IT) has been shown to have remarkable effects on management control (Granlund 2007). Although it was shown by these studies that management accounting is affected only moderately by ERP, there have been studies suggesting the 'driver' role of ERP in changing accountants to become business analysts (e.g. Granlund & Malmi, 2002; Scapens & Jazayeri, 2003).

Despite the significant contribution of these studies, little is known about the role of MC in achieving the desired competitive advantage, in spite of its obvious importance. The research on the relationship between ERP and MC is still in its infancy level (e.g. Kallunki et al., 2011; Ruvio et al., 2014). Pertaining to this issue, Rose and Kraemmerkaard (2006) characterized ERP as an implementation process whilst Granlund and Malmi (2002) studied the effects of the use of ERP in management accounting and the accounting profession. Moreover, Quattrone and Hopper, (2005) studied the centralization of organizations without taking into account the potential effects on competitive advantage. Essentially, the interrelation between MC and ERP systems demands a view with greater breadth and depth but little research has so far been published on this issue (Dechow & Mouritsen, 2005; Chapman, 2005; Chapman & Kihn, 2009; Rom & Rohde, 2007; Granlund, 2011). Recent demands for studies on enterprise systems have highlighted the need for enhanced validity of studies in this area and examination of issues regarding systems adoption and MC in organizations (Granlund, 2011; Ruvio et al., 2014).

This study examines the effect of ERP business process attributes on the competitive advantage of firms and whether forms of management control mediate this effect. As ERP system stands as a long-term strategic investment and the lengthy implementation process poses influence on the whole organization, it is imperative that competitive advantage of the firm is sustainable over the whole adoption periods which may take several years. This study would contribute to the ERP system and MC literature in two major aspects. Primarily, this study would increase the breadth and depth of ERP systems (Hunton et al., 2003; Nicolaou, 2004; Nicolaou & Bhattacharya, 2006, 2008; Wier and Hunton, 2007; Kallunki et al., 2011) and offer evidence of how competitive advantage could be achieved due to the effects of ERP systems through business process attributes for a proper ERP assessment (Scapens & Jazayeri, 2003; Sanchez & Spraakman 2012; Alomari et al. 2019). This is to create a competitive advantage which is sustainable. In addition, this paper expands the study by Kallunki et al. (2011) and Sanchez and Spraakman (2012) by examining the role of MC as a mediating variable of ERP systems in paving the way for accomplishing competitive advantage.

## **2. LITERATURE REVIEW**

### *2.1 Background of Enterprise Resource Planning (ERP)*

ERP systems date back to the 1990s with a substantial body of knowledge exists in terms of their implementation and management, therefore, revealing various concepts of ERP opening the way for better definition and understanding of the ERP systems. The term "enterprise resource planning" was first coined by The Gartner group in the 1990s as the next generation MRPII systems (Dahlen & Elfsson, 1999). The main idea of ERP is managing the logistical concepts from materials requirements planning (MRP) and manufacturing resource planning (MRP II). As an option to utilize few systems in managing companies and business, ERP attends as company source that combine companies' traditional systems and operation in one integrated and shared data base. This allows the flow of information to be shared through a conjoint ERP system, thus generating high efficient, quality reporting, and straightforward business process. The basic architecture of ERP business process organize an application, data base and integrated boundaries for the entire organization (Mashari et al., 2003). ERP facilitates transactions of business process in the firms for better managing their

operations in a way to create competitive advantage (Kharab & Lyytinen, 2012). Using multiple case studies Sanchez and Spraakman (2012) are attempt to provide a clear understanding of ERP implementation and its impact on management accounting and control. They found that systems standardization which extended to more departments and functions caused an increase of accuracy, timely manner and more production rate. In addition, there were efficient and effective techniques and data entry was less for management accountant which allow them to carry out more analysis and extensive non-financial information. In short, these four attributes were the benefits of ERP (a) timely and more accurate information (b) increased the availability across all company unites for information (c) and reduced the amount of data entry done by management accountant. The study emphasized the main issue to support the impact of ERP on management accounting and also its effect in understanding the different levels of ERP systems in terms of physical, transactional and informational. The knowledge on ERP levels was also presented by Magal and Word (2009) in which different ERP levels were highlighted thus making clear of the benefits of ERP (Kallunki et al., 2011; Sanchez & Spraakman, 2012). In a critical review of the issue, this study attempts to explore knowledge on the levels by referring it as the business process (Magal & Word, 2009; Berente & Vandenbosch, 2009). Thereby, Business process refer to be a flows of within different functions in the organization (Child and McGrath, 2001; Magal and Word, 2009). Moreover, Melan (1993), mentioned that business process is a group of interrelated activities in the organization which provides greater output than the inputs though one or more transformation. As compared to Sanchez and Spraakman (2012) who classified different levels of ERP systems in terms of physical, transactional and informational. Melan (1993) classified transformations as physical, locational, transactional and informational. Accordingly, a business process referred to as the "input" and the "output" represents after the transformation flows between company activities comprised with information. Companies that change they are focused on information systems to integrated enterprise systems such as ERP systems, can stop relying on a manual connection of information systems, by printing information from one system and reenter it into another systems or next systems which would not be feasible given the complexity of managing the data across entire business process. Enterprise systems support the entire business process rather than some of it, including the interdependence between roles, functions, people and departments to provide customers with the products or services in more comprehensive manner (Magal and Word, 2009; Aubert 2009).

While other researchers discuss ERP system from different perspectives, Scapens and Jayazeri (2003) introduced ERP from a user perspective. It was notable that the research by this group actually underlined the characteristics of integration. Apparently subsequent studies by Sanchez and Spraakman (2012) did accept this conceptualization. Based on a longitudinal case study in the European division of a large US multinational, Scapens and Jazayeri (2003) established four attributes which are deemed necessary in facilitating changes in an organization through ERP implementation. Recently, Rahimi et al. (2016) indicated that ERP as a technology not only an integration systems which integrate business process, but its including also the standardization of business process.

Consequently, the current study will look into ERP systems business process using its main attributes which are integration, centralization, standardization and routinization following Scapens and Jazayeri (2003) and Sanchez and Spraakman (2012).

## *2.2 Forms of Control*

Management control (MC) has been existed to persuade managers to ensure the best possible way for achieving organizational targets and objectives. This is done by controlling and by fulfilling and elevating individuals as indicated by specific criteria (Cuguro-Escofet & Rosanas, 2013). MC has been discussed in previous literature and defined in different ways which has been main slightly

problematic and the first point of criticism in the literature stream (Chenhall 2003). Chenhall (2003) put forward the terms Management Control Systems (MCS), Management Accounting Systems (MAS), and organizational controls, these terms have been used interchangeably. To date, MC has been discussed and studied from different perspectives, while there is still lacking and there is no a single specific definition for MC available (Helsen et al., 2016). MC is focusing on behaviors of workers, output and/or employees minds and consists of an apparatus for specifying, monitoring and evaluating individual and group actions. There have been lots of discussions on management control under different labels and characterization in many different ways (Table 1).

**Table 1.** MC dimensions derived from prior literature

<b>The MC dimensions</b>	<b>Sources</b>
Action/results controls	Ouchi (1979), Merchant (1989)
Formal/informal controls	Amigoni (1978), Modell (1995), Merchant (1989), Whitley (1999),
Tight/loose controls	Amigoni (1978), Merchant (1989), Whitley (1999)
Restricted/flexible controls	Otley (1994)
Impersonal/interpersonal controls	Whitley (1999)
Action/results/ personal/ cultural controls	Merchant et al. (2007)
planning, cybernetic control, reward and compensation, administrative and cultural controls	Malmi and Brown (2008)
Accounting and non-accounting	Abernethy & Brownell (1997).
More bureaucratic and less bureaucratic	Auzair & Smith (2005)

A common theme in organization and business studies are forms of organizational and management control. The whole idea of management accounting is based on the belief that management control is achievable, crucial, and, indeed, essential. Despite suggestions of a wide array of forms of control, it is common to put emphasis on the main forms of control, be it in the form of a particular organizational structure or in the form of a specific mode of control dominating (Alvesson & Karreman, 2004).

There have been lots of discussions on management control under different labels and characterization in many different ways. Arguably the variations in the number and type of controls render difficulties to develop a coherent body of knowledge (Langfield-Smith, 1997). Past studies used the same types of management control with different names or labels to represent forms of control. This study will be following Caker and Siverbo (2014) and Alvesson and Karreman (2004) and use forms of control to incorporate all types of control with two main labels such as technocratic and socio-ideological which will be used in the current study as shown in the table (2).

**Table 2.** Forms of control

<b>Technocratic forms of control</b>	<b>Socio-ideological forms of control</b>
Formal	Informal
Tight	loose controls
Action/results controls	personal/ cultural controls
Accounting	non-accounting
More bureaucratic	less bureaucratic
Restricted	flexible controls
Planning, administrative and cybernetic control	reward and compensation and cultural controls

**Source:** (Caker & Siverbo 2014; Alvesson & Karreman 2004)

### 3. HYPOTHESES DEVELOPMENT

Companies invest in ERP systems expecting to achieve their goals and develop company capabilities and resources together with the technical and managerial skills in order to create sustainable competitive advantage (Piccoli & Ives 2005). The implementation of ERP systems would carry operational benefits by enhancing the chance of innovation involving building capacities which consequently lead to create benefits opportunities for long term, which create sustainable competitive advantage (Piccoli & Ives, 2005; Molla and Bhalla, 2006). Previously, studies have highlighted the significant of integration which created by ERP systems implementation to achieve forms' competitive advantage. Genoulaz et al. (2005) showed the improvement of competitive advantage which created by ERP business process integration.

Competitive advantage is achieved by main changes of behaviors and culture and this would be allowed through the employment of ERP systems. Apart from that, it has also been highlighted by Lengnick et al., (2004) that ERP systems make way for intellectual value build up which results in a competitive advantage. In addition, it was suggested by Zhang et al. (2005) most manufacturing companies opt for ERP systems as the most broadly accepted choices for competitive advantage achievement although it was argued by Ellram (1991) that the competitive performance of a firm is enhanced by integrated all internal organization functions and effective linking with the external process and operations. This was further

validated by Bhatt and Grover (2005) who stated that IT business expertise along with an infrastructure of business partnerships would pave the way for competitive advantage achievement.

Through ERP integration, with a sense of interest in success information technology, the advances required will lead to improvement to competitiveness and meeting customer's expectations (Mzoughi et al., 2008). The evolution of ERP systems since their first appearance in the software markets in the nineties (Uwizeyemungu & Raymond, 2004) is gradually opted by companies of all different sizes. ERP and competitive advantage relationships has been studied by several authors (Kallunki et al., 2011; Chapman & Kihn, 2009).

As ERP systems serve as an effective tool in ensuring a lasting competitive advantage and boosting the company's performances (Li et al., 2004; Mzoughi et al., 2016; Huseyin et al., 2013). It is therefore sensible that competitive advantage can be derived from ERP systems adoption. Based on the explanation given this study proposes the following hypothesis:

**H1:** More extensive use of the ERP system will have a positive direct effect on competitive advantage.

MC is very critical in ensuring firm competitive advantage. As MC becomes a key tool that manager use for different aspects of budgeting, planning, measuring, analyzing and evaluating which provide useful information for rational decision making (Simons, 1995). Additionally, MC effectiveness serves as device that leads to enhanced firms' performance (Malina and Selto (2001). Similarly, companies give special attention toward forms of control implementation as tool required to contribute to business success and competitive advantage (Alomari et al. 2018).

Managers attempts to create balancing of controlling and enabling the use of MC (Mundy 2010). It has been recommended that increasing of MC usage level would result a positive influence of company performance level. Thus, positive MC impact on competitive advantage and business performance has been reported by several studies (e.g. Schulze et al. 2002; Lubatkin et al. 2005; Laitinen, 2014; Harlez and Malagueno, 2015; Songini and Gnan, 2015). Past studies showed results of how MC point to achieve competitive advantage. Hence, this leads to the following hypothesis:

**H2:** More extensive use of forms of control will have positive direct effect of on firm competitive advantage.

Granlund and Malmi (2002) as one of the earliest studies has been done in the area of management control and accounting in examining the effects of integrated, enterprise information systems such as ERP systems on management accounting and control. The study concluded that there is no actual evidence about the role of ERP systems in term of its impact on management accounting and control. Alternatively, the results of study pointed to relatively small changes.

Quattrone and Hopper (2005) in a study analyses the effects of implementing an ERP system upon management control in two multinational organizations focusing on two case studies ie: Japanese and American. The study showed that in one organization the ERP reproduced existing structures and distance which allows conventional accounting controls based on action at maintained distance to. The second organization utilized ERP to collapse distance through real-time information in a matrix structure. There was no significant impact on ERP systems on management control.

On the other hand, in investigating the role of formal and informal management control systems as mechanisms which mediate the effect of ERP systems adoption on firm performance Kallunki et al (2011) carried out empirical analyses which are based on survey data drawn from 70 Finnish business units. The study exposed a significant path from ERP systems to formal controls which are linked between ERP systems and non-financial performance. There was however no informal controls mediating the positive direct impact of ERP system on the future non-financial and financial performance. Sánchez and Sprakman (2012) in their study refine the findings and theory on the impact that ERP systems implementations have

had on management accounting. In particular in analyzing the impact of the changes that ERP implementations have on management accounting and control. Using 13 major Canadian firms interviews were conducted as part of multiple case studies. The study found out significant impact of ERP on management accounting which increases efficiency and effectiveness.

Granlund (2011, p. 5) therefore concludes the impact of IT, and more specifically of ERP systems, on management accounting as "has been studied relatively little, although the number of studies in the field seems to be increasing" and there has not been a clear understanding of the relationship between ERP systems and management accounting. Therefore, this study tries to analyze the relationship between management control and ERP from a different perspective in terms of providing the benefits of ERP implementation to create competitive advantage.

**H3:** More extensive use of ERP systems will have a positive direct effect on forms of management control.

Merchant and Otley, (2006) stated that the main objective of MC is in providing useful information for decision making, planning, and evaluation especially in decision controls across the entire organization. In addition, MC serves as a platform in guiding behavior in appropriate ways needed by an organization in achieving the target objectives (Anthony & Govindarajan, 2007; Bhimani et al., 2008).

ERP, therefore, serves as an umbrella for management control systems with the objective of improving the performance of an organization. Despite the fact that ERP can be perceived as the mere existence technical software which does not bring improvement on organizational performance, optimal performance of an organization is, on the other hand, achievable by joint utilization of ERP with informal communication which serves as more 'organic' control.

Taken together, all previous studies showed the effects of the extent of use in controls termed as 'organic process' on the performance of an organization to lead to competitive advantage. It is expected that different forms of MC would render achievement of improved organizational performance through ERPs as there have been reported on a number of managerial benefits in MCs rendered by better planning and control (Shang & Seddon, 2002; Chapman, 2005). Accordingly, ERPs help to accomplish the dream of management controllers by real-time information obtained which are remote and instantaneous (Quattrone & Hopper, 2005) although arguably most accountants have the perception that IT is central and acts a single driver of recent developments in managerial accounting. In contrast, some studies show that regardless of the significant potential of ERPs, retaining the existing MCs would still be the choice of firms (Rom & Rohde, 2007). This was set forth by Scapens and Jayazeri 2003 in a case study which indicated no significant change albeit ERP implementation due to choice taken by plant managers of retaining existing MC. Some studies found the crucial role of management support in delivering a successful ERP implementation process (e.g. Rose & Kraemmerkaard, 2006; Rom & Rohde, 2007). Granlund and Malmi, (2002) discovered similar results where existing principles of MC were merely transferred to the ERP systems which show little change on the use of the existing MC by firms prior to the implementation of ERP systems. Furthermore, due to the use of ERP systems, there has not been the adoption of new and sophisticated MC.

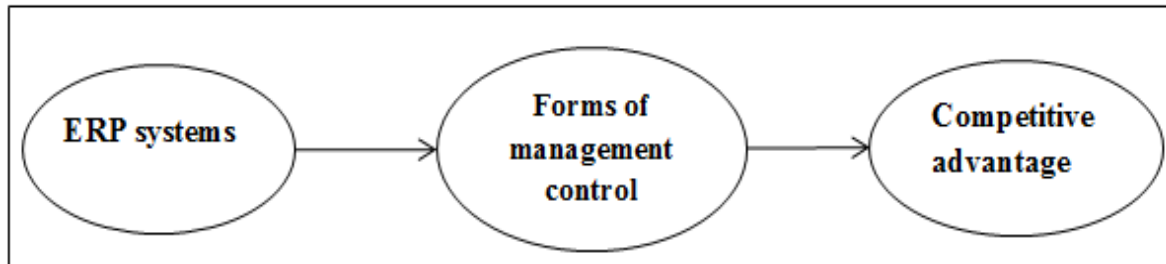
Significant impacts of ERP systems on MC have been studied by Spathis and Constantinides (2004) with survey research shows increased use of non-financial performance measures and profitability analyses upon ERP implementation. It was also shown that there may be significant effects by ERP systems on MC as evident by two cases in a study by Quattrone and Hopper (2005). It was concluded in the study that ERP systems did not serve as a vehicle enabling radical change in MCs but was rather restricted to increasingly improving prevailing practices.

Hence ERPs serve as a platform for more extensive use of both formal and informal controls. Chapman and Kihn (2009) showed the integration of information systems allow budgeting systems and formal MCS to perceived the success information system. Recently Kallunki et al. (2011) stated that management control mediates the effect of ERP and firm performance.



**H4:** More extensive use of management control mediates the positive direct effect of ERP systems on firm competitive advantage.

Accordingly, this study proposed the following framework:



**Figure 1.** Research framework

## 4. RESEARCH METHOD

### 4.1 Sample

The study sample based on stratified random sample, manufacturing companies where selected to fill up the study questionnaire from the Federation of Malaysian Manufacturers (FMM) directory 2016. Using online survey (SurveyMonkey) Chief Operation Officers (COO) was addressed to be our main respondents. A total of 972 survey questionnaires were mailed in batches over a week from 13 February to 30 March 2016. However, whenever possible the questionnaire was personally delivered to the respondents. To preserve the anonymity of the respondents, the surveys did not require respondents to identify themselves or their company and were not pre-numbered.

After the one month and a half, about 14 responses were received and follow-up with emails reminders for late respondents and to thank those who had already returned their questionnaires. There were companies that had refused to participate in the survey and they were struck off the sample. The main reasons for refusal to participate were either because they are too busy or it is against their company policy. The third mailing was sent out a month after the second reminder. The follow-up consisted of another reminder letter. The data were collected over a four-month period from 13 February 2016 to 20 June 2016.

## 5. MEASUREMENTS OF VARIABLES

Established instruments have been used in order to have better reliability of the findings. But, some instruments were modified to be fit with the study requirement. Seven- point likert scales were used to measure the study constructs and variables. A pilot test has been done by a group of managers and academicians to enhance the content validity of the instruments. Pre- test was done through online survey, containing five business managers and seven experts academic from the areas of information systems and management accounting. The final instruments and measures were refined and improved.

### 5.1 Enterprise resource planning systems

The study adopted the ERP systems measurements using a combination of Word and Magal (2009), Scapens and Jazayeri (2003) and Sanchez and Spraakman (2012) to come out with the modified version of ERP system instruments as business process attributes which are integration, standardization, routinization, and centralization of business process. The study used the version of Berente et al. (2009) to come out with the main instrument for integration of business process which is timeliness, accessibility, transparency, and granularity then modified the version of Chenhall and Morris (1986) to measure the timeliness. For accessibility, the study modified Hsu and Liao (2014) items. Meanwhile, a modified version of Wang and Strong (1996) items used to measure transparency. Finally, the granularity was measured by modified items developed by Wang and Strong (1996) and Goodhue (1995).

### *5.2 Measurement of forms of control*

Two main dimensions to measure forms of management control which are technocratic and socio-ideological controls. Technocratic control is represented by action and results control (Merchant & Van der Stede 2007). Meanwhile, result and action controls used by Caker and Siverbo (2014) to study technocratic forms of control quantitatively. In addition, the use of results controls is measured by a five-item scale originally developed by Jaworski and MacInnis (1989), as well as an adapted version of this construct been used by Hutzschenreuter (2009) and Kleine and Weibenberger (2013). The measurement of action controls builds on four items developed by Jaworski and MacInnis (1989) with refinement for this construct by Hutzschenreuter (2009) and Kleine and Weibenberger (2013).

### *5.3 Measurements of Competitive advantage*

The competitive business strategy was measured using Porter's (1980, 1985) strategy typology model, which is academically well accepted and found to be internally consistent (Dess and Davis, 1984; Govindarajan, 1988). In fact, Porter has provided a strong theoretical basis for linking different types of MCS to the differentiation and cost leadership strategies (Chenhall, 2003). For example, the cost leaders are similar to Miles and Snow's (1978) "defenders" and Hambrick's (1985) "efficient misers". While the "differentiators" are comparable with Miles and Snow's (1978) "prospectors" and Miller and Friesen's (1982) "innovators". In both, differentiation of business strategies and low-cost strategies are seen as an approach that relates the company to the competitive forces in the industry in which it competes (Nørreklit, 2000). The instrument has been used extensively and validated in many accounting studies (for example, Govindarajan & Fisher, 1990; Kumar & Subramaniam, 1998; Chenhall & Langfield-Smith, 1998; Md. Auzair & Langfield-Smith, 2005; Mohd Amir 2014). To reflect the current strategic priorities, Chenhall and Langfield-Smith (1998) incorporated additional emphases. Besides Govindarajan's (1988) original measures, Chenhall and Langfield-Smith added a new five items which are: customized product, product availability, production cost, rapid product changes, and accessibility of after-sales services. The current study adapts Chenhall (2005) using 22-items of competitive advantage.

## **6. DATA ANALYSIS- PARTIAL LEAST SQUARE**

The study used the SmartPLS- structural equation model (SEM) to analyze the data (Kallunki et al. 2011). The study attained partial least squares (PLS) estimates for both the measurement and structural model. The PLS software does not demand multivariate normal data, sets minimum requirements on measurement levels, and is appropriate for small samples (Chin 1998), which is very common in management accounting researches (Ylinen & Gullkvist 2014). Furthermore, the PLS method is more suitable for models comprising of complicated relationships, such as many indicators, variables, and relationships (Pondeville et al. 2013). Bootstrapping was also conducted to determine the level of significance of each item (Ferreira et al. 2010). Bootstrapping is recommended for small samples that do not follow a multivariate normal distribution (Ylinen & Gullkvist 2014). In bootstrapping, a great number of subsamples are drawn, including replacement from the original set of data (Hair et al. 2014). Each subsample is then used to estimate the model. This exertion used 114 cases and 5000 bootstraps from the original sample in order to test the hypotheses of the current research. The 5000 bootstrapped samples were run to confirm that the entire model parameter has empirical sampling distribution and to obtain its standard error. By utilizing a similar approach, the path coefficients were evaluated by employing t-statistics.

**Table 3.** Descriptive statistics analysis

<b>Variables</b>	<b>Mean</b>	<b>S.D.</b>
ERP	4.79	1.11
MC	4.81	1.01
Com. Adv.	5.03	1.26

## 7. RESULTS

### 7.1 Measurement Model

#### 7.1.1 Assessing Psychometric Properties

Measurement model assessment includes the examination of constructs and items relationships. By using a reflective measurement model, the assessment will be included indicator loading, internal consistent reliability, indicator reliability, convergent validity, and discriminant validity. The common item loading for the indicator loading as regarding Chin (2010) and Fornell & Larcker (1981) is .708 or higher. Though, it is considered common to have a loading of the weaker item in social science studies and deleting those items with low loading need to be done as a caution to affect the constructs' content validity (Hair et al 2013). Moreover, according to Hair et al. (2014), it's allowed to remove the items that include outer loading between .4 and .7, in case such removed items may result in increasing the composite reliability value and average value extracted (AVE). the outer loading is shown in table 4 before item removal.

**Table 4.** Outer Loading

		<b>Outer Loading(initial model)</b>	<b>Outer Loading(modified model)</b>	<b>Cronbach's Alpha</b>	<b>Composite Reliability</b>	<b>Average Variance Extracted (AVE)</b>
CM	CA1	0.762	0.759	0.942	0.950	0.659
	CA1	0.887	0.882			
	CA1	0.876	deleted			
	CA2	0.794	0.800			
	CA3	0.872	0.872			
	CA4	0.810	0.817			
	CA5	0.708	0.712			
	CA6	0.810	0.808			
	CA7	0.789	0.798			
	CA8	0.756	0.756			
	CA9	0.891	0.892			
MCT	MC_A1	0.840	0.838	0.931	0.943	0.673
	MC_A2	0.812	0.817			
	MC_A3	0.824	0.835			
	MC_A4	0.511	deleted			
	MC_A5	0.835	0.839			
	MC_R1	0.802	0.812			
	MC_R2	0.834	0.843			
	MC_R3	0.752	0.764			

		<b>Outer Loading(initial model)</b>	<b>Outer Loading(modified model)</b>	<b>Cronbach's Alpha</b>	<b>Composite Reliability</b>	<b>Average Variance Extracted (AVE)</b>
	MC_R4	0.819	0.815			
	MC_R5	0.522	deleted			
MCS	MC_C1	0.803	0.803	0.933	0.943	0.623
	MC_C2	0.789	0.789			
	MC_C3	0.765	0.765			
	MC_C4	0.755	0.756			
	MC_C5	0.811	0.811			
	MC_P1	0.773	0.772			
	MC_P2	0.761	0.760			
	MC_P3	0.817	0.817			
	MC_P4	0.785	0.785			
	MC_P5	0.829	0.829			
R	R1	0.636	0.652	0.854	0.889	0.533
	R2	0.734	0.754			
	R3	0.715	0.745			
	R4	0.725	0.767			
	R5	0.755	0.751			
	R6	0.741	0.733			
	R7	0.712	0.703			
	R8	0.476	deleted			
	R9	0.348	deleted			
S	S1	0.811	0.809	0.860	0.905	0.705
	S2	0.861	0.864			
	S3	0.872	0.870			
	S4	0.812	0.813			
C	C1	0.849	0.850	0.932	0.945	0.712
	C2	0.850	0.850			
	C3	0.861	0.861			
	C4	0.867	0.867			
	C5	0.839	0.839			
	C6	0.810	0.810			
	C7	0.828	0.827			
I	I1	0.707	0.716	0.938	0.948	0.645
	I10	0.401	deleted			
	I11	0.803	0.801			
	I12	0.467	deleted			
	I13	0.612	deleted			
	I14	0.469	deleted			

		Outer Loading(initial model)	Outer Loading(modified model)	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
	I15	0.569	deleted			
	I16	0.800	0.778			
	I17	0.509	deleted			
	I2	0.756	0.800			
	I3	0.403	deleted			
	I4	0.754	0.804			
	I5	0.790	0.833			
	I6	0.713	0.789			
	I7	0.803	0.844			
	I8	0.802	0.817			
	I9	0.807	0.840			

C = Centralization; S = Standardization; R = Routinization; I = Integration; MCT = technocratic forms of management control; MCS = Socio-ideological forms of management control; CM = competitive advantage.

The result of the PLS algorithm shows that most of the item loading exceeded .7 and below 0.85. Considering the low and overloading of items were removed as shown in table 4. Eleven items removed due to low loading factor < 0.7. Also, one item was removed due to high Collinearity (based on VIF value) which made composite reliability value more than 0.95 as acceptable levels. According to hair 2014 maximum acceptable of composite reliability is 0.95 and if there are items in the same construct which are highly correlated should be removed to reduce the composite reliability. After removing the low loading items, AVE and composite reliability were reexamined. The findings validate highest convergent validity for the centralization of ERP systems with AVE value .712 and the lowest was routinization of the business process with .533 which exceeding the minimum AVE value with the level of .5 (refer to Table 4). The assessment of cross loading for the level of items discriminant validity followed by Fornell-Larcker test as an assessment of constructs discriminant validity. The AVE square root for each construct must be higher than latent variable correlation with any other construct in the model of the study (Fornell and Larcker 1981). Meanwhile, Hair et al. (2014) mentioned that, in case if certain construct has been found higher than AVE square root, the researcher has to decide to eliminate this construct which has value higher than AVE square root in order to meet the criterion of Fornel-Larcher and increase the reliability and discriminant validity. However,

The researcher needs to make sure that the removal process doesn't effect the measurement of content validity (Refer to Table 5).

**Table 5.** Discriminant validity – Fornell-Larcker criterion

	C	CM	I	MCS	MCT	R	S
C	<b>0.844</b>						
CM	0.667	<b>0.812</b>					
I	0.778	0.739	<b>0.803</b>				
MCS	0.773	0.707	0.712	<b>0.789</b>			
MCT	0.668	0.715	0.682	0.766	<b>0.821</b>		
R	0.545	0.526	0.491	0.548	0.576	<b>0.730</b>	
S	0.560	0.608	0.550	0.627	0.687	0.581	<b>0.840</b>

**7.2 Structural Model**

The next step after assessing the measurement model is supporting the theory and literature of study by the empirical data by the structural modeling of results to determine both the theory and concepts are verified for the predicted hypothesis by the empirical results or not. The structural modeling included the assessing of collinearity, level of ( $R^2$ ), the predictive relevance ( $Q^2$ ), the effect of sizes ( $f^2$ ) and path coefficient (Hair et al. 2013). For collinearity issues, it can be attained by the variance inflation factor (VIF) from PLS algorithm in SmartPLS. Using the PLS-SEM a tolerance value is .20 or lower and VIF .5 and higher to indicate the potential problem of collinearity (Hair et al. 2011). As illustrated by Table 6 that VIF for each construct was less than the common cut-off threshold of 5.0. Thus, in this proposed study model there is no collinearity issue.

**Table 6.** VIF values among model predictors

Predictors	Dependent
	CM
ERP	3.509
MC	3.509

Chin (2010) the main objective of PLS-SEM is to maximize the variance of dependent variables using the assessment of the coefficient of determination ( $R^2$ ) of the endogenous constructs. It is preferred to achieve high  $R^2$  as indicating a higher level of predictive accuracy. In accounting literature,  $R^2$  values if .75 for latent variables is considered as substantial, 0.50 as moderate, and .25 as weak (Hair et al. 2014). Based on the results of  $R^2$ , the conceptual model is displayed a large portion of the variance in the endogenous construct as shown in Table 7 because of  $R^2$  values for competitive advantage and management control 0.638 and 0.715 respectively. This study is achieving a satisfactory level of explanatory power for the proposed model.

**Table 7.** Results of  $R^2$

	R Square	R Square Adjusted
CM	0.6386	0.6321
MC	0.715	0.7125

Additionally, the Stone-Geisser's  $Q^2$  has examined by using the blindfolding procedure in order to evaluate the predictive relevance of the model. Referring to Table 8 which shows the positive  $Q^2$  values for all endogenous constructs and that suggest predictive relevance for the model (Hair et al. 2016).

**Table 8.** Results of  $Q^2$

	SSO	SSE	$Q^2 (=1-SSE/SSO)$
CM	1,140.00	703.8107	0.3826
MC	2,052.00	1,279.20	0.3766

Hair et al. (2013) mentioned that the evaluation of the relevance for each predictor constructs (exogenous) on an endogenous construct by the measurement of effect size  $f^2$ . The value of  $f^2$  determines the contribution level for exogenous construct toward the value of  $R^2$  for the structural model targeted construct. The values of  $f^2$  are 0.02, 0.15, and 0.35 indicate as having small, medium, and a large degree of predictive relevance, respectively. Table 9 shows the findings effect sizes of the structural model. A large effect of the significant predictors on their endogenous variables compared to the insignificant predictors. The result revealed that ERP effect on management control is the highest effect size with (2.509), followed by the

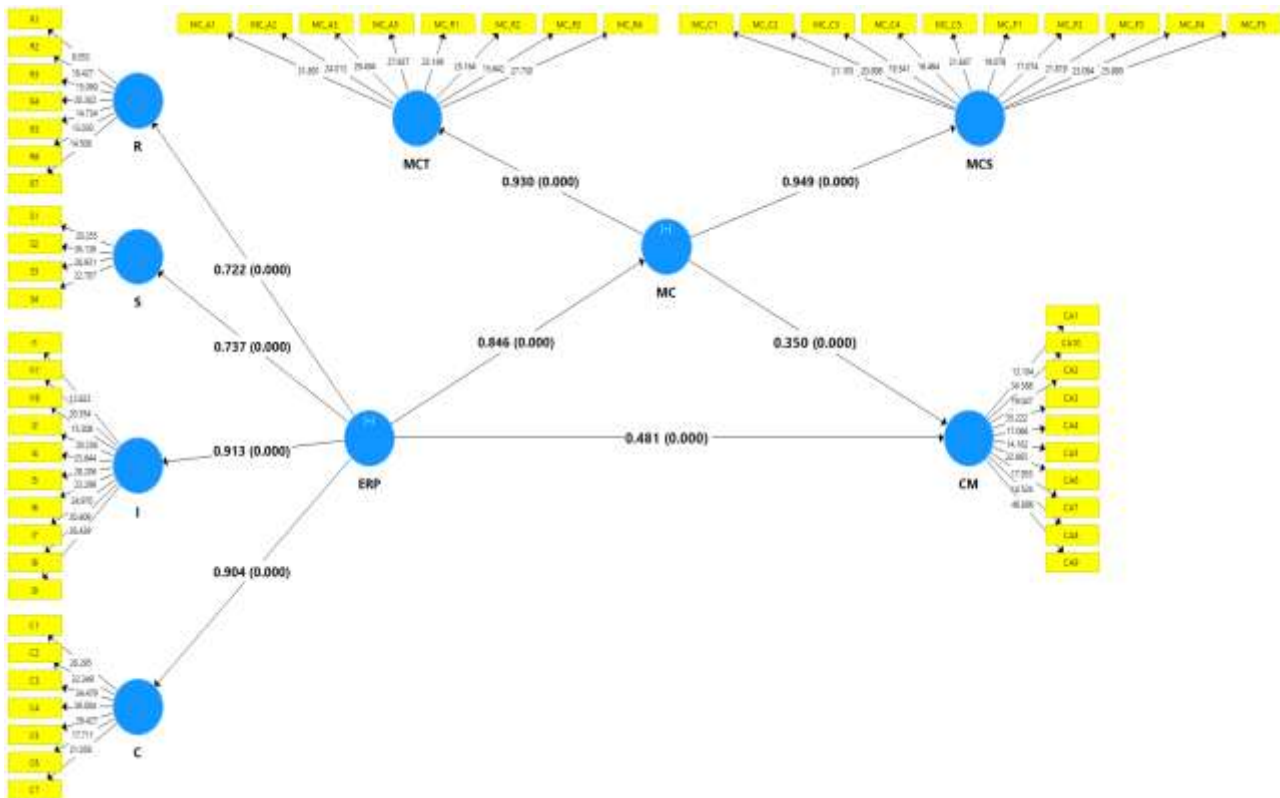
medium effect size of the manager on competitive advantage (0.183), and the lowest effect size is between management control and competitive advantage (0.097). The ranged of effect size for this from small to large effect size.

**Table 9.** Results of  $f^2$

		CM	MC
8.	ERP	0.1827	2.509
	MC	0.0965	

**HYPOTHESIS TESTING**

As SmartPLS 3.0 model and its path coefficient have a similar explanation as standardized beta weight in the regression analysis. The range of estimated path coefficient from -1 to +1, if the path coefficient close to +1 that indicate a strong positive relationship while -1 indicate a strong negative relationship. Table 10 illustrates the path coefficient including the significance testing results, t-statistic, standard error, and the mediating effect.



**Figure 2** Results of the first structural model

Including the mediation effect, the hypothesis testing dealt with only three paths. The resulting hypothesis testing presents that the three paths were statistically significant at 0.001 levels. 5 percent significance level is assumed as an acceptable level in business literature (Hair et al. 2013). The path coefficient (refer to figure 1) was statistically significant positive direct effect of ERP and MC on CM with a path coefficient of  $\beta$  equal to 0.846 ( $p < .001$ ) and 0.350 ( $p < .001$ ) respectively. Thus, both H1 and H2 were supported. The positive direct effect of ERP on CM was also significant ( $\beta = .481$ ,  $p < .001$ ), thus H3 was supported.

**Table 10.** Significance testing results of the structural model path coefficients

	BETA	SE	t value	P Values
Path a				
ERP -> MC	0.846	0.021	39.886	0.000
Path b				
MC -> CM	0.350	0.103	3.406	0.000
Path c'				
ERP -> CM	0.481	0.109	4.412	0.000
Indirect effect				
	BETA	SE	t value	P Values
ERP -> CM	0.296	0.089	3.336	0.000
Mediation	Direct	Indirect	Results	
beta	0.481	0.296		
p value	<0.001	<0.001	Complementary mediation	

According to Hair et al. (2016) complementary mediation when the indirect effect and the direct effect both are significant and point in the same direction. Testing for the type of mediation in a model requires running a series of analyses. The first step addresses the significance of the indirect effect via the mediator variable as shown in Table 10. If the indirect effect is not significant, there is no mediation effect and the proposed mediator does not function as mediator in the nested relationship. Specifically, if the direct effect is significant, the result concludes it is possible there is an omitted mediator, which potentially explains the relationship between independent and dependent variable (direct only nonmediation). If the direct effect is also not significant (no-effect nonmediation), however, it should be concluded that the theoretical framework is flawed. In this case, should go back to theory and reconsider the path model setup. According to the above-mentioned classification of mediation, This study showed that management control had complementary mediation role between ERP and CM since both direct and indirect effect was significant and showed the same direction. Therefore, management control mediates the positive direct effect of ERP systems on firm competitive advantage was supported. Thus H4 was supported.

## 9. DISCUSSION AND CONCLUSION

The goal of the study was to statistically test the positive relationship between ERP and MC to create competitive advantage specifically when using business process attributes to measure ERP systems. A path model was developed which empirically tested by using survey data from 114 manufacturing company in Malaysia. Using this path model which is illustrated in Fig. 1, we find a significant path from ERP systems and MC to competitive advantage (H1 and H2). Our results also show that ERP is positively related to MC (H3). However, we do find support for the hypotheses (H4) that management controls mediate the effect of ERP system on the firm's competitive advantage. This study has replied to the call made which has been asked by several studies such as Sanchez and Spraakman (2012) and Granlund (2011), studies examining the relationships amongst constructs specifically ERP and MC to explain their relationship which claimed to be unclear. ERP framework as proposed in this study for better ERP assessment and measurement have responded to the call made by Sanchez (2012) for management accounting and information system researchers to use that measurement to enhance the literature in the area and find clearer results. Thus, the study confirms earlier results (Chapman & Kihn 2009; Kallunki et al. 2011; Ruivo et al. 2014) by providing



evidence on the effect of ERP on competitive advantage while management control is a mediator variable. Our findings show that management control helps ERP systems to create competitive advantage.

This study extends Kallunki et al. (2011) and Sanchez and Sprakman (2012) by arguing that MC as a mediator variable to support ERP systems to create competitive advantage. Using business process attributes to measure ERP systems to create better results in terms of affecting MC. The results support previous literature but the ERP effect seems to be stronger than previous studies. The results supported Sanchez and Sprakman (2012) argument which claim that studies couldn't use proper ERP assessment to analyze the relationship between ERP and MC. The results of this study show a high impact on MC after using different measurements to ERP systems included business process. Drawing the conclusion of the study findings the limitation must be acknowledged in terms of small sample size; and final results were consisting of 114 responses over 3879 population of the companies. Thus, the generalizability of the ERP system role can't be made without considering the generalizability issue.

This study, therefore, provides opportunities for further future research to examine more closely the interaction between ERP and MC from different types of perspectives and compare the results. It is recommended and it's interesting to apply the findings of this study on other countries since this study was carried out in Malaysia as a developing country or adopting the same study from the perspective of the services industry. Thus, future studies could lead to other variables to be used in studying and investigate firms' competitive advantage during ERP adoption using a broader set of MC measures or other factors likely to influence firms' performance. Finally, we confirm Sanchez and Sprakman (2012) that ERP systems should be studied through its business process and attributes for better assessment.

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