

## **Towards a B2B E-Commerce Evaluation Management Model to Assess Organizational Drivers in Hospitals**

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### **Abstract**

Effective utilization of business-to-business (B2B) electronic commerce (e-commerce) in hospitals may lead to many benefits such as increased accessibility to healthcare providers, improved process efficiency, enhanced quality of healthcare services, increased responses to changes, decreased scheduling conflicts, and reduction in administrative costs. However, many hospitals have found that they have not yet fully reaped the expected benefits from their B2B e-commerce investments. Despite this, there has not been much discussion in the literature with respect to the relationship between the organizational drivers on B2B e-commerce benefits for hospitals. Hence, a mixed-method of case study and survey was conducted to examine the relationships between B2B e-commerce benefits, IT evaluation resources allocation, IT investment evaluation methodologies, IT maturity, and user information requirements determination process. A B2B e-commerce evaluation management model was developed to test these relationships. The results provided empirical evidence in support of our proposed model and revealed that hospitals' IT evaluation resources allocation practices mediated the relationship of IT investment evaluation methodologies, IT maturity, and user information requirements determination process with B2B e-commerce benefits. The results also showed that the level of IT maturity had a significant impact on the adoption of IT investment evaluation methodologies.

*Keywords:* hospital, information requirements determination, IT maturity, IT evaluation, B2B e-commerce

## 1. Introduction

Organizations are increasingly relying on business-to-business (B2B) electronic commerce (e-commerce) applications to streamline their business processes.<sup>1,2,3,4</sup> Effective use of B2B e-commerce can assist hospitals to reduce costs in procuring and distributing medicines and other medical-related products to the patients, to procure requisite medical supplies on a 24/7/365 basis, to improve business process efficiency, and to provide accurate and timely business information and streamline orders and payments. For example, the use of e-commerce technologies in conjunction with video-conferencing equipment enables hospitals and other healthcare organizations to procure their products more effectively and efficiently via online detailing with pharmaceutical companies.<sup>5,6,7</sup> A survey conducted by Institute for Information Industry estimated that the investments in B2B e-commerce by Taiwanese enterprises increased by 8.4% between 2008 and 2009 and it is likely to increase to more than US\$340 billion by 2013.<sup>8</sup>

The management of IT/B2B is a challenging task with many projects failing to achieve their intended objectives.<sup>9,10,11,12,13,14,15,16,17</sup> In fact, many senior hospital executives have discovered that they have not yet fully reaped the benefits from their B2B e-commerce investment. Research studies have continued to debate whether productivity benefits of spending in IT for healthcare have been overstated.<sup>18,19</sup> The relationship between the use of IT in healthcare and the slowdown in productivity became known as “IT productivity paradox” and the term has gained increasing notoriety as researchers continue to argue whether the investments in healthcare IT was worthwhile.<sup>20,21,22</sup> Some researchers take the position that the confusion over the realization of B2B e-commerce benefits is due to, among other things, low level of organizational IT maturity (hereafter referred to as IT maturity) and lack of use of IT investment evaluation methodologies.<sup>23,24,25</sup> In addition, despite the focus by recent literature of the role played by the IT investment evaluation methodologies and the importance of other organizational drivers (e.g. the levels of IT maturity, allocation of appropriate and sufficient IT evaluation resources (hereafter referred to

as IT evaluation resources allocation), and user information requirements determination process) on B2B e-commerce benefits remain unclear.<sup>24,26</sup> For example, Hackbarth & Kettinger and Lin et al. have found that there was some connection between organizational IT maturity and IT investment evaluation.<sup>27,28</sup> Melville et al. have pointed out that allocation of appropriate IT evaluation resources is somewhat linked with successful adoption of IT investment evaluation methodologies.<sup>29</sup> There is also some evidence to suggest that organizations with high levels of IT investment evaluation may lead to higher level of B2B e-commerce benefits.<sup>30,31,32</sup>

Despite this, there has not been much discussion in the literature with respect to the relationship between these organizational drivers on B2B e-commerce benefits. In fact, very few B2B e-commerce studies have been conducted in the healthcare area<sup>33,34,35,36</sup> and most of these studies deal with strategic marketing of e-health services and systems<sup>37</sup>, customer relationship management<sup>38</sup>, and initial designing stage of e-fulfillment systems<sup>39</sup>. In particular, IT investment evaluation and the organizational drivers affecting the realization of B2B e-commerce benefits in Taiwanese hospitals remain poorly understood and relatively under-researched. Given the financial stakes involved, better understanding of the implication of B2B e-commerce investments and their relationships with IT investment evaluation methodologies and the above-mentioned organizational drivers in Taiwanese hospitals is warranted. Hence, a mixed-method of case study and survey was conducted to examine the relationships between IT investment evaluation methodologies and other organizational drivers identified during the case study phase and their impact on the B2B e-commerce benefits. The main objectives of this study were to: (1) develop a B2B e-commerce evaluation management model; and (2) test the relationships between B2B e-commerce benefits, IT evaluation resources allocation, IT investment evaluation methodologies, IT maturity, and user information requirements determination process.

## 2. Theoretical Background

Two different perspectives, production economics and organizational perspectives, form the basis for this

study. The production economics perspective establishes a direct connection between IT investment evaluation practices and B2B e-commerce benefits whereas the organizational perspective conceptualizes the linkage between technology adoption and diffusion and B2B e-commerce benefits realized. The production economics perspective views organizational activities as economic production processes<sup>40</sup>. In these processes, input factors such as the adoption of IT investment evaluation methodologies can assist in transforming B2B e-commerce investments into outputs such as B2B e-commerce benefits. Previous studies have shown that organizations that adopt IT investment evaluation methodologies can achieve better business performance or benefits.<sup>29,41,42</sup> For example, the adoption of IT investment evaluation methodologies serve as an essential studying tool for organizations and it assists in gathering support from key stakeholders.<sup>43,44,45</sup> It also helps to underscore best practices which organizations can apply lessons learnt to future B2B e-commerce investment processes and this has a significant impact on organizations' B2B e-commerce benefits from.<sup>29,46,47</sup> This is important as the use of IT investment evaluation methodologies assists organizations to focus on all aspects of a B2B e-commerce investment at regular intervals in order to evaluate realized benefits against their original objectives and to initiate corrective action.<sup>42,48,49,50,51</sup>

However, the adoption of IT investment evaluation methodologies is a complex process for most organizations.<sup>52,43,54</sup> Several studies have revealed that many organizations fail to adopt IT investment evaluation methodologies.<sup>41,42</sup> This indicates that organizations need to consider not just the production economic perspective but also the organizational perspective when investing in B2B e-commerce. The organizational perspective can be useful to view the contribution of the organizational drivers in eliminating or minimizing the barriers of adopting IT investment evaluation methodologies. The technology adoption and diffusion theory stipulates that various kinds of barriers will eliminate or minimize the benefits of an IT investment (e.g. B2B e-commerce). The Limits-to-Value model proposed by Chircu and Kauffman<sup>55</sup> stated that there are many technology adoption barriers which can prevent organizations in realizing benefits from their B2B e-commerce investment. The technology adoption and diffusion theory highlights the need for

organizations to eliminate or minimize the adoption barriers by, for instance, increasing the level of organizational IT maturity, the level of complete and accurate user information requirements determination process, and by allocating appropriate IT evaluation resources. This will greatly assist hospitals in successfully adopting the IT investment evaluation methodologies as well as in realizing the expected B2B e-commerce benefits.

### 3. Research Hypotheses

#### 3.1. *IT investment evaluation methodologies and B2B e-commerce benefits*

Hospitals generally have very poor understanding of the importance of their B2B e-commerce adoption and implementation.<sup>56</sup> Empirical studies in this aspect have also been scarce in the literature,<sup>57,58,59,60</sup> particularly in the healthcare area.<sup>33,35,61</sup> The use of B2B e-commerce by healthcare and other organizations includes online activities such as transactions between themselves and their suppliers and the sales of products and services via e-marketplace.<sup>56,62,63</sup> It enables hospitals to minimize their procurement costs and assists their suppliers to sell via an efficient marketing channel.<sup>56</sup> B2B e-commerce also allows hospitals' business partners to access their internal business systems via the Internet. Moreover, it facilitates hospitals to efficiently position their organizational procurement structures (ie. insourcing or outsourcing) by seeking alternative product and service suppliers via B2B marketplace.<sup>64</sup>

Hospitals must look at B2B e-commerce from a strategic perspective and evaluate its benefits because it can assist them in developing and controlling strategic, tactical, and operational plans that define the appropriate role of B2B e-commerce in their organization.<sup>65</sup> In addition, the evaluation and benefits realization mechanisms can expedite the organizational learning process and help make B2B work to the benefit of all customers and external partners, whether viewed from a narrow buyer/seller perspective or a broader supply chain perspective.<sup>65,66,67</sup>

In order to keep abreast of changing requirements, organizations require new metrics to evaluate whether their B2B e-commerce investments are paying off.<sup>68</sup> This is crucial given the effective leverage and evaluation of B2B e-commerce investments can assist

organizations to realize their expected B2B e-commerce benefits.<sup>69,70</sup>

However, despite the high expectations for the benefits from B2B e-commerce in hospitals, its evaluation issues and processes remain poorly understood and relatively under-researched.<sup>71,72</sup> Factors contributing to low adoption vary and one important factor is the inability by hospitals to evaluate the business value of their B2B e-commerce investments as well as to ensure that the expected benefits are eventually realized or delivered.<sup>73,74</sup> Evaluation of B2B e-commerce in hospitals is not straightforward and can be confusing and problematic due to its complexity.<sup>73,75,76</sup> The less precisely bounded environment of B2B e-commerce technology adds more complexity to the traditional IT measurement problem as this type of investment is physically distributed between suppliers and vendors, making the evaluation process even more difficult.<sup>77,78,79</sup> The problem becomes more evident as B2B e-commerce is used to link the supply chain or to change the structure of industries, since costs and benefits have to be tracked across functional and organizational boundaries.<sup>48,80</sup>

There are several IT investment evaluation methodologies (e.g. Five-step Evaluation Process,<sup>75</sup> Health Technology Assessment,<sup>81</sup> System Development Stage,<sup>82</sup> and The 4Cs (communication, care, control, and context) Framework<sup>83</sup>) that can be used to evaluate B2B e-commerce investments in hospitals. Relevant IT evaluation research indicates that organizations using appropriate IT investment evaluation methodologies may result in higher level of B2B e-commerce benefits.<sup>29,73,84</sup> On the basis of the relevant literature reviewed, it is hypothesized that:

**H1:** The adoption of an IT investment evaluation methodology has a positive effect on B2B e-commerce benefits.

### **3.2. IT maturity, IT investment evaluation methodologies, and IT evaluation resource allocation**

The revised stages of growth model by Galliers and Sutherland<sup>85</sup> was used in this study to examine the level of IT maturity within the survey respondents. IT maturity refers to an organization's capability to utilize its existing IT processes and components to obtain

business value.<sup>85,86,87</sup> It is pertained to the organization's ability to effectively deploy IT towards the achievement of B2B e-commerce benefits.<sup>88</sup> The level of IT maturity is critical in assessing IT projects and is linked with the ability of an organization to adopt and implement processes and methodologies.<sup>27</sup> It is also about the balance between the IT being adopted, and the capabilities as well as management processes used to master and utilize IT within the organization.<sup>89,90</sup> Organizations are more capable to track and manage user information requirements of the proposed IT systems once sufficient organizational IT maturity in both processes and technology has been achieved.<sup>91,92</sup> In addition, these maturity models extend organizations' abilities to evaluate and track impacts of IT investments such as B2B e-commerce initiatives within their organizations.<sup>92</sup> It relates to the result of a history of IT performance assessment and modifications which can lead to improved management processes as organizations mature.<sup>93,94</sup>

The level of IT maturity may affect the adoption of IT investment evaluation methodologies which can be used as the tools to evaluate the functionality required in a proposed IT system.<sup>85,95</sup> Findings from a study of an Electronic Medication Management System in a major public hospital reveal that effective evaluation of a system requires appropriate level of IT maturity and a deep understanding of its nature and complexity.<sup>96</sup> Organizations which have place more emphasis on increasing their IT maturity are more likely to conduct evaluation.<sup>97</sup> Therefore, on the basis of the relevant literature reviewed, and specifically with respect to the adoption of IT investment evaluation methodologies, it is hypothesized that:

**H2:** The level of IT maturity has a positive effect on the adoption of an IT investment evaluation methodology.

According to Grant<sup>98</sup>, an organization's productivity and its ability to compete stem mainly from the valuable resources it possesses. These resources can take a variety of forms including core competence and capabilities, both in physical and intangible shapes. Amit and Schoemaker<sup>99</sup> point out that the organizational resources can take forms of enterprise knowledge, financial resources, physical assets, and manpower. In addition, resources are tradable and can be used to engage the resources within the organization, such as implicit processes to transfer knowledge within

the organization.<sup>15,100</sup> A resource is capable of assisting an organization in gaining a competitive advantage by, for example, formulating a value-creating strategy in order to outperform its competitors or to reduce its own weaknesses.<sup>99,101,102</sup> Chircu and Kauffman<sup>55</sup> have found that organizations need to possess sufficient capabilities to allocate resources as well as to identify and assess a number of industry-independent sources of benefits. We argue that hospitals can only take necessary steps to eliminate barriers to the allocation of IT evaluation resources when they increase their level of IT maturity. Thus, the following hypothesis is derived:

**H3:** The level of IT maturity has a positive effect on the allocation of IT evaluation resources.

### ***3.3. IT investment evaluation methodologies, IT evaluation resource allocation, and B2B e-commerce benefits***

Allocation of appropriate and sufficient IT evaluation resources is critical for the success of B2B e-commerce initiatives.<sup>88,102,103,104</sup> Chircu and Kauffman<sup>55</sup> have argued that organizations need to possess appropriate and sufficient resources and capabilities to evaluate benefits. In order to determine the potential B2B e-commerce benefits for a specific industry and/or a specific organization, the contribution of all the benefits need to be evaluated during the B2B e-commerce evaluation process.<sup>55</sup> However, this process is fraught with industry and organizational constraints that can determine the amount of realized B2B e-commerce benefits.<sup>55</sup> Organizations need to allocate appropriate IT evaluation resources in order overcome as many evaluation constraints as possible in order to obtain maximum B2B e-commerce benefits.

Ayal & Rothberg<sup>105</sup> have pointed out that resources usually encompass manpower, services, and hardware resources and capabilities. Chircu and Kauffman<sup>55</sup>, on the other hand, have argued that failures of adoption of IT investments were often due to resource constraints which were largely caused by the inability of an organization to obtain necessary enough up-to-date IT evaluation resources. The resources allocation can affect an organization's ability to undertake evaluation as well as to realize the expected B2B e-commerce benefits. The allocation of sufficient IT evaluation resources plays a key role in these processes as past studies have shown the positive link between IT investment

evaluation methodologies and allocation of appropriate and sufficient IT evaluation resources.<sup>106,107,108,109,110,111</sup>

We argue that hospitals need to undertake IT investment evaluation methodologies to determine the appropriate level of valuable and scarce IT evaluation resources needed within the organization to realize the expected B2B e-commerce benefits. Thus, the following hypotheses are derived:

**H4:** The adoption of IT investment evaluation methodologies has a positive effect on the allocation of IT evaluation resources.

**H5:** Allocation of IT evaluation resources has a positive effect on the realization of B2B e-commerce benefits.

### ***3.4. Information requirement determination and IT evaluation resources allocation***

The user information requirements determination process is a critical phase within any system development life cycle. It relates to an organization's capability to determine its own requirements. The user information requirements determination process has generated a lot of interest and debate among researchers and practitioners as a potential means for improving the success rates of IT investments.<sup>112,113,114</sup> The user information requirements determination process was defined by Browne and Ramesh<sup>95</sup> as "a set of activities used by a systems analyst when assessing the functionality required in a proposed system" (p. 625). It has become increasingly important in obtaining the correct and complete set of user requirements in developing of any IT or B2B e-commerce projects. However, with today's rapid changes of technology and customer driven environments and needs, user information requirements determination process has become increasingly difficult for organizations to elicit and predict.<sup>115</sup> This difficulty can result in interpersonal conflict among stakeholders since system users desire changes to reflect environmental changes whereas IT professionals desperately need to lock-in requirements so that the project or contract can be delivered within budget and on time.<sup>113</sup> This in turn can lead to poor allocation of IT evaluation resources or any other types of resources. Thus, the following hypothesis is derived:

**H6:** The user information requirements determination process has a positive effect on the allocation of IT evaluation resources.

#### 4. Research Methodology

A universal National Health Insurance scheme in Taiwan was officially launched in 1995. However, due to the financial difficulties within the national health care system, the costs and revenue of these hospitals and healthcare providers have been closely monitored by the Bureau of National Health Insurance.<sup>107,116</sup> The Bureau of National Health Insurance's fixed-budget policy has resulted in reimbursement prices that made many hospitals unsustainable. That is, the payments to hospitals, have been decreasing markedly each year while, at the same time, their costs have been increasing rapidly. The reimbursement prices by the Bureau of National Health Insurance are among the lowest in the world.<sup>117</sup> Under the twin pressures of Bureau of National Health Insurance reimbursement price constraints and the intense competition in the healthcare marketplace, the total number of hospitals in Taiwan has decreased by more than 30% (from 835 to 530) between 1986 and 2007.<sup>117,118,119</sup> Most hospitals have strategies in place to attract and win market share by connecting with other healthcare providers and businesses and by investing in B2B initiatives in order to provide quality and personalized care for their patients. The current roles of most Taiwanese hospitals are to focus on meeting their patient needs as well as to reduce their operating costs via the efficient use of their existing infrastructure and investments (e.g., B2B initiatives).

However, despite most Taiwanese hospitals are beginning to look for ways to realize benefits from their IT and B2B e-commerce investments, many of them simply do not evaluate their B2B e-commerce investments to confirm whether the expected benefits are actually realized. Hence, the main objectives of this study were to: (1) develop a B2B e-commerce evaluation management model; and (2) test the relationships between B2B e-commerce benefits, IT evaluation resources allocation, IT investment evaluation methodologies, IT maturity, and user information requirements determination process. These needed both: (a) a broad overview of such environments obtained from a smaller number of hospitals (case study); and (b) a detailed examination of these issues and relationships collected from a large number of hospitals (survey). Eisenhardt<sup>120</sup> argues that multiple data collection methods and sources provide stronger

substantiation of constructs and hypotheses, strengthening convergence of results. Mingers<sup>121</sup> indicates that mixed-method research results will be richer and more reliable. In addition, the use of both qualitative and quantitative data can be used to construct theoretical models<sup>122,123</sup> such as the B2B e-commerce evaluation management model. Therefore, a mixed-method (and paradigm) approach was taken in combining case study and survey.

##### 4.1. Case study

IT managers and executives from twenty-seven Taiwanese hospitals were interviewed. The cases were deliberately chosen in order to focus efforts on theoretically useful cases (following the theoretical, non-random sampling strategy by Eisenhardt<sup>120</sup>). The hospitals in Taiwan are accredited by Department of Health into three levels: medical centers (Level 3), regional teaching (Level 2) hospitals, and district (Level 1) hospitals. Hospitals which are classified as "medical centers" generally have more than 800 beds and are affiliated with a medical school. District hospitals are usually the smallest hospitals while the size of regional teaching hospitals are usually somewhere between Level 3 and Level 1 hospitals. In total, two of the interviewed hospitals were medical centers, nine were regional teaching hospitals, and sixteen were district hospitals. Eleven of these were public hospitals where the other nine were private hospitals. The remaining seven were not-for-profit hospitals.

The case study method enables the researcher to examine how Taiwanese hospitals evaluate their B2B e-commerce investments and to what extent their B2B e-commerce benefits are realized. The questions asked during the interviews included the practices and processes of B2B e-commerce evaluation and benefits realization and their impact on B2B e-commerce benefits, IT evaluation resources allocation, the user information requirements determination process, and user satisfaction in Taiwanese hospitals, as well as other B2B e-commerce adoption and IT outsourcing issues. Qualitative content analysis was then used to analyze the data from the case study.<sup>124</sup> The researchers evaluated the responses from the interviews and classified them according to the research themes. The analysis of the case study results was conducted in a cyclical manner and the results were checked by other experts in the field.

The external experts were asked to trace the logical flow of the research study, research questions, case findings and analysis and identification of constructs and thereby identifying any gaps in the chain of evidence.<sup>125</sup> The findings from these information gathering approaches were analyzed iteratively by the researchers on an individual level, differences reconciled and then a judgment made on each of the major themes. Questions relating to a particular research theme, for example, level of B2B e-commerce benefits, were examined as a cluster. Divergent views within the same hospital were assessed in terms of the relative strength of the perspective according to the numbers of responses falling in particular categories. This was done as a form of in-case analysis and to develop general explanations and interpretations.<sup>120</sup> These steps enhance the construct validity, reliability and overall quality of the research.<sup>125</sup>

#### 4.2. Survey

Prior to determining the sample size for the survey, a pilot survey of IT managers of 10 hospitals was conducted. Some valuable feedback was received and the questionnaire was slightly adjusted for the main survey. For the main survey, questionnaires were randomly sent to 350 hospitals in Taiwan from a list obtained from the Ministry of Health and Welfare. Two follow-up mailings or phone calls were carried out to increase the response rate. A total of 114 samples were returned but 7 of these either were incomplete or had no B2B e-commerce systems and therefore, were discarded. In the end, a total of 107 complete and usable responses were obtained. The potential problems inherent in a survey make the analysis of nonrespondents a crucial exercise in order to avoid non-response bias.<sup>126</sup> One of the key assumptions in such an approach is that later respondents to a survey are more similar to nonrespondents than are earlier respondents.<sup>127</sup> An ANOVA analysis was performed to compare late returns with earlier responses in order to check for non-response bias.<sup>127</sup> No significant differences were detected between the two samples on total number of employees.

Of these respondents, 39 (36.4%) were public hospitals while 22 (20.6%) were private hospitals. The remaining 46 (43.0%) were non-for-profit hospitals. Approximately a third (39, 36.4%) of these hospitals were located in Southern Taiwan and 31 (29.0%) were located in Central Taiwan. Just under a quarter (23,

21.5%) of the responding hospitals were from Northern Taiwan and the remaining 14 (13.1%) were from Eastern Taiwan.

#### 4.3. Measures

Respondents were asked to indicate their agreement on a 7-point scale (1 for strongly disagree and 7 for strongly agree) with statements concerning five main constructs: (1) IT maturity; (2) IT investment evaluation methodologies; (3) IT evaluation resources allocation; (4) user information requirements determination process; and (5) B2B e-commerce benefits. Reliability analysis (alpha) was conducted on these five main constructs.

The *IT maturity* scale was based on Galliers and Sutherland's Revised Stages of Growth Model.<sup>85</sup> This scale assesses a hospital's capability to utilize its existing IT infrastructure to obtain business value. The scale was revised into a six-item measurement. The alpha value for this scale was 0.86, indicating acceptable values of internal consistency.<sup>128</sup> This scale measured the organisational IT maturity of an organisation in terms of its stage of growth for each of the six elements – strategy, structure, systems, style, skills, and overall goals.

The *IT investment evaluation methodologies* scale was derived from Ward et al., Lin and Pervan, and Ward and Daniel.<sup>129,130,131</sup> The scale measured the use of IT investment evaluation methodologies of hospitals investing in B2B e-commerce investments. This scale has eight items and alpha value was 0.96. The scale measured the usage, wide use, processes taken to identify, review, and evaluate the B2B e-commerce projects.

The *IT evaluation resources allocation* scale was mainly derived from Chircu and Kauffman and Lin et al.<sup>55,132</sup> The scale measured the spending on, management of, and allocation of various B2B e-commerce related resources in the hospital. The scale has six items and the alpha value for this scale is 0.88.

The *user information requirements determination process* was mainly derived from Moody et al. and Lin and Lin.<sup>133,134</sup> The scale measured the usage and effectiveness of user information requirements determination process during the implementation of the B2B e-commerce projects for the participating hospitals. The scale has four items and the alpha value for this

scale is 0.85.

The *B2B e-commerce benefits* scale was derived from scales used by Lin et al., Kao, and Teo and Ranganathan.<sup>78,135,136</sup> The scale has eight items and the alpha value for this scale is 0.94. The scale measured the benefits (i.e. corporate images enhancement, increased sales, and cost reductions) obtained through the adoption of B2B e-commerce. In the absence of objective data on B2B e-commerce benefits, the IT executives' perceptions were used. Although there has been some debate regarding the legitimacy of perceptual measures as a proxy for objective measures of B2B e-commerce benefits, research has succeeded in alleviating some of the concerns by showing that perceptual measures of organisational performance has a strong positive relationship with more traditional objective measures.<sup>42</sup> For example, a study by Venkatraman and Ramanujam<sup>137</sup> showed that there was a high degree of correlation between perceptual and objective performance measures in the process of measuring performance of several competing organisations. This reflects the degree of experience of IT executives and their constant involvement in the IT investment process.<sup>138</sup> Indeed, several studies have shown that IT executives' perceptions are critical to understanding how IT affects the performance of organisations.<sup>139,140,141</sup>

## 5. Research Findings

### 5.1. Case study

Key issues identified during the case study phase were: IT investment evaluation methodologies, IT maturity, IT evaluation resources allocation, user information requirements determination process, and B2B e-commerce benefits. These issues were examined as research constructs in more details in the survey section.

### 5.2. Survey

Prior to analysis, data was screened for possible outliers, and missing or out-of-range values. All measures were then analyzed for reliability and validity in accordance with the guidelines set out by Jöreskog and Sörbom<sup>142</sup>. The reliability of these constructs was evaluated using Cronbach's coefficient alpha ( $\alpha$ ) and their  $\alpha$  values were all above 0.80, indicating a reliable measurement instrument.<sup>128</sup> In addition, three types of validity were assessed to validate our measurement model: content

validity, convergent validity, and discriminant validity. Content validity was established by ensuring consistency between the measurement items and the extant literature. This was done by interviewing IT managers and pilot-testing the instrument before sending out the main survey. Churchill<sup>143</sup> has suggested that convergent and discriminant validities should be examined for construct validity. Therefore, we assessed convergent validity by examining composite reliability (CR) and average variance extracted (AVE) from the three constructs.<sup>144</sup>

Our CR values of the five constructs were between 0.80 and 0.95 and all are above the suggested minimum of 0.70.<sup>144</sup> Their AVE values were all above 0.60 and these values provided further evidence of convergent validity.<sup>145</sup> These AVE values could also be used to assess discriminant validity which was evident in the results of this study as AVE values for all constructs were higher than the largest squared pairwise correlation between each construct.<sup>145,146</sup>

SPSS and AMOS were then used to analyze the data. SPSS was used initially to obtain some descriptive data and SEM (Structural Equation Modelling) using AMOS was then applied to estimate direct and indirect effects for the model. A two-step SEM approach was followed to first evaluate the quality of the measurement items and then estimated the structural model.<sup>146</sup> All variables within the model were regarded as separate reflective measures. The model was run as a structural model. It was found that the direct path between "IT investment evaluation methodology" and "B2B e-commerce benefits" (H1) was weak and not significant and so was removed from the proposed model. The final model (Figure 1) had achieved a good fit of the data and the resulting fit indexes indicated that the measurement model fitted the data well:  $\chi^2 = 213.91$  (171 degrees of freedom),  $p = 0.32$ , comparative fit index (CFI) = 0.98, root mean square error of approximation (RMSEA) = 0.04, and Goodness-of-Fit Index (GFI) = 0.90.

The value of (Chi-square/degree of freedom) is less than 3 and the GFI is above 0.90 (GFI=0.93).<sup>144,148</sup> In addition, the RMSEA value is less than 0.05, implying good model fit.<sup>149</sup> Moreover, the ranges of all factor loadings and the measurement errors were acceptable and significant at  $\alpha = 0.01$ , which provided evidence of convergent validity.



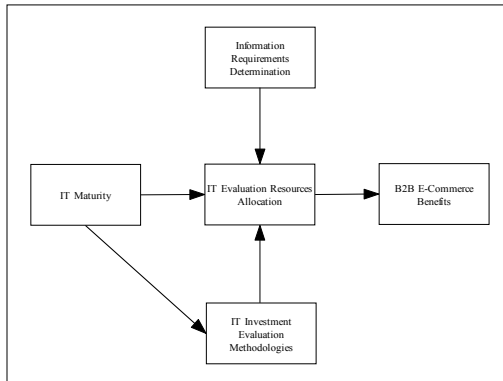


Fig. 1. The B2B e-commerce evaluation management model

The level of IT maturity was positively related to the adoption of IT investment evaluation methodologies ( $\beta=0.39^{***}$ ). This suggests that the level of IT maturity had a significant impact on the effective use of IT investment evaluation methodologies. This provides full support for H2. H3, which predicted that hospitals' level of IT maturity could affect their ability to allocate IT evaluation resources, was partially supported ( $\beta=0.26^*$ ). As anticipated, both the adoption of IT investment evaluation methodologies and the user information requirements determination process were positively related to the hospitals' ability to allocate IT evaluation resources which in turn had a significant impact on the realization of B2B e-commerce benefits ( $\beta=0.41^{***}$ ,  $\beta=0.47^{***}$ , and  $\beta=0.62^{***}$ , respectively). This provided support for H4, H5, and H6.

Table 1. The six proposed research hypotheses

	Hypotheses	Supported?
H1	The adoption of an IT investment evaluation methodology has a positive effect on B2B e-commerce benefits.	No
H2	The level of IT maturity has a positive effect on the adoption of an IT investment evaluation methodology.	Yes
H3	The level of IT maturity has a positive effect on the allocation of IT evaluation resources.	Partially
H4	The adoption of IT investment evaluation methodologies has a positive effect on the allocation of IT evaluation resources.	Yes
H5	Allocation of IT evaluation resources has a positive effect on the realization of B2B e-commerce benefits.	Yes
H6	The user information requirements determination process has a positive effect on the allocation of IT evaluation resources.	Yes

## 6. Discussion

To examine the impact of IT investment evaluation methodologies and three organizational drivers on B2B e-commerce benefits in Taiwanese hospitals, this study developed B2B e-commerce evaluation management model. IT maturity was found to have a significant positive impact on the adoption of IT investment evaluation methodologies which, in turn, had a significant effect on the allocation of IT evaluation resources. The results also revealed that an accurate and complete user information requirements determination process was positively related to the allocation of IT evaluation resources. These, in turn, also had a significant positive impact on the realization of B2B e-commerce benefits. In addition, the results showed that the level of IT maturity had a partial impact on the hospitals' ability to allocate IT evaluation resources. However, the adoption of IT investment evaluation methodologies alone did not have significant impact on the realization of B2B e-commerce benefits. The adoption of IT investment evaluation methodologies had only an indirect impact on the hospitals' B2B e-commerce benefits, depending on its ability to requisite IT evaluation resources. These results have provided a number of insights and implications.

First, Taiwanese hospitals' ability to allocate the requisite IT evaluation resources appears to have a mediating effects on the relationships between other organizational drivers (i.e. IT investment evaluation methodologies, IT maturity, and user information requirement determination process) and the realization of B2B e-commerce benefits. The results also reveal that those hospitals which had adopted IT investment evaluation methodologies alone could not produce B2B e-commerce benefits. In other words, these organizational drivers must be used by hospitals in conjunction with sufficient requisite IT evaluation resources to be able to realize any B2B e-commerce benefits. Second, hospitals' level of IT maturity played a significant role in dictating the use of IT investment evaluation methodologies which in turn led to allocation of adequate resources. Third, as argued by Carr, successful IT investment comes down to successful management processes and practices, not necessarily those who invest in IT.<sup>150</sup> This is a critical suggestion for hospitals which need to assess their IT evaluation resources allocation processes carefully.

## 7. Conclusions and Implications

### 7.1. Summary of key research findings

This study examines the effects of several organizational drivers on the realization of B2B e-commerce benefits and, in the process, empirically validates a B2B e-commerce evaluation management model that will be of use to both researchers and practitioners. IT maturity was found to have a significant positive impact on the adoption of IT investment evaluation methodologies which, in turn, had a significant effect on the allocation of IT evaluation resources. The results also revealed that an accurate and complete user information requirements determination process was positively related to the allocation of IT evaluation resources. These, in turn, also had a significant positive

### 7.2. Theoretical contributions

The findings provide a number of implications for theory and practice. A key finding of this study is the mediating role played by the allocation of IT evaluation resources in the process of B2B e-commerce benefits realization (Figure 1). The results first highlight the importance of the level of IT maturity in supporting the use of IT investment evaluation methodologies. The level of IT maturity among Taiwanese hospitals was found to be a crucial factor in their ability to adopt an IT investment evaluation methodology or process. Both the adoption of IT investment evaluation methodologies and the user requirements determination process evaluation practices were found to be the main organizational factors to assist in enhancing Taiwanese hospitals' capability to allocate requisite IT evaluation resources in the process of realizing B2B e-commerce benefits.

In addition, previous research has argued that IT/B2B e-commerce investments do not always lead to benefits.<sup>151,152,153</sup> This study provides a theoretical explanation as to why. Due to the complementarity nature of these organizational drivers, they need to be managed together, not in isolation. Focusing on one driver of a strategic alignment and neglecting the other drivers will not lead to desirable performance effects.<sup>154</sup> For example, IT investment evaluation methodologies and user information requirements determination processes have been found to have no direct influence on the realization of B2B e-commerce benefits. It has to

be used in conjunction with the allocation of sufficient requisite IT evaluation resources to have any significant impact on B2B e-commerce benefits. Hence, it is critical for senior hospital IT executives to carefully assess their B2B e-commerce investments and ensure that the required level of IT maturity, the adoption of IT investment evaluation methodologies and user information requirements determination processes, and the level of IT evaluation resources allocated are appropriate in the process of realizing B2B e-commerce benefits.

### 7.3. Implications for practice

Based on our findings senior hospital IT executives should focus on making IT an integral part of their business strategy. They should conduct an assessment of their IT and B2B e-commerce investments so that features and benefits can be readily identified and matched with the strategic vision of the hospital. Moreover, investments in IT/B2B e-commerce have allowed both large and small organizations to target customers at a much lower cost. Therefore, hospitals senior executives need to make more informed decisions on how to invest in various types of IT/B2B initiatives and systems in order to maximize their profitability and growth through building relationship with their customers and suppliers. For example, through the participation of the virtual or online communities, intensive public health promotion campaigns, the level of awareness and positive image of the products and services offered by hospitals and other healthcare organizations can be increased for both the existing and potential healthcare suppliers and customers.<sup>155,156,157,158</sup> However, these activities and strategies need to be implemented with good faith without resorting deceptive tactics as adopted by some healthcare organizations in the past.<sup>159,160,161,162</sup>

### 7.4. Limitations and future research directions

Some limitations have to be acknowledged in this study. The choice of constructs which may not fully capture the complex nature of the B2B/IT investment evaluation process of the business environment in which Taiwanese hospitals operate. Equally, benefits and organizational drivers such as user requirements determination process and IT maturity do not remain static, particularly during the different stages of an IT

project life cycle. Further research can take a longitudinal approach as the drivers and the approach to managing B2B/IT benefits and evaluation are likely to change over time.

### Acknowledgements

We would like to thank Sheng-Hsiang Hung who assisted in collecting some of the data for this study.

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