A study on performance tracing of the e-MP policy

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Since 2000, the Industrial Development Bureau (IDB) of the Government in Taiwan has been implementing a policy of Electronic Manufacturing Promotion (e-MP) to assist firms to implement Business to Business Information System (B2BIS). In general, the actual performance of e-MP policy has just been based on the data given in a final report produced by the funded firm. Consequently there is no clear evidence as to the efficacy of the e-MP policy. Therefore, this paper mainly covers two parts (i) A Fuzzy analytic hierarchical process (Fuzzy AHP) was utilized to explore the weights of each policy item according to project leaders’ response of 17 funded cases to see whether the current e-MP policy really benefits firms and (ii) financial data of 30 cases was collected from the stock exchange in Taiwan to understand the actual performance and Fuzzy AHP was utilized to find the funded cases’ initial expectation to see whether the adoption of B2BIS by those cases funded by the Government actually met initial expectation. The results of this study indicate that the e-MP policy need to be adjust and costs decreased and work efficiencies rose are most important benefit in most of the funded cases after introduction of B2BIS and this meet their initial expectation. Finally, implications and suggestions are given for the e-MP policy to facilitate adjustments by the IDB.

1. Motivation

A government’s efforts in promoting an IT policy not only maximizes infrastructure development but also further induces the diffusion and application of information technology (Tam, 1998). Within this context the Industrial Development Bureau (IDB) of the Ministry of Economic Affairs (MOEA) in the Government of Taiwan has been assisting enterprises to implement Business to Business Information Systems (B2BIS). In 2000 they started supporting these initiatives and formed a commitment in their “e-Manufacturing Promotion (e-MP)” policy (NICI, 2002) which consists of four main policy items (Table 1). In past seven years, the government allocated the majority of resources to technical guidance, and the followed sequence of resources allocation were then the personnel training, the establishment of standards on electronic data exchange, and exhibitions of successful cases.

From Table 1 it can be seen that a total of 65 cases of technical guidance were granted between 2000 and 2006 (IDB, 2007). The objective was to enable large firms to have access to sufficient experience and personnel to assist and train their suppliers to use Internet based business-to-business (B2B) information applications. The firms themselves were responsible for their own internal information systems, such as those involving enterprise resource planning (ERP), which were not covered within the e-MP. In the next paragraph we describe the procedure for applying for funding.

When a firm has decided that they want to apply for funding to implement B2BIS then an implementation proposal is completed and filed with the IDB. A committee is appointed by the IDB who decide whether or not to grant funding. After the project has been executed the committee requests the firm to provide a set of key performance indicators (KPI). Thus, when the KPI are compared against the proposal it is clear whether the initial objectives were met.

However, most KPIs proposed by funded cases related to general finance, as a set of lagging indicators, may not immediately reflect the promotional yield of a recently completed project. In addition the lack of actual operational data leaves considerable ambiguities as to whether the support offered by the e-MP policy has really enhanced the funded cases’ operational performance to meet initial expectations.

Furthermore the government has not conducted follow-up studies on performance tracking of the e-MP policy. Therefore in this study we wanted to examine; (i) whether the current e-MP policy benefits firms and (ii) whether the adoption of B2BIS by those cases funded by the Government actually met initial project

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objectives. At first, the fuzzy analytical hierarchical process (Fuzzy AHP) was utilized to understand importance of each e-MP policy item which the funded cases think to see whether the current e-MP policy really benefits firms. The authors also collected the actual financial data of funded cases from the stock exchange in Taiwan in order to understand whether the actual performance of adopting a B2BIS by funded cases actually meet their stated objectives. At first, the fuzzy analytical hierarchical process (Fuzzy AHP) can solve otherwise inexplicable problems and rank the excluded factors according to their weightings. This method has become a major research tool in calculating the relevant weightings of perceived significance between factors, and was therefore utilized in this paper. In the next sections we describe the Fuzzy AHP procedures as it was adopted in this study.

- **Establishment of a hierarchy framework**
  
  The establishment of a hierarchy framework is based upon the subject matter of interest and a variety of criteria may coexist. By definition, the statements (i.e., the description of the subject matter) of the sub-criteria should be more specific than those of the criteria.

- **Design of the questionnaire**
  
  The questionnaire used in AHP is used to obtain information about how informants perceive the weight (i.e., importance) of each item statement included in the questionnaire. The informants are asked to compare the paired relative weight among the item statements for a given criterion.

- **Development of fuzzy numbers**
  
  The responses collected from the questionnaire can be formulated as a membership function in a trapezoidal form. Thus, there are four trapezoidal fuzzy numbers: $\alpha$, $\beta$, $\gamma$, and $\delta$. The minimum and the maximum value of the membership function are represented by $\alpha$ and $\delta$, respectively. Where the level of the membership function equals 1 then $\beta$ and $\gamma$ are the smallest value and the largest value of the interval, respectively.

- **Construction of a fuzzy positive reciprocal matrix**
  
  On the basis of the four trapezoidal fuzzy numbers, defined above, we constructed a fuzzy positive reciprocal matrix $A$. With $a_{ij}$ as a fuzzy number constructed by sub-criterion $i$ and sub-criterion $j$, the matrix was defined as follows:

  $$a_{ij} = 1 \quad for \quad i = j,$$

  $$A = [a_{ij}] \quad where \quad a_{ij} = (x_{ij}, y_{ij}, z_{ij}, t_{ij}) \quad for \quad i < j,$$

  $$a_{ij} = (a_{ij})^{-1} \quad for \quad i > j, \quad where \quad (a_{ij})^{-1} = (x_{ij}^{-1}, y_{ij}^{-1}, z_{ij}^{-1}, t_{ij}^{-1}) = \left(\frac{1}{y_{ij}}, \frac{1}{z_{ij}}, \frac{1}{y_{ij}}, \frac{1}{z_{ij}}\right) \quad for \quad i > j, \quad i = 1, 2, 3, \ldots, n; \quad j = 1, 2, 3, \ldots, n.$$

- **Consistency tests**
  
  A consistency index (CI) and consistency ratios (CR) are generally used to check whether there was inconsistent causality or conflicting subjective judgments. The definition of CI and CR are as follows: $CI = (\lambda_{max} - n)/(n - 1)$ and $CR = (CI/R\lambda_n)$. The positive reciprocal matrix, generated by valuation metrics, yields different CI values at different hierarchical levels. These CI values are called

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Policy items and contents of e-MP.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical guidance</td>
<td>Funding to assist major domestic firms to integrate with their suppliers through the establishment of B2B quick response information systems</td>
</tr>
<tr>
<td>Establishment of electronic data exchange standards</td>
<td>Facilitate the development by firms of a standard on electronic data exchange</td>
</tr>
<tr>
<td>Personnel training</td>
<td>Support for training programs to develop talent to consult, design and operate e-manufacturing systems</td>
</tr>
<tr>
<td>Demonstration and exhibition of best practice</td>
<td>Hold of exhibitions, seminars and visits to successful firms of implementing B2BIS</td>
</tr>
</tbody>
</table>

3. Methodology

One of the main objectives of this study was to establish the relative weights among B2BIS related the policy items and performance indicators. Since this can be conceptualized as a multicriteria analysis (MCA) problem this lead us to the analytic hierarchical process (AHP) proposed by Saaty (1980). This technique has been widely applied to identify the weight ratios among strategic factors (Moreno-Jiménez & Polasek, 2003; Radcliffe & Schiederjans, 2003). Although the purpose of AHP is to capture experts’ knowledge it fails to adequately allow for human cognitive processes. In an attempt to overcome these shortcomings Van Laarhoven and Pedrycz (1983) introduced fuzzy theory. A fuzzy analytic hierarchical process (Fuzzy AHP) can solve otherwise inexplicable problems and rank the excluded factors according to their weightings. This method has become a major research tool in calculating the relevant weightings of perceived significance between factors, and was therefore utilized in this paper. In the next sections we describe the Fuzzy AHP procedures as it was adopted in this study.

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Random Indexes (RI). Between matrices $\lambda_{max}$ is the maximum eigenvector in a pair comparative matrix. The number of sub-criteria is represented as $n$. Aguaron and Moreno-Jimenez (2003) definition of $RI_n$ (Table 2) that represents RI was adopted. Saaty (1980) suggested that the value of CR should be no bigger than 0.1.

- **Establishment of an original matrix (X matrix)**

First we verified the consistency of the fuzzy positive reciprocal matrix and then we began to work to establish an original matrix (X matrix). By denoting $b_{ij}$ as a fuzzy number constructed by sub-criterion $i$ and sub-criterion $j$, we obtain the original matrix as:

$$b_{ij} = 1 	ext{ for } i = j,$$

$$X = [b_{ij}]$$

where $b_{ij} = \frac{(p_i + \gamma_j)}{2}$ for $i < j$.

$$b_{ij} = \frac{(p_i + \gamma_j)}{2} \text{ for } i > j, (p_i + \gamma_j)^{-1} = \left(\frac{1}{p_i} + \frac{1}{\gamma_j}\right) \text{ for } i = 1, 2, 3, \ldots;$$

$$j = 1, 2, 3, \ldots n.$$

After establishing the original matrix we obtained its number of eigenvalues. This allowed us to normalize the number of eigenvalues to obtain:

$$W = (W_{1}, \ldots W_{n}).$$

- **Defuzzification (x-cut)**

As suggested by Chen and Hwang (1992) we used the x-cut method proposed by Csutora and Buckley (2001) to undertake defuzzification. Firstly, we set $q$ number of x-cut for a given positive reciprocal matrix. In this case $x_{pl}$ represented the value of the $p^{th}$ x-cut when $p = 1, \ldots q$. When $x_{pl}$ is undertaken then two matrices, $A_{x_{pl}}$ and $A_{y_{pl}}$ is formed. Where $A_{x_{pl}}$ is the value of $x_i$, where the x-cut values equals to $x_p$, and $A_{y_{pl}}$ is the value of $y_i$ where the x-cut value equals to $y_p$. When $x_{pl} = 1.0$ then we can obtain the two matrices, $A_{x_{pl}}$ and $A_{y_{pl}}$, shown as:

$$c_{ij} = 1 \text{ for } i = j,$$

$$A_{ij} = [c_{ij}]$$

where $c_{ij} = \frac{1}{p_i}$ for $i < j$.

$$c_{ij} = \left(\frac{1}{p_i} \right)^{-1} \text{ for } i > j, \text{ for } i = 1, 2, 3, \ldots n; \text{ for } j = 1, 2, 3, \ldots n.$$

$$A_{1i} = [c_{ij}]$$

where $c_{ij} = \frac{1}{y_i}$ for $i < j$.

$$c_{ij} = \left(\frac{1}{y_i} \right)^{-1} \text{ for } i > j, \text{ for } i = 1, 2, 3, \ldots n; \text{ for } j = 1, 2, 3, \ldots n.$$

This enabled us to calculate the n number of eigenvalues for the matrices of $A_{pl}$ and $A_{pl}$. The resulting eigenvalues were normalized to obtain $W_{1} = (W_{1,1}, \ldots W_{1,n})$ and $W_{1} = (W_{1,1}, \ldots W_{1,n})$. In defining $K_{ij} = \min \{\frac{W_{1,1}}{W_{1,2}}, \ldots \frac{W_{1,n}}{W_{1,1}}\}$ and $K_{1i} = \max \{\frac{W_{1,1}}{W_{1,2}}, \ldots \frac{W_{1,n}}{W_{1,1}}\}$ we can calculate:

$$W_{ij} = K_{ij} \times W_{ii} = (W_{1,1}^{ij}, \ldots W_{1,n}^{ij}), \text{ where } W_{1}^{ij} = K_{ij} \times W_{1i} = (W_{1,1}^{ij}, \ldots W_{1,n}^{ij}).$$

The values of $p$ and $y_n$ are dependent upon the x-cut value, $x_p$, when $p = 2, \ldots q$. The calculation of $p$ and $y_n$ was as follows:

$$p_i^{x} = 0.5 + \frac{\beta_i - \beta_{min}}{2 \times (\beta_{max} - \beta_{min})} \times (2p - 1) \text{ for } 2 \leq p \leq q,$$

$$p_i^{y} = 0.5 + \frac{\gamma_i - \gamma_{min}}{2 \times (\gamma_{max} - \gamma_{min})} \times (2p - 1) \text{ for } 2 \leq p \leq q,$$

After obtaining the new calculated values of $p$ and $y_n$, we formed the matrices of $A_{x_{pl}}$ and $A_{y_{pl}}$ and then arrived at $W_{x_{pl}}$ and $W_{y_{pl}}$. We also obtained $W_{x_{pl}} = K_{x_{pl}} \times W_{x_{pl}} = (W_{1,1}^{x_{pl}}, \ldots W_{1,n}^{x_{pl}})$ and $W_{y_{pl}} = K_{y_{pl}} \times W_{y_{pl}} = (W_{1,1}^{y_{pl}}, \ldots W_{1,n}^{y_{pl}})$ with $K_{x_{pl}} = \min \{\frac{W_{1,1}}{W_{1,2}}, \ldots \frac{W_{1,n}}{W_{1,1}}\}$ and $K_{y_{pl}} = \max \{\frac{W_{1,1}}{W_{1,2}}, \ldots \frac{W_{1,n}}{W_{1,1}}\}$.

- **Normalization**

In this step we normalized the weights of all items within the fuzzy weight interval given a criterion and then obtain the weight of each item given the criterion.

4. Data collection and analysis

This paper examined whether current Government B2BIS policy yields benefits for firms. It also explored whether the adoption of a B2BIS approach actually contributed to overall efficiency and whether firms were able to meet the outcomes they originally anticipated. We start with an examination of policy and performance.

4.1. Policy aspect

To understand better whether the current policy items suited the demands of funded cases, 17 project leaders were interviewed. One theme dominant to all the interviews, was the suggestion that experienced professionals consultants should assist with the understanding of IS problems and their solutions. Therefore, in addition to the four items mentioned in Table 1, IS implementation consulting was also included as a policy item. Based on these five items a pair-by-pair comparison questionnaire was designed to enable data collection for the Fuzzy AHP.

The questionnaires were pleased the IDB e-MP policy promotion office to delivered to a total of 38 project leaders. The data was collected every October for three years. In 2004 data was collected from 17 cases that concluded in 2001 and 2002, in 2005 12 cases’ information was received and in 2006 9 cases’ questionnaires were gathered. As a result a total of 38 project leaders’ responses were received. Finally, a total of 35 were returned and all were valid. Respondents were asked to return the completed questionnaire using the addressed postage-paid envelope to the IDB. Because all respondents were project leaders, it is assumed that the answers represent the thinking of experts in these cases.

As a first step in the analysis the authors constructed a trapezoidal fuzzy numbers and established a fuzzy positive reciprocal matrix with 35 valid questionnaires. Each of the matrices was then verified to ensure that they fulfilled consistency requirements. Thus, an initial matrix was established and defuzzification (x-cut) was carried out using Matlab software. The weights of the policy items were derived and are shown in Table 3.

Table 3 indicates that corporations hoped, in order of importance, that the government would hold more exhibitions of successful cases (0.32), offer more IS implementation consulting (0.25), support personnel training (0.22), providing funding.
Definitions of the KPIs.

Table 4

<table>
<thead>
<tr>
<th>Policy items</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel training</td>
<td>0.22</td>
</tr>
<tr>
<td>IS implementation consulting</td>
<td>0.25</td>
</tr>
<tr>
<td>Establishment of standards on electronic data exchange</td>
<td>0.09</td>
</tr>
<tr>
<td>Technical guidance</td>
<td>0.12</td>
</tr>
<tr>
<td>Exhibition of successful cases</td>
<td>0.32</td>
</tr>
</tbody>
</table>

support for technical guidance (0.11) and establish standards for electronic data exchange (0.09). Therefore, our results suggest that the allocation of resources needs to be reconsidered.

4.2. Performance aspect

The performance evaluation of funded cases was divided into actual performance and expected performance.

4.2.1. Actual performance after completing the B2BIS

In order to measure actual performance a set of practical and consistent indicators need to be determined. Commonly firms’ IT adoption performance indicators include cost, response time, customer satisfaction and flexibility (Beamon, 1998; Min & Galle, 1999). In addition Zhu and Kraemer (2002) noted that a business can significantly improve the cost indicator, profitability indicator and inventory turnover by investing in IT. Bendoly and Schoenherr (2005) revealed that the extent to which firms witness maintenance-repair-operating (MRO) savings through e-procurement is dependent not only on the presence of an ERP system, but also on the length of time systems have been in use. Mcalvor and Humphreys (2004) indicated that effective use of B2B electronic commerce has the potential to improve the materials management process of both the buyer and supplier in areas such as inventory reduction, delivery lot-size reduction and purchase order and invoice reduction. Sacristán Sacristán Díaz, Álvarez Gil, and Domínguez Machuca (2005) suggested the use of both financial and non-financial indicators when acquiring advanced manufacturing technologies (AMT). There are two main indicators of success in IT implementation from the above: reduction in both cost and response time. Therefore, in this study we focused on the use of measurement indicators related to cost and response time. For cost reduction, the ratio of operating expenditure to income (ROEI) and gross profit margin (GPM) were selected as financial measurement indicators. Response time reduction, inventory turnover (ITO) and accounts receivable turnover (ART) were also used as non-financial indicators (Table 4).

The indicators in Table 4 were then distributed to five IDB committee members and 12 project managers who had previously responded to the questionnaire. They were asked to comment on the suitability of the measures. All agreed on their appropriateness and therefore we adopted the four measures as indicators of performance.

Of the 38 cases financial data were unavailable for 8 firms as they are privately held companies. Consequently, the analysis of financial data in this section focused on the other 30 funded cases. The financial data were collected from the market observation post system of the Taiwan stock exchange website (MOPST, 2007). Table 5 shows the data from the GPM, ROEI, ART and ITO indicators. Data was gathered from a one period starting immediately after completion of the project to determine whether the B2BIS implementation had made an impact on actual performance. Data for a longer period were not included since factors other than the B2BIS implementation may have influenced performance on these

Table 4

<table>
<thead>
<tr>
<th>KPI</th>
<th>Formula</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross profit margin (GPM)</td>
<td>NOI – OC</td>
<td>The higher the gross profit margin, the higher the operation income and the lower the operation cost</td>
</tr>
<tr>
<td>Ratio of OE vs. OI (ROEI)</td>
<td>OE/OC</td>
<td>A lower ROEI ratio is better since it indicates that a firm has a low operation cost</td>
</tr>
<tr>
<td>Accounts receivable turnover (ART)</td>
<td>365/DARC</td>
<td>A higher level of accounts receivable turnover is better since it indicates that the firm is waiting a shorter time to collect its income</td>
</tr>
<tr>
<td>Inventory turnover (ITO)</td>
<td>365/DARC</td>
<td>A higher level of inventory turnover is better since it indicates that the firm is selling goods faster</td>
</tr>
</tbody>
</table>

Table 5

<table>
<thead>
<tr>
<th>Company</th>
<th>Execution period</th>
<th>GPM</th>
<th>ROEI</th>
<th>ART</th>
<th>ITO</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYC Brother</td>
<td>2000–2001</td>
<td>0.43</td>
<td>–0.17</td>
<td>0.15</td>
<td>0.16</td>
</tr>
<tr>
<td>Everest Textile</td>
<td></td>
<td>–0.11</td>
<td>–0.04</td>
<td>0.11</td>
<td>0.00</td>
</tr>
<tr>
<td>Chia Her</td>
<td></td>
<td>–0.21</td>
<td>–0.06</td>
<td>–0.10</td>
<td>0.11</td>
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<tr>
<td>CPC Technology</td>
<td></td>
<td>0.66</td>
<td>–0.02</td>
<td>0.30</td>
<td>0.34</td>
</tr>
<tr>
<td>China Motors</td>
<td>2001–2002</td>
<td>–0.02</td>
<td>–0.12</td>
<td>–0.05</td>
<td>0.08</td>
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<tr>
<td>Dong Ho Steel</td>
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<td>0.07</td>
<td>0.00</td>
<td>0.12</td>
<td>–0.19</td>
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<tr>
<td>Cheng Loong Paper</td>
<td></td>
<td>–0.05</td>
<td>–0.03</td>
<td>0.06</td>
<td>0.33</td>
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<td>Hey Song</td>
<td></td>
<td>–0.11</td>
<td>–0.10</td>
<td>–0.05</td>
<td>0.18</td>
</tr>
<tr>
<td>Accton Technology</td>
<td></td>
<td>–0.28</td>
<td>–0.02</td>
<td>–0.09</td>
<td>–0.23</td>
</tr>
<tr>
<td>Anderson Industrial</td>
<td></td>
<td>–0.25</td>
<td>–0.08</td>
<td>–0.01</td>
<td>0.26</td>
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<tr>
<td>Fu Yu Tools</td>
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<td>0.02</td>
<td>–0.30</td>
<td>–0.08</td>
<td>0.17</td>
</tr>
<tr>
<td>Fortune Electric</td>
<td></td>
<td>–0.20</td>
<td>0.05</td>
<td>0.13</td>
<td>0.06</td>
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<tr>
<td>Yuen Foong Yu (YFY) Paper</td>
<td>2002–2003</td>
<td>–0.02</td>
<td>–0.06</td>
<td>0.002</td>
<td>0.14</td>
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<tr>
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<td>0.11</td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td>Fu Chun Shin Machinery</td>
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<td>–0.16</td>
<td>–0.12</td>
<td>–0.06</td>
<td>0.06</td>
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<tr>
<td>Askey Computer Corporation</td>
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<tr>
<td>Pou Chen group</td>
<td></td>
<td>–0.31</td>
<td>–0.39</td>
<td>0.3</td>
<td>–0.28</td>
</tr>
<tr>
<td>Formosa Taffeta</td>
<td></td>
<td>–0.1</td>
<td>–0.09</td>
<td>0.24</td>
<td>0.18</td>
</tr>
<tr>
<td>Shinkong Synthetic Fibers</td>
<td></td>
<td>–0.39</td>
<td>–0.15</td>
<td>0.03</td>
<td>–0.07</td>
</tr>
<tr>
<td>USI Far East Corporation</td>
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<td>0.54</td>
<td>–0.23</td>
<td>0.12</td>
<td>0.37</td>
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<tr>
<td>Hota Industrial</td>
<td></td>
<td>–0.01</td>
<td>0.16</td>
<td>0.5</td>
<td>0.27</td>
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<tr>
<td>Namchow Chemical Industrial Company</td>
<td></td>
<td>–0.07</td>
<td>0.03</td>
<td>0.07</td>
<td>0.06</td>
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<tr>
<td>Lipeng enterprise</td>
<td>2003–2004</td>
<td>–0.05</td>
<td>–0.19</td>
<td>0.02</td>
<td>0.09</td>
</tr>
<tr>
<td>Hiwin Technologies</td>
<td></td>
<td>0.00</td>
<td>–0.09</td>
<td>0.05</td>
<td>0.11</td>
</tr>
<tr>
<td>Shihlin Electric &amp; Engineering</td>
<td></td>
<td>0.01</td>
<td>0.04</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>Advanced International</td>
<td></td>
<td>0.01</td>
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<td>0.02</td>
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<tr>
<td>Total</td>
<td></td>
<td>0.004</td>
<td>–0.095</td>
<td>0.08</td>
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Notes: NOI = Net Operation Income; OC = Operation Cost; OE = Operating Expenditure; OI = Operation Income; DARC = Average Number of Days in which Accounts Receivable are Collected; ADGS = Average Number of Days in which Goods are Sold.
measures. The percentage change on each measure was calculated, so for example: for the TYC case concluded in 2001, GPM rate = (GPM in 2002–GPM in 2001)/(GPM in 2002).

In Table 5, of the 30 cases only 11 reported a positive growth, while 19 reported a decline in GPM. The ROEI fell in 25 cases and only 5 reported an increase. 20 cases reported an increase in ART, and 9 reported a fall. The ITO increased in 20 cases, and fell in 9. Table 5 reveals positive effects in terms of ART (0.08), ITO (0.091) and ROEI (–0.095) after firms introduced B2BIS. However, no overall evidence of improvement in GPM (0.004) is seen. This indicates that firms introduce B2BIS projects mainly to reduce their operating costs by improving operational efficiency.

4.2.2. Expected performance

In this study, general performance indicators were based on the balanced scorecard (BSC) structure (Kaplan & Norton, 1992), related literature and inputs from the IDB committee in order to arrive at the summary set that were reviewed by respondents from 12 of the funded cases. After they agreed on the appropriateness of the measures, a final list was created as shown in Table 6 (DC_MOEA, 2007). Then the performance indicators were used to design pair-by-pair comparison questionnaire for the Fuzzy AHP.

The questionnaires were distributed to a total of 38 project leaders for cases concluded between 2001 and 2004 in October of 2004, 2005, and 2006, respectively. A total of 35 were returned and all were valid. The weights of expected performance indicators were also calculated (Table 7).

Table 7 indicates that the internal business process view (0.305) is the most important factor in the metric layer. From the internal business process view it can be seen that improved operational efficiency (0.525) is the most important indicator. The other two indicators, finalizing client service and purchasing procedure (0.235) and shortened delivery time (0.24) have an equal level of importance. In the element layer, the top four importance indicators are: improved operational efficiency (0.16), client satisfaction (0.121), absorbing innovative management concepts (0.118) and product design ability (0.114). These four indicators represented more than 0.5 of the global weighting.

These measures showed that improved operational efficiency, client satisfaction, absorbing innovative management concepts and product design ability are the most important indicators in the internal business process, customer, learning and growth and financial metrics, respectively.

The results shown from the analysis of the four metrics reveal that the projects’ expected performance corresponds to the improvement in operational efficiency and customer satisfaction. Moreover, senior managers fully participated in, supported and maintained close interaction with the committee members. Consequently there were able to absorb new management concepts and thus reduce their dependency on external consultants.

Our analysis shows that the firms’ actual performance, in terms of the four KPIs, matched their expected performance of implementing B2BIS.

5. Discussion and policy implications

The findings of this study can be summarized as follows:

- The performance of most firms focused on ROEI and ITO after introducing the B2BIS.
- Performance, in terms of GPM and ART, did not improve significantly thereby indicating that the primary goals of introducing B2BIS for corporations were to improve operational efficiency and to reduce costs.
- The performance measures corresponded to the expected performance in each of the cases.

The e-MP policy has been implemented for a number of years and the majority of the cases surveyed came from traditional industries. These industries take a long time to assimilate new technologies. Therefore, funding policy can be directed towards encouraging these traditional industries to adopt new technologies in the initial stage of promoting an e-MP. The government can adjust its policy when firms, especially their top management, understand the benefits of the policy after it has been implemented for a number of years. On the basis of our findings we suggest that the IDB consider the following:

- The policy of funding large firms with a large funding cap should be modified to fund small and medium-sized enterprises (SMEs) at a reduced cap but with increased coverage. Consequently the capability of SMEs to manage IT will improve and as a result improve the overall operational efficiency of the supply chain.
- The funding policy of allocating significant resources to technology guidance could be refocused towards developing the infrastructure and standards of electronic data interchange. This, together with an emphasis on educating top managers to re-evaluate new technology and new approaches, would help corporations adopt new information systems.
- The focus of the e-MP policy should be gradually shifted from the supply end to the client end. The e-MP policy is primarily designed to assist firms and their suppliers in implementing a B2BIS. However, since the client end represents the source of...
cash flow into the supply chain the focus of the e-MP policy should be shifted to facilitating the customer ordering process.

- An e-business consulting commission should be formed. Firms that have completed their projects could form an e-business consulting body and offer assistance and support to other firms in the form of diagnosis and consultancy.
- Encourage case demonstrations and exhibitions. Since successful implementation of B2BIS is complex then firms need the opportunity to learn from case studies of effective implementations. Therefore, joint conferences should be arranged between firms so that project managers have the opportunity to discuss the process of introducing new systems and thus smooth out the path through sharing experiences.

6. Conclusion

In prior studies of the effectiveness of Government-industry policy implementation there has been a heavy reliance on the information provided by the funded companies. However, the results of these studies do not show an immediate performance improvement after the completion of the project. Since there is a lag before the results of implementation become clear the firms must be tracked to understand the actual performance outcome. In this study we used data drawn from both the funded companies and external measures drawn from the stock exchange in Taiwan.

The results of this study indicate that costs decreased and work efficiencies rose in most of the funded cases studied after the introduction of B2BIS. These results are consistent with the performance outcome anticipated prior to B2BIS implementation. We made highlighted the e-MP policy implications of the findings from this study. These implications and suggestions provide point of reference to the IDB for refinement of its e-MP policy so as to effectively enhance firm operational performance.

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References


