# The Impact of Structured, Unstructured and Integrated Decision Support Systems on SME Economic Performance. An Empirical Study

Christina Beneki, Avraam Papastathopoulos

***Abstract*—**This study investigates the impact that Information and Enterprise Systems have on economic performance in a sample of Greek SMEs. Furthermore, it analyses whether the adoption of unstructured decision support systems (DSS), structured decision systems (MIS) and enterprise application systems (ERP) are linked to increase the firm's turnover in four economic sectors. The results of the study indicate that the systems which support the unstructured decision making (like DSS) and systems which integrate a related set of functions and business processes (like ERP) are positively associated with firm's turnover. On the other hand, statistical analysis suggested that there was a negative relationship between the systems which support the structured decision making (like MIS) and firm's economic performance. The empirical analysis is based on a joint methodology of fully structured questionnaires and personal interviews in 54 Greek SMEs at four different industrial Sectors (Other Services, Manufacturing, Trade and Hotels).

***Keywords*—** MIS, DSS, ERP, SME Performance.

## I. Introduction

The current economic environment where SMEs and the businesses as a whole develop their action appears to be unprecedentedly turbulent. The latter is dominated by three powerful influences: globalization, the knowledge and information revolution, and structural change in organizations [1]. Today's information revolution is stimulated by Information and Communication Technologies (like Information Systems and Enterprise Application Systems).

Information and Enterprises systems change the way with which companies trade with their suppliers as well as with their customers, while they are important catalysts for far-reaching innovation processes in many sectors.

Manuscript received December 15, 2009.

Christina Beneki is an Assistant Professor in the Department of Business Administration, Technological Educational Institution (T.E.I.) of Ionian Islands, Cephalonia, 28200 GREECE (Phone: +302671092855; fax: +302671092856; email: benekic@teiion.gr) and Visiting Lecturer in the Department of Mathematics, State University of New York (SUNY) at New Paltz, NY 12561, USA.

Avraam Papastathopoulos is an Adjunct Lecturer in the Department of Business Administration, T.E.I. of Ionian Islands, Cephalonia, 28200 GREECE (email: apapast@hotmail.com).

The Global Information Technology Report 2006-2007 argues that there is growing evidence that ICT is driving innovation by allowing creative thinking and responsive problem-solving; with this way, it ensures the overall distribution of never-before-seen opportunities. Access to the global networked economy consists the cornerstone of the development of economies and societies [2].

Therefore, all different types of ICTs become more and more widespread in businesses of all sizes. As is the case with all technologies, small businesses are slower than the large ones to the adoption of new ICTs. Potential small business benefits as well as firm and sector-specific strategies drive the adoption and use of ICTs [3]. In this context, the basic prerequisite that stems from the use of ICTs, equally including the rest of all technologies, is not only their acquisition by the SMEs, but also their correct and functional use [4].

A statistical analysis was conducted to determine if there is a significant association between systems which support structured and unstructured decision making (MIS, DSS) and firm's turnover. Furthermore, it was examined the relationship between systems which integrate a related set of functions and business processes and firm's turnover. Finally, it was examined the probability of small and medium-sized enterprises to achieve higher levels of turnover based on the use of Information (MIS, DSS) and Enterprise systems (ERP).

The rest of the article is organized as follows. In the following section, the relevant literature is discussed. It constitutes an illustration of the approach deployed for the purposes of this study in relation to earlier work in the field. The next section presents the methodology of the study. The interpretation of the findings of the field-work research occupies the main part of this article. The final section proposes further studies and discusses some general implications and conclusions based on our findings.

## II. Theoretical Background and Related Research

A Decision Support System (DSS) is an interactive computer-based system that provides the user with easy access to decision models in order to support semistructured and unstructured decision making tasks

[5]. DSS have evolved from two main areas of research—the theoretical studies of organizational decision making (Simon, Cyert, March, and others) conducted at the Carnegie Institute of Technology during the late 1950s and early 1960s and the technical work (Gerrity, Ness, and others) carried out at MIT in the 1960s [6]. Classic DSS tool design is comprised of components for (i) sophisticated database management capabilities with access to internal and external data, information, and knowledge, (ii) powerful modeling functions accessed by a model management system, and (iii) powerful, yet simple user interface designs that enable interactive queries, reporting, and graphing functions [7].

While large corporations have relied more and more upon DSS for effective decision-making, SMEs have ignored this new technology. With the proliferation of personal computers, practical and inexpensive DSSs are within the reach of SMEs to improve the quality of inferences and judgments [8]. For instance, a study conducted by Van Bruggen et al. [9] found that managers who use a DSS are less inclined to anchor their decisions on earlier decisions compared with managers who do not use the system. Similarly, these authors found that the incorporation of model-based results into a DSS is especially beneficial. However, the application of Decision Support Systems in business planning and operations and a wide variety of strategic and economic decisions depends to a large extent on the level of understanding of SMEs about the link between firm's economic performance and adoption of DSS.

Management Information Systems deals with behavioral issues as well as technical issues surrounding the development, use, and impact of information systems used by managers and employees [10]. Today, most firms cannot survive without using information systems. Information systems are the programs that provide the basis for the capture and dissemination of data through an organization [11]. MIS help managers monitor and control the business by providing information on the firm's performance. They typically, produce fixed, regularly scheduled reports and provide answers to routine questions. These systems generally are not flexible and have little analytical capability [10].

Information technology/systems (IT/IS) plays a vital role in the sustained growth of business organizations. Love and Irani [12] examined the approaches used in Australian construction small and medium sized enterprises to evaluate and justify IS investments for information system development. They conducted an exploratory study of IT evaluation and benefits management practices of SMEs in the construction industry. They observed IT investments had a positive relation with the IS management practices, while a recent research conducted to 54 Greek SMEs shows that the development of the SMEs stemming from the effective – efficient application of information and communication technologies is the result of the adoption of a specific strategy, and not just the result of the investment in information technology [13].

The emerging field of ERP adoption by SMEs has not been ignored in the analysis [17], [18], [19], [20], [21], even though a considerable amount of the published ERP literature shows that research tends to focus on larger businesses, but less on small and medium-sized enterprises [22], [23], [24], [25], [26]. The benefits of ERP systems are not only for large firms, SMEs can also benefit from ERP systems, but they lack the experience and the necessary resources to implement ERP systems effectively. According to a study conducted by Van Everdingen et al. (2000) the three most important factors for ERP adoption by medium-sized European companies are fit, flexibility, and minimize costs, while a recent research of Shiau *et. al.,* (2009) [30] argues that the best motivation for ERP adoption comes from the benefit the system can bring to organisations.

However, ERP software systems are designed to support organization-wide process coordination and integration so that the organization can operate efficiently. They span multiple functions and business and management processes within and beyond a firm's boundary [22]. Enterprise Resource Planning Systems integrate the key internal business processes of a firm into a software system so that information can flow throughout the organization improving coordination, efficiency and decision making [10]. Finally, ERP systems have the ability to increase accurate and on-time shipments, minimize costs, and increase customer satisfaction adds to firm profitability [10], [27], [28], [29].

Many studies provide evidence of the positive effects of ICT adoption on firm performance, others have shown no relation between information systems use and firm performance [14]. A study of Canadian manufacturing establishments (plants) with ten or more employees (excluding food processing establishments) drawn from Statistics Canada's Business Register, shows that those with high productivity growth are more likely to be using greater numbers of advanced ICTs [15]. Between 1988 and 1997, advanced technology users grew more in terms of both productivity and profitability than non-ICT users, especially when they used communication technologies, including company-wide and/or inter-company computer networks [16].

## III. RESEARCH METHODOLOGY

A joint methodology of fully-structured questionnaire and in-depth interviews was selected as the primary research instrument in order to gain as broad a view as possible of the issues surrounding application of ICT. This methodology was applied among a spectrum of SMEs from 4 out to 51 Greek geographical areas (States/provinces) which fulfilled the criteria of GDP-sharing, working population and total number of population. A total of 100 companies was selected and letters were sent out requesting an interview, while follow-up telephone calls by the researcher negotiated access to each business. Fifty-four SMEs were positively responded. The main reason why the authors have attempted to use a combination of techniques was to minimize bias and error and overcome any ambiguities.

The survey questionnaire was divided into four parts. Part one deals with the adoption and use of ICTs and part two covers questions addressed to evaluate the degree of

emphasis placed on strategic and operational planning of ICTs and evaluate whether the strategic process was systematic and formal. Part three covers the financial information while the last part was based on general information about each firm.

A stratified random sample of SMEs was drawn from four industry sectors according to classification of economic activity by NACE (rev. 1.1). Personal interviews were conducted with the person deemed to be most knowledgeable on the ICTs developments within the firm. For that reason, the interviewees ranged from director or owner-manager and IT personnel to general managers. Only one interview per company was conducted. A mix of closed and open-ended questions was included to conduct the structured interviews. This provided a collection of quantitative and qualitative data, and enabled comparisons based on rating, ranking and individual contextual analysis. On average, the interviews lasted one hour and 15 minutes based on a fully structured questionnaire. Completed questionnaires were coded and analyzed using the SPSS 17.0 (Statistical Package for Social Sciences). The final allocation of our sample (n=54) according to industry sector and firm size is illustrated as follows (Table 1):

TABLE 1
DISTRIBUTION OF INTERVIEWS BY FIRM SIZE AND SECTOR

| Industry Sector | Sub-sector – two digits allocation | Micro Firms (0-9) | Small Firms (10-49) | Medium Firms (50-249) | Total |
|---|---|---|---|---|---|
| Other Services | K 70, K 72, K74 | 13 | 8 | 2 | **23** |
| Manufacturing | D15, D 22 | 2 | 5 | 2 | **9** |
| Wholesale Trade | G 52 | 7 | 3 | 3 | **13** |
| Hotels | H 55 | 1 | 6 | 2 | **9** |
| Total | | 23 | 22 | 9 | **54** |

Finally, for the categorization of the SMEs, the European Commission (2003) [33] definition for small and medium-sized enterprises was adopted. According to this new official definition, the basic condition for an enterprise to be recognized as a small and medium one is to respect the limits regarding Staff headcount and financial ceilings (annual turnover or annual balance sheet). The new definition introduces three different categories of enterprises (micro, small and medium). Each corresponds to a type of relationship that an enterprise might develop with another. This distinction is necessary in order to establish a clear picture of an enterprise's economic situation and to exclude those that are not genuine SMEs. The definition categorizes SMEs in the following three categories:

1. The category of micro, small and medium-sized enterprises (SMEs) are made up of enterprises, which employ fewer than 250 persons and, which have an annual turnover not exceeding 50 million EUR, and/or an annual balance sheet total not exceeding EUR 43 million.
2. Within the SME category, a small enterprise is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million.
3. Within the SME category, a micro-enterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million.

The new definition is the result of wide-ranging discussions between the Commission, Member States, business organizations and experts as well as two open consultations on the internet. The changes reflect general economic developments since 1996, and a growing awareness of the specific hurdles that SMEs confront.

## IV. EMPIRICAL ANALYSIS AND FINDINGS

First, we examine the statistical information from the use of MIS, DSS and ERP systems by each SME category. Second, we explore the association between small firm's turnover and small firms that deploy MIS, DSS and ERP systems versus the ones that do not. Finally, an ordinal logistic regression (OLR) analysis was used to predict the probabilities of small and medium-sized enterprises to achieve higher levels of turnover based on the use of systems which support:

a. the 'structured' decision making (MIS).

b. the 'unstructured' decision making (DSS).

c. the 'integrated' decision making (ERP).

### *A. Statistical Information from the Use of MIS, DSS and ERP Systems by each SME Category*

The application study of the information systems (MIS and DSS) and enterprise application Systems (ERP) produced the following results. First, the MIS is used by the 30.4% of micro, the 50% of small and the 77.8% of medium firms while DSS is applied by the 13% of micro, the 45.5% of small and the 77.8% of medium firms. The low application of Decision Support Systems, especially by micro and small sized enterprises demonstrates that the small firms do not use systems which enhancing decision making. On the other hand, as for the use of Enterprise Resource Planning systems, an increase of application from a category to category is observed,

starting from 43.5% by the micro, 81.8% by the small and 88.9% for the medium sized ones. The rates are very high in all three categories, which prove the SMEs interest in using enterprise systems. The explanation, for the high use of Enterprise Systems, is that they provide valuable information for improving management decision making and offer company-wide information to help managers analyze overall profitability, cost structures and performance [10].

### *B. Analysis of Association Between Firm's Turnover and MIS, DSS and ERP*

First, we explored the association between small firm's turnover and small firms that deploy MIS, DSS and ERP systems versus the ones that do not. Following are the results of the contingency tables between firm's turnover and Information Systems (MIS, DSS) and Enterprise Systems (ERP) as well as the chi-square tests for association.

TABLE 2
FIRM'S TURNOVER & MIS, DSS, ERP CONTINGENCY TABLES

| | | | MIS | | DSS | | ERP | |
|---|---|---|---|---|---|---|---|---|
| | | | **Applied** | **Not Applied** | **Applied** | **Not Applied** | **Applied** | **Not Applied** |
| **Firm's Turnover** | Above 5 million Euro | Count | 2 | 1 | 2 | 1 | 2 | 1 |
| | | % within Firm Size | 66.7% | 33.3% | 66.7% | 33.3% | 66.7% | 33.3% |
| | | Adjusted Residual | 0.7 | -0.7 | 1.1 | -1.1 | 0.0 | 0.0 |
| | 3.000.000 – 5.000.000 | Count | 5 | 3 | 4 | 4 | 7 | 1 |
| | | % within Firm Size | 62.5% | 37.5% | 50.0% | 50.0% | 87.5% | 12.5% |
| | | Adjusted Residual | 1.0 | -1.0 | 0.8 | -0.8 | 1.4 | -1.4 |
| | 1.000.000 – 3.000.000 | Count | 12 | 9 | 11 | 10 | 17 | 4 |
| | | % within Firm Size | 57.1% | 42.9% | 52.4% | 47.6% | 81.0% | 19.0% |
| | | Adjusted Residual | 1.3 | -1.3 | 1.9 | -1.9 | 1.8 | -1.8 |
| | Less than 1.000.000 | Count | 6 | 16 | 3 | 19 | 10 | 12 |
| | | % within Firm Size | 27.3% | 72.7% | 13.6% | 86.4% | 45.5% | 54.5% |
| | | Adjusted Residual | -2.3 | 2.3 | **-3.0** | **3.0** | **-2.7** | **2.7** |
| **Total** | | Count | 25 | 29 | 20 | 34 | 36 | 18 |
| | | % within Firm Size | 46.3% | 53.7% | 37.0% | 63.0% | 66.7% | 33.3% |

TABLE 3
CHI-SQUARE TESTS BETWEEN FIRM'S TURNOVER & MIS, DSS, ERP

| | | | | | **MONTE CARLO SIG. (2-SIDED)** | | |
|---|---|---|---|---|---|---|---|
| | | | | | | **95% Confidence Interval** | |
| | **Statistic** | **Value** | **df** | **Asymp. Sig. (2-sided)** | **Sig.** | **Lower Bound** | **Upper Bound** |
| **Fisher's Exact Test for Firm's Turnover & MIS** | Pearson Chi-Square | 5.541[a] | 3 | 0.136 | 0.131[b] | 0.124 | 0.137 |
| | Likelihood Ratio | 5.695 | 3 | 0.127 | 0.186[b] | 0.178 | 0.193 |
| | **Fisher's Exact Test** | **5.586** | | | **0.118[b]** | **0.112** | **0.124** |
| | Linear-by-Linear Association | 4.347[c] | 1 | 0.037 | 0.043[b] | 0.039 | 0.047 |
| | N of Valid Cases | 54 | | | | | |
| **Fisher's Exact Test for Firm's Turnover & DSS** | Pearson Chi-Square | 8.992[d] | 3 | 0.029 | 0.024[e] | 0.021 | 0.026 |
| | Likelihood Ratio | 9.689 | 3 | 0.021 | 0.032[e] | 0.028 | 0.035 |
| | **Fisher's Exact Test** | **9.417** | | | **0.015[e]** | **0.013** | **0.018** |
| | Linear-by-Linear Association | 6.539[f] | 1 | 0.011 | 0.015[e] | 0.013 | 0.018 |
| | N of Valid Cases | 54 | | | | | |
| **Fisher's Exact Test for Firm's Turnover & ERP** | Pearson Chi-Square | 7.946[g] | 3 | 0.047 | 0.043[h] | 0.039 | 0.047 |
| | Likelihood Ratio | 8.129 | 3 | 0.043 | 0.066[h] | 0.061 | 0.071 |
| | **Fisher's Exact Test** | **7.575** | | | **0.039[h]** | **0.036** | **0.043** |
| | Linear-by-Linear Association | 4.341[i] | 1 | 0.037 | 0.047[h] | 0.043 | 0.051 |
| | N of Valid Cases | 54 | | | | | |

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 1.39.
b. Based on 10000 sampled tables with starting seed 2.000.000.
c. The standardized statistic is -2.085.
d. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 1.11.
e. Based on 10000 sampled tables with starting seed 2.000.000.
f. The standardized statistic is 2.557.
g. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 1.00.
h. Based on 10000 sampled tables with starting seed 2.000.000.
i. The standardized statistic is 2.083

For the examination between the four categories of firm's turnover and the MIS, DSS and ERP systems, *Fisher's Exact Test* was used as an alternative to the Chi-square test. According to the methodology of Chi-square test, no cell in the contingency table should have an expected count less than 1, and no more than 20% of the cells should have an expected count of less than five; otherwise a Fisher's exact test will be more appropriate [31].

Consequently, statistical analysis suggested that there were positive relationships between the firm's turnover and DSS with *p*-value of 0.015 and firm's turnover and ERP with *p*-value of 0.039. Since both *p*-values are less than the traditional threshold of 0.05, it can be verified that there is a statistically significant association between the firm's turnover and whether they had deployed DSS-ERP or not. Om the other hand, Fisher's exact test shows weak association between the firm's turnover and MIS.

The Chi-square and Fisher's exact tests tell us that there is some departure from statistical independence, but it says nothing about the nature of this departure or how strong it is. Post hoc analyses of the contingency table cells are based on adjusted residuals that are calculated by dividing the residual (i.e., the difference between observed and expected cell frequency) by the standard error of the contingency table cell. The adjusted residuals (table 2) of the category "Less than 1.000.000 Euro" are greater than 1.96 in their absolute magnitude, indicating significant deviations from the independency assumption.

### C. Ordinal Regression Model to Predict Firm's Turnover

In order to study the DSS and ERP systems influence to the firm's turnover, an ordinal regression (OLR) analysis was used. The ordinal logistic regression (OLR) model was selected as a statistical procedure used when the dependent response variable is ordinal categorical and the independent variables may be categorical, interval or ratio scale. At this point, we have to clarify that even when categories of the dependent variable are ordered, that does not mean that an OLR model is necessarily the most appropriate, especially if categories are ordered on more than one dimension, such as strength of opinion and direction, or if categories can be ordered in different ways [31]. In our case, the dependent variable (firm's turnover) used in the following OLR model is ordered on one dimension only, allowing the use of ordinal regression method. The dependent variable for firm's turnover was measured on a four-point Likert scale: *Above 5.000.000 €* (1), *3.000.000-5.000.000 €* (2), *1.000.000-3.000.000 €* (3), *Less than 1.000.000 €* (4). Before proceeding to examine the individual coefficients for our model, we have to look at an overall test of null hypothesis that the location coefficients for all of the variables in the model are 0. From Table 4, we see that the differences between the two log-likelihoods and the chi-squares have observed significance levels less than 0.05. This means that we can reject the null hypothesis that the model without predictors is as good as the model with the predictors.

TABLE 4
MODEL FITTING INFORMATION

| Model | -2 Log Likelihood | Chi-Square | df | Sig. |
|---|---|---|---|---|
| Intercept Only | 43.686 | | | |
| Final | 31.560 | 12.125 | 2 | 0.002 |

Before moving ahead, it has to be tested the assumption that the regression coefficients are the same for all five categories. The test of parallel lines was designed to judge the model adequacy concerning the model adequacy. The null hypothesis stated that the corresponding regression coefficients were equal across all levels of the outcome variable. The alternative hypothesis stated that the corresponding regression coefficients were different across all levels of the outcome variable. The chi-square test results were $\chi^2 = 4.614$ with d.f. of 4, and $p = 0.329$. The observed significance levels are large indicating that there was no significant difference in the corresponding regression coefficients across the response categories and also suggesting that the models assumption of parallel lines were not violated in the complete models.

The study results for the complete model containing all satisfaction items revealed a number of interesting findings. As table 5 shows, our independent variables – DSS and ERP systems are all related to the categories of the firm's turnover while MIS are not associated with firm's economic performance (*p-value > 0.05)*. The following table 5 contains the estimated coefficients for the model. The estimates labeled *Location* are the coefficients for the predictor variables. Using the OLR analysis, the coefficient for *DSS = Applied*, is 1.290 with *p*-value of 0.023 and the coefficient for *ERP = Applied,* is 1.251 with *p*-value of 0.039. That means, that it can be verified that there is a statistically significant association between the level of firm's turnovers and whether they had deployed DSS, ERP or not. Furthermore, we explored models containing the interactions of these two variables, but none of these interactions were significant at the 0.05 level. The estimates in the below output are given in units of ordered logits, or ordered log odds. So, for the independent variable *'DSS = Applied',* we would say that a 1.29 increase is expected in the log odds of *'Firm's Turnover"* in the small firms which have deployed systems which support the unstructured decision making, given all of the other variables in the model are held constant. For the independent variable *'ERP = Applied',* we would say that for the enterprises, who have implemented an enterprise resource planning system, a 1.25 increase is expected in the log odds of dependent variable *'Firm's Turnover*, given all of the other variables in the model are held constant.

TABLE 5
PARAMETERS ESTIMATES

| | | Estimate | Std. Error | Wald | df | Sig. |
|---|---|---|---|---|---|---|
| Threshold | Firm's Turnover: Above 5.000.000 € | 0.915 | 0.521 | 3.085 | 1 | 0.079 |
| | Firm's Turnover: Between 3 – 5 millions € | 2.987 | 0.660 | 20.485 | 1 | 0.000 |
| | Firm's Turnover: Between 1 – 3 millions € | 4.522 | 0.846 | 28.548 | 1 | 0.000 |
| Location | DSS = Applied | 1.290 | 0.569 | 5.147 | 1 | 0.023 |
| | DSS = Not Applied | 0[a] | . | . | 0 | . |
| | ERP = Applied | 1.251 | 0.606 | 4.262 | 1 | 0.039 |
| | ERP = Not Applied | 0[a] | . | . | 0 | . |

Therefore, the ordinal logistic models that are evaluated through the sample data for the performance of ICTs in the production procedures, should have the following forms:

$$\ln\left[\frac{P(y \le j)}{1-P(y \le j)}\right] = a_j - \beta_1 X_1 - \beta_2 X_2,$$

where *j* runs from category 1 (Turnover: above 5 millions €) to category 3 (Turnover between: 1 – 3 millions €).
P = estimated probabilities of every one category of the response variable for the SMEs which deploy DSS (in contrast to the SMEs, which do not use a Decision Support System) and ERP (in contrast to the SMEs, which do not use a Enterprise Resource Planning System)
$\alpha_j$ = coefficient for each category of the response variable 'Firm's Turnover"
$\beta_1$ = coefficient for the predictor variable 'DSS'
$\beta_2$ = coefficient for the predictor variable 'ERP'

The fact of positive coefficients in the above output for our dichotomous factors (DSS and ERP), means that higher scores are more likely for the first category [31].

The model-fitting statistic, namely the pseudo R-square, measured the strength of the association between the dependent variable and the predictor variables for each model. The pseudo R square was calculated depending upon the likelihood ratio.

TABLE 6
PSEUDO R-SQUARES

| | |
|---|---|
| Cox and Snell | 0.201 |
| Nagelkerke | 0.222 |
| McFadden | 0.095 |

The interpretation of pseudo R square in the ordinal regression model is similar to that of the R square (Coefficient of the Determination) in the linear regression model. The larger the pseudo R square was, the better the model fitting was. As the above table shows, the pseudo R-squares statistics are sufficiently large.

## V. CONCLUSIONS, IMPLICATIONS & FUTURE RESEARCH DIRECTIONS

The empirical evidence presented in this article offers some interesting insights in the relationship between systems which support unstructured decision making (DSS) and systems which integrate a related set of functions and business processes (ERP) in the turnover of small business sector. There is only a weak relationship between the firm's turnover and systems, which provide answers to repetitive and routine decisions (MIS). However, the article also lends support to the argument developed by the Erik Brynjolfsson and Lorin Hitt (2000) [32] that information technologies have had an impact on firm's economic growth. Predictably, the use of Decision Support Systems and Enterprise Resource Planning Systems is related positively with the profit making. The fact that there is a little disparity among firm's levels of turnover and implementation of Information and Enterprise Application Systems offers further support in this direction. Indeed, SMEs with a limited use of DSS and ERP systems are less profitable than those with an extensive use of these systems.

DSS can have a tremendous benefit in the creation of economic performance for SMEs because they support nonroutine (unstructured) decision making for middle management. They focus on problems that are unique and rapidly changing, for which the procedure for arriving at a solution may not be fully predefined in advance. Also, the ERP systems are included in the category of systems which are closely associated with firm's performance. Enterprise systems are designed to support organization-wide process coordination and integration so that the organization can operate efficiently. They integrate the key internal business processes of a firm into a single software system so that information can flow throughout the organization, improving coordination, efficiency and decision making. On the other hand, Management Information Systems, which produce fixed, regularly scheduled reports and provide answers to routine questions that have been specified in advance and have a predefined procedure for answering them, are not directly related to economic performance of small firms.

There is a possible interpretation of these apparently contradictory finding between MIS, DSS and ERP systems. The argument is that our era is characterized by an increase intensity of competition, globalization of the world economy, rapid technological changes and the growing expectations of suppliers, customers and employees. In order to survive and grow in this turbulent and dynamic business environment, SMEs have to be based on systems which are able to combine data, use sophisticated analytical models and tools, support semistructured or unstructured decision making and, simultaneously, promote business process integration and improve organizational performance.

The limited use of specialized software systems can be attributed to several factors including lack of technological and human resource infrastructure, as well as lack of knowledge of potential benefits of such applications. Every effort must be made, by both academic and governmental entities, in order to continue to educate entrepreneurs, managers, and small business owners about the benefits and opportunities presented by advanced technology. Lastly, however, as suggestive as the findings of these comparisons may be, they should not conceal the fact that there is considerable technological diversity within the small business sector.

Future research should focus on the examination of more Information and Communication Technologies-systems, in more industrial sectors so as to identify which other technologies-systems contribute directly to firm's economic performance. However, we believe that this research makes an important contribution and we are committed to continuing our research of the information and communication technologies followed by the small business sector for many years to come.

## REFERENCES


[1] Hamilton, B. A. (2002), *The World's most Effective Policies for the E-economy 2002*, Booz Allen Hamilton, London.

[2] Dutta, S. and Mia, I. (2007), *The Global Information Technology Report 2006-2007,* 6th Edition, France: World Economic Forum and INSEAD.

[3] OECD (2004), "ICT, E-BUSINESS AND SMEs", DSTI/IND/PME(2002)7/FINAL, OECD, Paris. (available at http://www.oecd.org)

[4] El Louadi, M. (1998), "The Relationship Among Organization Structure, Information Technology and Information Processing in Small Canadian Firms". *Canadian Journal of Administrative Sciences*, Vol. 15, No. 2, pp 180-199.

[5] Chen, K. C. (1989), "Developing decision support systems for small business management: a case study". *Journal of Small Business Management,* Vol. 27, No. 3, pp. 11-22.

[6] P. Keen, M. Scott Morton (1978), *Decision Support Systems: An Organizational Perspective.* Reading: Addison-Wesley Publishing.

[7] J.P. Shim, Merrill Warkentin, James F. Courtney, Daniel J. Power, Ramesh Sharda, Christer Carlsson (2002), "Past, present, and future of decision support technology". *Decision Support Systems,* Vol. 32, pp. 111-126.

[8] Temtime, A. T., Chinyoka, S. V. & Shunda, J. P. W. (2003), "Toward strategic use of IT in SMEs: a developing country perspective". *Information Management & Computer Security,* Vol. 11, No. 5, pp. 230-237.

[9] G.H. Van Bruggen, A. Smidts, B. Wierenga, (1998), "Improving decision making by means of marketing decision support system". *Management Science,* Vol. 44, pp. 645–658.

[10] Laudon, K.C. & Laudon P.L. (2006), *Management Information Systems. Managing the Digital Firm.* 10th Edition, USA: Pearson Prentice Hall.

[11] Levy, M. & Powell, P. (2005), *Strategies for Growth in SMEs –The role of information and information systems.* London: Elsevier Limited

[12] Love, P., Irani, Z. (2004), "An exploratory study of IT evaluation and benefits management practices of SMEs in the construction industry", *Information & Management*, Vol. 42 pp. 227-42.

[13] Papastathopoulos, A., Anastassopoulos, G., and Beneki, Chr. (2009), "An Assessment of the Effectiveness and Efficiency of Information and Communication Technologies in the development of the Small and Medium Sized Enterprises (SMEs)", *Proceedings of Global Conference on Business and Finance (GCBF)*, San Jose, Costa Rica, Central America, May 27-30, Vol. 4, No.1, pp. 261-275, ISSN: 1931-0285 CD, ISSN: 1941-9589 Online, 2009.

[14] Bitler, M. P. (2001), "Small Businesses and Computers: Adoption and Performance", preliminary draft, October.

[15] Baldwin, J.R. and D. Sabourin (2002), "Impact of the Adoption of Advanced ICTs on Firm Performance in the Canadian Manufacturing Sector", STI Working Papers 2002/1, OECD, Paris (available at www.oecd.org/sti/).

[16] OECD (2004), "ICT, E-BUSINESS AND SMEs", DSTI/IND/PME(2002)7/FINAL, OECD, Paris. (available at http://www.oecd.org)

[17] Sanna, L., Sami, S. and Petri, H. (2007), "Enterprise size matters: objectives and constraints of ERP adoption", Journal of Enterprise Information Management, Vol. 20 No. 3, pp. 319-34.

[18] Kai, A.O. and Per, S. (2007), "ERP for SMEs – is proprietary software an alternative?", Business
Process Management Journal, Vol. 13 No. 3, pp. 379-89.

[19] Chun-Tsai, Y., Marcela, M. and Theo, V. (2006), "The importance of being local? Learning among Taiwan's enterprise solutions providers", Journal of Enterprise Information Management, Vol. 19 Nos 1/2, pp. 30-49.

[20] Quiescenti, M., Bruccoleri, M., Commare, U.L., Diega, S.N.L. and Perrone, G. (2006), "Business process-oriented design of enterprise resource planning (ERP) systems for small and medium enterprises", International Journal of Production Research, Vol. 44 Nos 18/19, pp. 3797-811.

[21] Raymond, L. and Sylvestre, U. (2007), "A profile of ERP adoption in manufacturing SMEs", Journal of Enterprise Information Management, Vol. 20 No. 4, pp. 487-502.

[22] Hitt, L.M., Wu, D.J. and Zhou, X. (2002), "Investment in enterprise resource planning: business impact and productivity measures", Journal of Management Information Systems, Vol. 19 No. 1, pp. 71-98.

[23] Oliver, D. and Romm, C. (2002), "Justifying enterprise resource planning adoption", Journal of Information Technology, Vol. 17 No. 4, pp. 199-213.

[24] Sumner, M. (2000), "Risk factors in enterprise-wide ERP projects", Journal of Information Technology, Vol. 15 No. 4, pp. 317-27.

[25] Thong, J.Y.L. (1999), "An integrated model of information systems adoption in small businesses", Journal of Management Information Systems, Vol. 15 No. 4, pp. 187-214.

[26] van Everdingen, Y., van Hillegersberg, J. and Waarts, E. (2000), "ERP adoption by European midsize companies", Communications of the ACM, Vol. 43 No. 4, pp. 27-31.

[27] Holsapple, C.W. and Sena, M.P. (2005), "ERP plans and decision-support benefits", Decision Support Systems, Vol. 38 No. 4, pp. 575-90.

[28] Gefen, D. and Ragowsky, A. (2005), "A multi-level approach to measuring the benefits of an ERP system in manufacturing firms", Information Systems Management, Vol. 22 No. 1, pp. 18-25.

[29] Buonanno, G., Faverio, P., Pigni, F., Ravarini, A., Sciuto, D. and Tagliavini, M. (2005), "Factors affecting ERP system adoption: a comparative analysis between SMEs and large companies", Journal of Enterprise Information Management, Vol. 18 No. 4, pp. 384-426.

[30] Shiau, W. L., Hsu, P. Y., & Wang, J. Z. (2009), "Development of measures to assess the ERP adoption of small and medium enterprises". Journal of Enterprise Information Management, Vol. 22, No. ½, pp. 99-118.

[31] Norusis, M. (2008) *SPSS Statistics 17.0 Advanced Statistical Procedures Companion,* USA: Prentice Hall Inc.

[32] Brynjolfsson, E. & Hitt L. (2000) 'Beyond Computation: Information Technology, Organizational Transformation and Business Performance'. *Journal of Economic Perspectives,* Vol. 14, No. 4, pp. 23-48.

[33] European Commission (2003). "Commission Recommendation of 6 May 2003 Concerning the Definition of Micro, Small and Medium-sized Enterprises," *Official Journal of the European Union*, http://ec.europa.eu/enterprise/enterprise_policy/sme_definition/decision_sme_en.pdf. (Accessed on May 06, 2003).