기업정보시스템의 특징들이 경영성과에 미치는 영향: 타이완 기업의 경우

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The Impact of Characteristics of Enterprise Information Systems on Business Performance: the cases of Taiwan companies

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요 약 경영자와 연구자들은 경영성과에 대해 관심도 높고 이에 대해 인식하고 있지만, 성숙도나 하부조직 같은 기업정보시스템의 특징이 조직의 경영성과에 어떻게 그리고 어떤 요인들이 영향을 미치는지에 대한 연구는 아직 미비한 실정이다. 그래서 본 연구는 정보화수준, 경영환경, 정보시스템의 성숙도와 하부구조가 경영성과(재무적 경영성과와 비재무적 경영성과)에 어떤 영향을 미치는지를 알아보고자 대만의 136개 기업을 대상으로 실증분석을 실시하였다. 설문지 표본의 응답자들은 각각의 기업 경영성과업무와 관련된 부서에 근무하고 있는 사람들을 대상으로 하였다. 본 연구에는 구조방정식모델을 사용하여 연구 가설들을 검증하였다.

주제어 : 기업 정보시스템(EIS). 경영성과, 구조방정식, 경영환경, 정보화 (infomatization)

Abstract Despite growing interest and attention from researchers and practitioners in management studies, empirical research has been limited on how factors that influence an organization's business performance are affected by certain characteristics of enterprise information systems (IS), such as maturity and infrastructure. This study reports on an empirical analysis of survey data to identify relationships among the informatization level, the business environment, and IS maturity and infrastructure related to business performance—based on financial and non-financial performance measurements—from the perspective of 136 Taiwan firms. The survey questionnaire respondents were drawn from individuals in each of these firms who were typically working in divisions related to business performance functions. Structural equation modeling was used to test the hypotheses that came from the research model in this study.

Key Words : Information System(IS). Business Performance, Structural equation modeling

1. Introduction

Currently, we live in a era in which the key political, economic, and cultural elements of societies are being globally shared. In particular, due to the proliferation of free trade systems and the opening up of the economy, Korea is now training professional managers to be global-minded and readily adaptable to

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the changing business environments needed to build skills in management information systems.

Due to a variety of factors, both within and outside of the organization, many companies have been challenged by the strength of other companies and have met and overcome these challenges. In order to improve business performance, a redesign that is responsive to changes in a variety of strategies is required to gain a competitive advantage. To achieve this goal, the issue has been raised that a more effective information system for management must be provided within organizational structures (Awal and Stumpf, [4]).

To improve the effectiveness of decision-making in modern management, managers must be able to receive key information in a timely manner in a way that utilizes efficient methods to transfer, process, store, and utilize information that is critically related to the business environment (Suman and Lalita, [53]). In response to the changing business environment, business organizations continue to react and adjust, according to their specific business environment, to new characteristics that keep changing the way information management is handled (Shi and Lu, [52]).

Both internal and external business environments have an effect on the retailers' choice of competitive strategies and their business performance (Kean et al., [35]). The best way to measure business performance has been a significant issue both in academic and practitioner areas (Moxham and Boaden, [44]). For example, the use of financial measures－such as return on investment, return on sales, productivity, and profit per unit of production－has long been utilized to evaluate performance in commercial organizations (Ghalayini and Noble, [23]). Bai and Lee [6] investigated organizational factors affecting the quality of the strategic planning process for information systems (IS) and suggested that both internal and external business environments affect the level of maturity of the IS function and IS infrastructure in improving the quality of the IS strategic planning process. Since Earl's [20] model of the maturity of IS planning in organizations first suggested this factor, only a few studies have focused on factors related to the maturity of IS in regard to its connection to business performance. For instance, Haider [28] assessed business performance based on the level of the maturity of the IS infrastructure.

Cho, Leem, and Shin [12] measured the informatization level in the Korean mold industry based on factors that included the timing of the plan to introduce an information system, the utilization status of information systems, and the informatization effect on business performance.

All companies invest heavily in selecting and installing their information systems (IS), yet many companies fail to achieve a full payoff from this investment in either financial or non-financial terms. This has been an ongoing and complex unsolved task for many practitioners and scholars (Zhen et al., [63]). Thus, the main focus of this study is to gain an understanding of the key issues affecting both the financial and non-financial business performance from the perspectives of the business environment and the informatization level via characteristics of enterprise information systems, such as the level of maturity of the IS and the infrastructure of IS. This area has only rarely been investigated in previous studies.

Therefore, in this study, the author suggests a new conceptual framework, based on reviews of previous scholarly literature, consisting of four key elements: (1) the external and internal business environments; (2) the informatization level; (3) characteristics of the information system, focusing on maturity of IS and infrastructure of IS; and (4) business performance. The method used was an online survey that was distributed and the data collected; data was analyzed by using the statistical packages SPSS and PLS.

Chapter 1, the Introduction, has described the structure of this study, including the purpose, method, and composition of the study. Chapter 2 includes a discussion of the theoretical background and previous

research on management information systems. Chapter 3 presents the hypotheses and describes the research design. The empirical analysis is explained in Chapter 4; and chapter 5 presents the results and limitations of this research and possible directions of future studies.

2. Theoretical Background and Previous Studies

2.1 Business Environment

The business environment can be described as encompassing the status of both the internal and external business environments. The internal environment refers to the unique characteristics and atmosphere of a specific group. The external environment exists in the organizational strategy, structure, and management of the environments of other external groups that affect the total environment (Marshall and Mckay, [43]).

To be successful, corporations must be able to analyze the business environment. Wren [59] described the organizational environment thus: "The corporate management is the product of processing in environment." Deu and Olsen [17] found that the performance results of businesses appear to be related to factors that include the environment, the business strategy, and the internal structure. Park [47] found the internal environmental factors affecting personnel and the organizational and financial structure to have a positive effect.

The external business environment in which a firm competes changes continually, so an organization must continually adapt and make changes that help them remain competitive within that changing environment (Auster and Choo, [3]). The external business environment is experiencing increasing and unpredictable levels of change (Macneil, [42]). To measure the external business environment, perceived uncertainty of the business environment is divided into six sectors: customer, competition, technology, regulatory constraints, economics, and social-cultural sectors (Daft et al., [14]).

The environmental uncertainty consists of multiple attributes that include degree of competition, complexity, and dynamics within the environment (Brandt and Hartmann, [9]). To measure the degree of uncertainty in the business environment, Khandwalla [38] and Kim [39] also used degree of competition. Looking at environmental uncertainty in business, Duncan [18], Hayes [29], Aldrich [1], and Dess and Beard [16] found that environmental uncertainty was primarily defined by the dynamics within the business environment; that is, if the dynamics were heterogeneous, the environmental uncertainty could be high. Thus, this study will investigate how this perceived environmental uncertainty, along with other factors, affects business performance.

2.2 Informatization Level

Enterprise informatization is defined as a dynamic, developing process in which enterprises exploit and utilize the information resources both within and outside of the enterprise, such as computer technology and network communication technology, at every level and in every aspect of production, management, business, and decision-making. Its main methods include continual improvement of production, management, and marketing, with the aim of improving its economic benefits and remaining competitive (Zhen, [64]).

This definition includes primarily several aspects, described as follows: (1) from a technology aspect, enterprise informatization involves the widespread application of modern information technology; (2) from a user aspect, businesses use enterprise informatization to organize, exploit, and utilize their information resources; (3) from a motivational aspect, it is aimed at improving production, management, and the efficiency and quality of decision-making; (4) from an evolutionary aspect, it is a dynamic, developing process that serves to continually enhance the competitiveness,

efficiency, and profits of the enterprise; and (5) from a systems aspect, it involves complicated systematic engineering.

The levels of informatization that have been measured in various industries and countries include the mechanical industry in China (Xiangdong and Lansheng, [60]) and the automotive industry in Korea (Yu et al., [61]). Their studies commonly measured informatization levels using multiple dimensions, such as plan levels, infrastructure levels, effect levels, and utilization levels. Jeon [31] mentioned that assessment of informatization levels was divided among propagation levels of infra, using labor force and investment activity as measurements.

Sun and Feng [54] also empirically investigated manufacturing enterprises' informatization levels based on their analysis of technological flow-through plans, effects, and utilization levels. Moreover, Yu [62] found that assessment levels were divided among information infrastructure, introduction and utilization of information, and information's effects on tasks; Kang [33] found that assessment levels were divided among information infrastructure and information systems.

2.3 Characteristics of Enterprise Information Systems

The maturity of ISs, as seen from the perspective of the characteristics of enterprise information systems, is examined by looking at the flexibility and utilization related to the introduction of information technology, the retention of experts within the organization, and the compatibility of technology due to the dynamic characteristics of enterprise system processes and their adaptation to the current business environment, resulting in organizational structural changes (Gutierrez Vela et al., [27]).

An enterprise information system is composed of a series of factors. The degree of maturity and the effect of these factors determine the level of development and application of enterprise information systems, as well as their effectiveness. These factors can be divided into two categories: internal factors and external factors (Guo and Wei, [26]).

Grover and Goslar [24] found that the realization stage during the introduction of information systems affects the maturity of information systems. Further, Premkumar and Ramamurthy [50] found that when business environments are able to retain many great experts within the organization, this indicates a high level of maturity within the organization, which affects its willingness to accept new technology.

As organizations accommodate new technologies in order to obtain better performance levels, the presence of a suitable infrastructure is very important. Cash et al. [10] found that the realization of success with new technology demands a mature information infrastructure. Their results showed that mature organizations were found to be very active in introducing new information technologies. According to Tornatzky and Fleischer [56], they found that when the introduction of IS occurs in the process of innovation, this affects the technological situation that is associated with the company, including both its internal and external technology. Armstrong and Sambamurthy [2] also found in several business units of some companies that sophisticated information technology infrastructure can be developed within or outside of the organization.

2.4 Business Performance

Eventually, when the source of competitiveness in business is a result of corporate performance, analysis of corporate performance and identification of symptoms are indicators used to evaluate the competitiveness of corporate performance. In the past, companies typically measured the success of their attempts to compete based on cost advantages and evaluations of management performance primarily from a financial aspect, using financial measures such as return on investment, return on sales, productivity, and profit per unit of production. These kinds of financial measures have long been used to evaluate performance in commercial organizations (Ghalayini and Noble,

[23]). King (1988) found that business performance is often measured by the return on investment (ROI), and Venkatraman and Ramanujam (1986) found that financial performance measures often include sales growth and income growth.

Critics of performance measures derived from costing and accounting systems began to gain attention in the 1970s (Bourne et al., [8]), and by the 1980s there was a growing realization that it was no longer appropriate to use financial measures as the sole criteria for assessing organizational success (Kennerley and Neely, [37]). This criticism stimulated the development of a number of performance measurement models that aim to overcome the shortcomings associated with purely financial measurement systems. In a study of non-financial measures used in evaluations, Venkatraman and Ramanujam (1986) found that power of sales, potential of future sales, quality, and technical skill were common non-financial measures.

Models of non-financial measurements include the SMART pyramid (Cross and Lynch, 1989), the performance measurement matrix (Keegan et al., 1989), the results and determinants matrix (Fitzgerald et al., 1991), the balanced scorecard (Kaplan and Norton, 1992), and the performance prism (Neely, 1999).

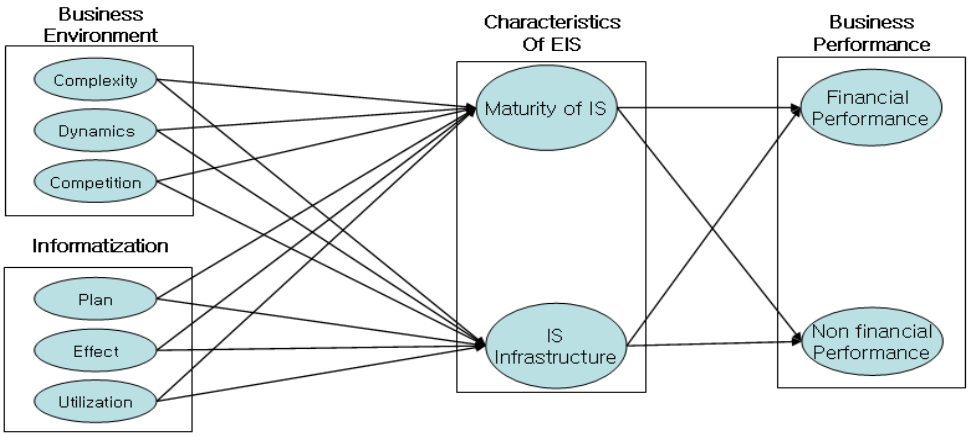
Recently, Ong and Teh (2009) used both financial and non-financial measurements to assess business performance, and emphasized that companies should consider both non-financial and financial perspectives to evaluate business performance.

3. Research Model and Hypotheses

From a review of previous literature on this subject, the author developed the following research model (Figure 1) and sets of hypotheses. The reasoning behind them are described in the following paragraphs.

3.1 Business Environment

Deu and Olsen [17] found that business performance is affected by factors such as environment, business strategy, and internal structure; Grover and Teng [25] noted that maturity of information systems refers to the maturity levels of information systems and the employees' expertise regarding the use of information systems within organizations. Kim et al. [40] studied how outsourcing providers are selected, using various factors including maturity of IS and the internal and external business environments. Park [47] found that internal and external environmental factors affected the growth, complexity, dynamics, personnel, organizational, and financial structure as positive effects. Premkumar and Ramamurthy [50] and Cash et al. [10] found that certain factors within the



[Figure. 1] Conceptual Research Model.

organizational environment—such as level of expertise, response to strategic changes, and infrastructure support—have an impact on readiness for technology adoption.

Brandt and Hartmann [9] and Dess and Beard [16] also conducted studies to measure the external business environment. Their studies focused on three factors: level of complexity, dynamics, and competition.

The first set of hypotheses in this study was created based on a modification of Ruohonen and Higgins' [51] work. However, the characteristics of IS in this study were divided into two key factors—the level of maturity of IS and the IS infrastructure. The reason for this is that the maturity of IS concerns the maturity of IS functions, whereas the IS infrastructure is about hardware/software and other related IT skills.

H1: The complexity level of the external business environment affects the maturity of IS as a positive effect.

H1-1: The complexity level of the external business environment affects the infrastructure of IS as a positive effect.

Yu et al. [61] evaluated the level of IS maturity based on the dynamic business environment. Bai and Lee [6] investigated organizational factors affecting the quality of the IS strategic planning process, and their model showed that internal/external business environments affect the level of maturity of IS functions and the IS infrastructure to improve the quality of the IS strategic planning process. Thus, the following second set of hypotheses in this study has been established based on their work:

H2: The dynamic level of the external business environment affects the maturity of IS as a positive effect.

H2-1: The dynamic level of the external business environment affects the infrastructure of IS as a positive effect.

Drury [19] studied organizations whose emphasis was on business environmental competition and technological advantage, and this study found a positive relationship between the sophistication of IS and the maturity of IS management regarding IS infrastructure. Thus, the following third set of hypotheses for this study was established:

H3: The competitive level of the external business environment affects the maturity of IS as a positive effect.

H3-1: The competitive level of the external business environment affects the infrastructure of IS as a positive effect.

3.2 Informatization Level

Sun and Feng [54] investigated the informatization level of manufacturing enterprises, which they called the technological plan; and they analyzed the technological plan and its application to the business process to give the technological plan's flow in "improving plan, effect, and utilizations' level."

As a way to measure informatization levels, Jeon [31] and Kang [33] found that the information plan levels, infra levels, effect levels, and utilization levels were all related to improvement in the informatization of organizations. Grover and Goslar [24] also found that the realization stage in the introduction of information technology affected the maturity of information technology as a positive effect. Armstrong and Sambamurthy [2] found that sophisticated information technology infrastructure could be developed within or outside of the organization in several business units of companies. As a result of their findings, the following three sets of hypotheses were created for this study:

H4: The informatization plan level affects the maturity of IS as a positive effect.

H4-1: The informatization plan level affects the infrastructure of IS as a positive effect.

H5: The informatization effect level affects the maturity of IS as a positive effect.

H5-1: The informatization effect level affects the infrastructure of IS as a positive effect.

H6: The informatization utilization level affects the maturity of IS as a positive effect.

H6-1: The informatization utilization level affects the infrastructure of IS as a positive effect.

3.3 Characteristics of Enterprise Information Systems

The impact of enterprise information systems, such as ERP, SCM, and CRM, on an organization's business performance, based on the maturity of IS, was studied by Peng and Zheng [48]. Enterprise information systems that can handle upgrades or changes in the IS infrastructure in a more flexible way have a positive impact on business performance (Kalogeras et al., [32]). Technologies such as enterprise information systems (EIS) can enhance global integration and efficiency of organizational performance (Davenport, [15]). Also regarding business performance, both the financial and non-financial business performances are effective attributes in measuring business performance. Bourne et al. [8] showed that there is a need for alignment of financial and non-financial measures for IS business performance. As a result of their findings, this study created the following two sets of hypotheses:

H7: The maturity of IS affects financial business performance as a positive effect.

H7-1: The maturity of IS affects non-financial business performance as a positive effect.

H8: The infrastructure of IS affects financial business performance as a positive effect.

H8-1: The infrastructure of IS affects non-financial business performance as a positive effect.

3.4 Design and Methods of Study

In the spring of 2010, a previously validated questionnaire for the main survey was sent to a number of business organizations in Taiwan. The questionnaire was addressed to the employee responsible for technology adoption and implementation within each organization. A total of approximately 200 surveys were sent out, and 156 of the surveys were returned. There were 136 usable responses from the 156 returned. Twenty responses out of 156 were eliminated because of the respondents' failure to answer all questions. The survey items were measured on a 7-point Likert-type scale, with 1 being "strongly disagree" and 7 being "strongly agree."

4. Data Analysis and Results

4.1 Description of Statistics

The information technology (IT) industry made up the highest percentage (40.0%) of responses, followed by machinery (12.2%), services (13.2%), and other (12.2%). The majority of the respondents were in their 30s (48.0%) and 20s (38.5%). Only 13.5 percent of the respondents were 40 years of age or older. The distribution of the number of employees appeared to be well balanced. The breakdown of job roles held by the respondents was as follows: report to the chief decision maker (38.3%), give advice to the chief decision maker (35.5%), do not directly play a role (20.0%), and the chief decision maker (6.2%). The majority of the respondents' educational level was university graduate (52.7%), followed by graduate school (47.3%).

4.2 Measurement Model Analysis

Reliability of items of a measuring instrument was verified using a Composite Scale Reliability Index (CSRI). Typically, based on Fornell and Larcker's work [22], it is expressed to achieve strong internal consistency of measuring items if CSRI values are more than 0.5. Convergent validity exists when loading values of measuring variables should exceed 0.5 (Fornell and Larcker, [22]) and AVE of each construct should exceed 0.5.

To test discriminant validity, AVE for each construct should be greater than the square of correlation between others such as AVE (Barclay et al. [7]; Chin [11]; Fornell and Larcker [22]). Generally, the variables used in the study are confirmed to be sufficiently validity based on the results of Table 1 and 2, which exceed the suggested criteria values.

〈Table 1〉 Composite Reliability and AVE

	AVE	Composite Reliability	Cronbachs Alpha	Communality
Complexity	0.72338	0.912714	0.87396	0.72338
Dynamics	0.597353	0.88098	0.833379	0.597353
Competition	0.779952	0.913908	0.858459	0.779952
Plan	0.700785	0.903445	0.858448	0.700785
Effect	0.72601	0.913722	0.876402	0.72601
Utilization	0.651414	0.881826	0.823271	0.651414
Maturity	0.794741	0.920667	0.870309	0.794741
Infrastructure	0.671738	0.889968	0.832956	0.671738
Financial Performance	0.809201	0.944294	0.921204	0.809201
Non-financial Performance	0.694037	0.940605	0.926099	0.694037

As seen Table 3, the result of the factor analysis with varimax rotation showed that eigenvalues for all ten independent factors were greater than 1 and the value of cumulative variance for all ten factors was 83.39%. All factor loading values except dynamics 3 and 4, competition 1, effects 3, utilization 4, IS infrastructure 3, and non-profit performance 2 and 6 for the ten factors in this study exceeded the suggested threshold of .60, which is considered to be an acceptable level for a newly-developed scale across disciplines (Barclay et al., [7]). Also, composite scales constructed by averaging items within each factor all showed acceptable reliability levels, as Cronbach's alpha values ranged from 0.823 for utilization to .926 for non-financial performance. The values are higher than the recommended threshold of .70 (Barclay et al., [7]; Bagozzi and Yi, [5]).

〈Table 2〉 Correlation Analysis

	Comp	Dyna.	F.P.	Eff.	Compe.	Mat.	N.F.P.	Plan	Infra.
Dyna.	0.55	1.00							
F.P.	0.68	0.55	1.00						
Eff.	0.56	0.49	0.46	1.00					
Compe.	0.36	0.50	0.44	0.34	1.00				
Mat.	0.63	0.64	0.46	0.64	0.27	1.00			
N.F.P.	0.57	0.62	0.44	0.75	0.31	0.79	1.00		
Plan	0.51	0.51	0.36	0.75	0.26	0.77	0.83	1.00	
Infra.	0.58	0.52	0.84	0.37	0.46	0.49	0.38	0.41	1.00
Utili.	0.50	0.44	0.72	0.48	0.44	0.39	0.54	0.42	0.76

〈Table 3〉 Factor Analysis

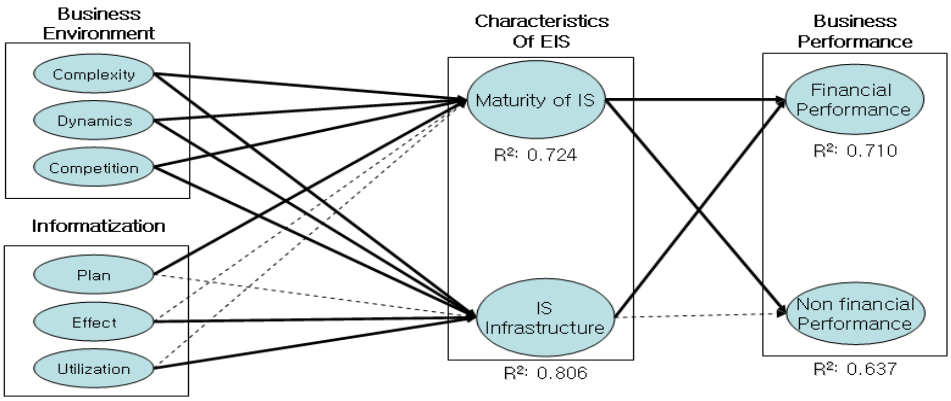
	1	2	3	4	5	6	7	8	9	10
Comp1	0.92	0.11	0.05	0.01	0.12	0.38	0.00	0.03	0.06	0.13
Comp2	0.89	0.02	0.14	0.01	0.09	0.15	0.15	0.05	0.27	0.16
Comp3	0.85	0.16	0.39	0.18	0.04	0.14	0.14	0.38	0.05	0.38
Dyna1	0.53	0.69	0.57	0.02	0.03	0.21	0.18	0.33	0.27	0.13
Dyna2	0.28	0.76	0.13	0.20	0.28	0.80	0.66	0.03	0.07	0.08
Dyna5	0.06	0.76	0.80	0.04	0.02	0.45	0.33	0.06	0.11	0.19
Compe2	0.14	0.04	0.81	0.81	0.09	0.11	0.03	0.24	0.13	0.02
Compe3	0.12	0.04	0.84	0.84	0.18	0.12	0.12	0.22	0.13	0.19
Compe4	0.02	0.12	0.83	0.82	0.03	0.02	0.05	0.32	0.01	0.06
Plan1	0.16	0.80	0.10	0.85	0.03	0.26	0.20	0.07	0.16	0.04
Plan2	0.19	0.83	0.13	0.86	0.07	0.02	0.05	0.17	0.23	0.35
Plan3	0.08	0.81	0.07	0.80	0.19	0.06	0.08	0.30	0.18	0.06
Plan4	0.09	0.76	0.20	0.83	0.12	0.17	0.12	0.04	0.50	0.18
Eff1	0.50	0.24	0.05	0.06	0.85	0.36	0.02	0.11	0.13	0.09
Eff2	0.52	0.30	0.16	0.07	0.85	0.30	0.24	0.16	0.05	0.09
Eff4	0.46	0.21	0.48	0.05	0.77	0.33	0.11	0.17	0.07	0.10
Utili1	0.23	0.15	0.12	0.36	0.69	0.77	0.21	0.19	0.16	0.16
Utili2	0.25	0.30	0.64	0.13	0.39	0.80	0.22	0.01	0.07	0.02
Utili3	0.23	0.14	0.21	0.19	0.79	0.81	0.22	0.24	0.05	0.39
Mat1	0.23	0.25	0.02	0.09	0.02	0.16	0.92	0.21	0.06	0.22
Mat2	0.01	0.02	0.14	0.08	0.13	0.24	0.85	0.32	0.17	0.25
Mat3	0.23	0.05	0.06	0.06	0.01	0.04	0.90	0.01	0.11	0.38
Infra1	0.06	0.13	0.06	0.20	0.19	0.17	0.16	0.87	0.40	0.11
Infra2	0.31	0.02	0.25	0.09	0.17	0.07	0.08	0.86	0.34	0.14
Infra4	0.51	0.26	0.31	0.05	0.19	0.27	0.01	0.58	0.21	0.06
N.F.P.1	0.18	0.13	0.08	0.07	0.06	0.02	0.15	0.31	0.83	0.44
N.F.P.3	0.03	0.00	0.08	0.12	0.10	0.04	0.19	0.19	0.92	0.39
N.F.P.4	0.05	0.26	0.11	0.22	0.31	0.21	0.05	0.09	0.82	0.26
N.F.P.5	0.11	0.32	0.08	0.11	0.05	0.35	0.08	0.24	0.75	0.17
N.F.P.7	0.11	0.11	0.27	0.07	0.18	0.18	0.25	0.10	0.83	0.19
F.P.1	0.49	0.16	0.16	0.04	0.08	0.22	0.07	0.23	0.10	0.93
F.P.2	0.34	0.18	0.03	0.03	0.07	0.13	0.19	0.07	0.29	0.88
F.P.3	0.48	0.19	0.09	0.04	0.01	0.35	0.04	0.03	0.12	0.91
F.P.4	0.38	0.02	0.37	0.05	0.22	0.03	0.04	0.04	0.24	0.86
Eigne V.	7.429	6.091	2.751	2.261	2.040	1.637	1.634	1.516	1.512	1.478
Cum. V.	21.85	39.76	47.86	54.51	60.50	65.32	70.12	74.58	79.03	83.38

Table 4 and Figure 2 show the results of the structural equation model test using Smart PLS. This modeling has been employed to test the proposed research model based on the sample groups. The results of the structural path analysis of the research model provide support for the sixteen hypotheses. In terms of explanatory power of the model, R^2 values of PLS analysis for each endogenous variable was used to verify research hypotheses in this study (Hulland, 1999).

The sixteen hypotheses presented above were tested collectively using the structural equation modeling (SEM) approach (Bagozzi et al., [5]); testing of the hypotheses was also performed using SMARTPLS. The path significance of each hypothesized association in the research model, and the variance explained (R^2

〈Table 4〉 Structural Equation Model Test

	β	T Statistics	Results
Complexity -> Maturity	0.25420	3.03441**	Accept
Complexity -> Infrastructure	0.20302	2.43627**	Accept
Dynamics -> Maturity	0.29298	3.27201**	Accept
Dynamics -> Infrastructure	0.08577	1.89599*	Accept
Competition -> Maturity	-0.09371	1.82396*	Accept
Competition -> IS Infrastructure	0.12516	2.01574*	Accept
Plan -> maturity	0.50160	5.01278**	Accept
Plan -> Infrastructure	-0.05072	0.64537	Reject
Effect -> Maturity	0.02872	0.23995	Reject
Effect -> Infrastructure	-0.11352	2.29099*	Accept
Utilization -> Maturity	-0.10580	0.84661	Reject
Utilization -> IS Infrastructure	0.23434	2.49457**	Accept
maturity -> financial performance	0.075	1.96483*	Accept
maturity -> non-financial	0.80085	11.35321**	Accept
Infrastructure -> Financial performance	0.803252	20.70152**	Accept
Infrastructure -> Non-financial Performance	-0.00549	0.09635	Reject
**: p-value < 0.01, *: p-value < 0.05			



[Figure 2] Structural Equation Model Test

value) by each path, was examined, and Fig. 2 and Table 4 show the standardized path coefficients and path significances. Twelve hypothesized associations out of sixteen were strongly significant at $p < 0.01$ or $p < 0.05$, except for these four links: (1) between informatization plan level and IS infrastructure; (2)

between informatization effect level and maturity of IS; (3) between informatization utilization level and maturity of IS; and (4) between IS infrastructure and non-financial performance. For the business performance measurement, financial performance in this study was predicted by the maturity of IS (β = 0.075, < 0.05) and IS infrastructure (β = 0.803, < 0.01), and these variables together explained 71% of the variance of financial performance for business performance (R^2=0.71, coefficient of determination). Non-financial performance was predicted by maturity of IS (β=0.800, < 0.01), explaining 63% of the variance of non-financial performance for business performance (R^2=0.63, coefficient of determination).

In addition to their direct effects, maturity of IS, in turn, was predicted by the variables of complexity (β = 0.254, $p < 0.01$), dynamics (β = 0.292, $p < 0.01$), competition (β = 0.093, $p < 0.05$), and informatization plan level (β = 0.501, $p < 0.01$); together these explained 72% of the total variances. IS infrastructure was jointly predicted by complexity (β = 0.203, $p < 0.01$), dynamics (β = 0.085, $p < 0.05$), competition (β = 0.125, $p < 0.05$), informatization effect level (β = 0.113, $p < 0.05$), and informatization utilization level (β = 0.234, $p < 0.01$), and together these explained 80% of the total variances.

5. Discussion

The results of this study provide support for the research model and for the hypotheses regarding the directional linkage among the model's variables. The overall explanatory power of our research model had an R-square of 71% for financial business performance and an R-square of 63% for non-financial business performance. The finding of 72% for maturity of IS and 80% for IS infrastructure as they relate to financial and non-financial business performance suggests that the extended model is capable of explaining a relatively high proportion of variation of business performance. Several insightful results can be summarized from our research framework, and these are presented below.

5.1 Relationships Between Antecedent Constructs and Business Performance

This study has examined the effects of business environment (complexity, dynamics, and competition), informatization level (plan, effect, and utilization), and characteristics of enterprise information systems (maturity of IS and IS infrastructure) on business performance (financial and non-financial performance). The maturity of IS-business performance link has previously been identified only in some product and service contexts (Grover and Goslar, [24]; Guo and Wei, 2009; Gutierrez Vela et al., [27]); and its revalidation in this study confirms this relationship. Further, maturity of IS may be the key to measuring business performance in terms of financial and non-financial aspects. Because maturity of IS was the direct predictor of financial performance (explaining 71% of variance) and non-financial performance (explaining 63% of variance), the lower maturity score, indicating low flexibility and sophistication of IS, may not support increasing high business performance. IS infrastructure was the only direct predictor of financial performance. In other words, financial measurement is jointly affected by maturity and infrastructure of IS, despite maturity having a positive impact on non-financial performance. So, managers should assume that maturity of IS is a necessary and strong condition for the measurement of business performance when considering the investment of IS to increase business performance.

Business environment was identified in this study as an indirect determinant affecting business performance via maturity and infrastructure of IS. When this result is compared with that of the previous work by Bai and Lee [6], some interesting findings emerge. Based on their findings, it is shown that the higher the maturity of IS function, the better the quality of IS strategic planning, while factors in the business environment,

such as a high level of competition and complexity, affects the high sophistication level of IS function, such as requiring many great experts to handle large-scale enterprise systems (Premkumar and Ramamurthy, [50]). In other words, because complexity, dynamics and competition were found to be significant indicators affecting maturity of IS. Further they also have an impact on strategic planning performance in increasing financial and non-financial business performance.

Informatization level was another strong predictor of the maturity and infrastructure of IS, while only informatization plan level affects IS maturity, and only informatization effect and utilization levels affect IS infrastructure in this study. Informatization level reflects the extent of plan, effect, and utilization of the information resources within and outside of the company in using the computer technology and network. So, high informatization level should be supported by sophisticated IS function and infrastructure, and is more closely related to flexible and quick response to change. In contrast, low informatization level is grounded in inefficient use of information resourcing using technologies and systems in organizations, and is therefore less supportive of positive characteristics of enterprise systems, such as high maturity of IS.

The above findings imply that there is an association among business environment, maturity of IS, and business performance. Therefore, business performance related to investment in enterprise information systems by managers should consider a twofold strategy in order to increase financial and non-financial performance: an analysis of the levels of business environment in the industry and the informatization level in the organization; and decisions regarding installing new systems or upgrading old enterprise information systems based on an appropriate level of IS maturity and infrastructure to sufficiently support these two requirements (environment and informatization) for affecting business performance.

5.2 Limitations and Direction of Future Studies

This study has several limitations. First, the work was conducted using a short-term snapshot of research variables, and additional research efforts with longitudinal studies would give a clearer picture of how the business performance and the relationships among variables change over time.

Second, because the study collected the data for the independent and dependent variables from the same respondents, concerns about common method bias could arise (Woszczynski and Whitman, [58]), and the study conducted Harmon's one-factor test (Podsakoff, MacKenzie, et al., [49]) to assess that risk. The author entered all the variables into a factor analysis. Because more than a single factor emerged from the factor analysis, and no single factor in general accounted for the majority of the variance in those variables, no evidence was seen to suggest the presence of a common method variance bias.

This study focused on certain perspectives of constructs and did not take into account other disciplines in each construct, limiting the breadth of these conclusions. Future study should consider a wider range of business performance, characteristics of EIS, business environment, and informatization disciplines, as they may show different relationships between constructs.

Further, this study conducted empirical analysis only in Taiwan, which means that the survey research did not target companies in other countries. To overcome these limitations, further studies should be expanded to other populations in order to strengthen the theoretical foundations.

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