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ABSTRACT

This study attempts to look at the internal and external factors which result in improved interior design project management through the proposal and empirical validation of a theoretical model. The model incorporates three major dimensions: users' technology readiness, their perceptions of information system quality, and project management effectiveness. Sample data collected from 50 interior design companies located in north, central and southern urban cities in Taiwan (n = 497) were analyzed using structural equation modeling (SEM). Results showed that both users' technology readiness and information system quality have positive effect on project effectiveness. Specifically, technology readiness influences project management effectiveness indirectly through information system quality, indicating that it is crucial for organizations to invest and enhance quality technological performance support tools in conjunction with fostering users' acceptance and readiness of technology adoption and application.

KEYWORDS: Technology Readiness, Information System Quality, Project Management Effectiveness

INTRODUCTION

The rapid development of information and internet technology have shortened the life cycle of products which results in heavy pressure on making products to become available in the markets within limited periods of time. Thus, not only is it vital for enterprises to focus on their core businesses and technology development, it is also important to develop new products, and expand their target markets in order to enhance business effectiveness and efficiency. However, effective and efficient product design activities require a distributed, cross-functional, and collaborative product development process, which is likely to result in increased complexity in project management and data transmission of product design. To deal with increasing product development complexity, enterprises have been dependent on the adaptation and application of information technology on the key product development processes [19,27,29,69,92].

Following the footsteps of fast developing information and communication technology, local industries have made transformations to manufacture high technological products, leaving along the descending traditional markets, such as manufacturing, construction, and architecture industries. With the present economic recession, architecture and related industries (e.g., interior design companies) have encountered unprecedented impact. At the current state, the local residential vacancy rate reaches the highest and the need of purchasing falls to the lowest [18]. The architecture industry must strive for their survival with new business strategies. The adaptation of information technology into product designs or business operations opened a new door of opportunities for better managing the product developmental process, as well as meeting the needs of their clients [7,17,70,95,105].

To support a just-in-time and customized product development process, a web-based decision support system for interior design was developed based on the fuzzy analytic hierarchy process, a commonly used tool for multi-criteria decision making problems. The web-based system was designed to facilitate the interior design process which aims to deliver products that meet the needs of clients with unique styles and fashion. Fuzzy concepts were integrated with authentic data, which supports sensible multi-criteria classification. The system was tested in a local company and the results suggest that the fuzzy multi-criteria classification design scheme was effective in supporting the interior design process. Therefore, it was introduced to other companies to assist their interior design process. However, it is essential to learn whether the quality of information system or the technology readiness of the interior designers accounts for the effectiveness of product design process.

Past research indicates that enterprises are implementing and integrating information and communication technology into business functions as a method of facilitating efficient internal flow of knowledge [36], which means that the employees within an enterprise are able to access and apply knowledge to improve their business operations. However, despite the considerable investment in computerized information infrastructure to improve the distribution of knowledge, some enterprises are not gaining a correlated performance outcome [58]. Feng, Chen and Liou [30] argue that the mere act of increasing IT investment do not ensure better business performance or distribution of information among employees. In order words, successful implementations of information technology to aid business processes (e.g., knowledge management) involve the coordination of people, technology and technique within an enterprise [8].

The combination of information technology and personal drive to use and apply information technology within an organization is influencing the effectiveness of the design and development process of new products. This study attempts to look at the internal and external factors which result in improved interior design project management through the proposal and empirical validation of a theoretical model. The model incorporates three major dimensions, namely (1) the employees' technology readiness for using the web-based decision support system, (2)

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the quality of the web-based decision support system in terms of system information, functions, and services, (3) the employees' perception of the project outcome gained from applying the web-based decision support system in the interior design process. The following section constructs the theoretical background upon which the proposed model is created.

LITERATURE REVIEW

Technology Readiness

Past studies indicate that personality characteristics have significantly influenced online behaviors or intentions of online behaviors [99]. Ranaweera, Bansal, and McDougall [86] contend that trust disposition, risk aversion, and TR have fundamental relevance to online behaviors. Ranaweera et al. point out that technology readiness (TR) is one of the most important factors that influence online behaviors. According to Parasuraman [78], TR refers to people's tendency to embrace and use new technology to accomplish their goals in their professional as well as personal lives, which can be evaluated on four dimensions, namely optimism, innovativeness, discomfort and insecurity.

TR is considered a useful tool for identifying users who exhibit both innovative attitudes and behaviors [61,102], and has been employed in a number of studies [54,107]. Furthermore, Lin, Shih, and Sher [56] integrate TR into the technology acceptance model (TAM) in the context of consumer adoption of e-service system and discover that readiness and acceptance of technology have significant effect on consumers' adoption of technological innovations. So far, the TR instrument has been used to compare consumers in different countries [9], to understand the TR of service employees [104], and to explain the relationship between perceived ease of use, usefulness and behavioral intentions [109]. However, it is important to be tested in other contexts as well [54].

Information System Quality

Technology can be seen as recent knowledge embodied in tools, which are used to perform human tasks. Technology-supported decisions are not limited to manufacturing. According to Bahouth [5], the service sector accounts for 70 percent of the gross national product in the United States, and employs 80 percent of all information technology equipments. The concept of knowledge management has placed attention on the implementation of information technology to support managing knowledge assets [32,76,89].

In the modern enterprise, adequate investment in knowledge-oriented technology infrastructures (such as the internet) can support the management of knowledge or business operations [24]. However, it is important to know that technology is the answer to all the problems with enterprises. In reality, technology can both improve and defer business operations [31]. As Money and Turner [65] have stressed the importance of the user's perceived usefulness and ease of use in encouraging IT usage. Consequently, information system designs have gradually evolved from a technically-orientated user interface to one that is accessible to the end-users. In other words, decision support system design must incorporate a human-centered approach which takes the goals, needs and preferences of the users into consideration [43].

Information system quality represents a broader perspective than software quality which involves only software and hardware technology. The quality of information system is a multi-perspective entity whose dimensions represent the various interest groups of the systems. Past studies have somewhat different take in conceptualizing the quality of information systems. For example, Andersson and Von Hellens [3] argue that quality information system must be able to effectively support people with their work practices, thus propose the organizational hierarchy of information system quality factors, involving information system work quality, use quality and business quality. Boritz [10] suggested that there are three major quality concepts of an information system, including information integrity, processing integrity and system reliability.

DeLone and McLean [26] introduced the information system success model. The model indicates that system quality and information quality affect the use of information within the system as well as the user satisfaction. Pitt, Watson and Kavan [81] argued that DeLone and McLean's work overlooked the service function which the information technology serves, thus added one element to this model: service quality. Such three-factor model of information system quality (i.e., information quality, the system quality, and the service quality) has been adopted in a number of studies to assess information technology quality [1,63,67,68].

Project Management Effectiveness

The complex and unpredictable nature of projects generates serious challenges for managers of projects and project-based organizations. Many researchers have tried to identify key project capabilities (or attributes of effective project management) which may lead projects and project-based organizations to cope with problems, difficulties or challenges [48]. Current literature presents various sets of factors that demonstrate influences on project effectiveness (or project performance) [80]. For example, Landaeta proposes that the amount of knowledge about implementing projects which obtained from other projects is positively associated with project effectiveness. While Ramasubbu, Mithas, Krishnan, and Kemerer [85] discover a structured learning process would mitigate the negative effects of work dispersion in a development team, Buettner [12] realizes that communal knowledge mechanism has a statistically significant impact on effective project outcomes.

Within the context of a project, the success of project may mean different things to the client and the project team and at different phases of the project. Eijnatten [28] suggests that success factors of project implementation could be categorized into four dimensions, reflecting both the micro and macro levels of "social" and "technical" organization design elements. Rad and Levin [84] propose project success indicators in three categories, including enterprise, people and things. In evaluating the impact of dynamic capabilities on project performance, Ho and Tsai [35] examined project effectiveness at six levels: cost analysis, benefit analysis, successful ratio, product quality, process improvement, and technology innovation. Furthermore, Kaplan and Norton [39] suggest balanced scorecard (BSC) as an alternative of the management of project performance. Consisted of financial, customer, internal business process, and learning and growth dimensions, the BSC evolved in response to a growing dissatisfaction with traditional performance measurement, which focused on a narrow range of mainly financial-based measure, such as profit and return on investment. Following the same line of application, Niebecker, Eager, and Kubitza [71] introduce the

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concept of a collaborative project scorecard, involving finances, customers, process and development, which can be revised and adopted to support the effectiveness and efficiency of project management.

METHOD

The research model is shown in Figure 1. The relevant hypotheses of the model and questionnaire design are presented below.

As much of the work of employees is supported by information technology, the quality of the employees' work largely depends on how the technology is perceived and used by the employees [107]. Many people only use a fraction of the functionality available on their desk-top, which may also result from their personality. Thus, there is a relationship between people's individual traits and the way they perceive technology [54]. In their study, Lin and Hsieh [57] examine the role of customer's technology readiness and assess the influence of technology readiness on both satisfaction and behavioral intentions toward self-service technologies. They discover that customer's technology readiness has a positive effect on their satisfaction and behavioral intention with self-service technologies. In order words, a higher level of users' readiness toward technology results in a higher satisfaction with the quality of technology and willingness of using technology. Furthermore, Mattila and Mount [62] learn that technology enthusiasts are more demanding of an immediate response than their counterparts, who tend to be less responsive to advances in information technology. Thus, it can be concluded that the quality of the information system is a subjective judgment. Information system quality depends on how the users perceive its ease of use or usefulness based on their background, experience, skill or personality. In accordance with these observations, the following hypothesis is proposed:

HYPOTHESIS 1: *Employees with higher technology readiness will have higher level of self-perception of information system quality.*

As mentioned earlier, Lin and Hsieh [57] argue that users' technology readiness is influential to their behavioral intentions toward information technology applications. In an information technology exposed world, technology influences the way we live and work. However, literature tells us that the effect of information technology still depends on how well the people and technology fit together. For example, Lee and Park [51] suggest that perceived loss of control has a negative effect on user satisfaction and perceived market performance is influenced by user satisfaction toward and perceived usefulness of information system. Hernandez, Jimenez, and Martin [34] analyze current and future company use of new business technologies, and find that technological compatibility, web procurement, perceived usefulness and perceived ease of use influence future use of as well as the outcome of business technologies. Curtis and Payne [23] find that the individual characteristics of employees play an important role on how they decide to adapt to new technology-supported work environment. As long as the firm may strategically level up the employee's acceptance toward technology, it has the potential to increase efficiency and effectiveness of task engagements and work performance. With these observations, the following hypothesis is proposed:

HYPOTHESIS 2: *A higher level of employees' technology readiness will facilitate a higher level of project effectiveness.*

Past research presents evidence showing that quality information technology plays a critical role in business operations

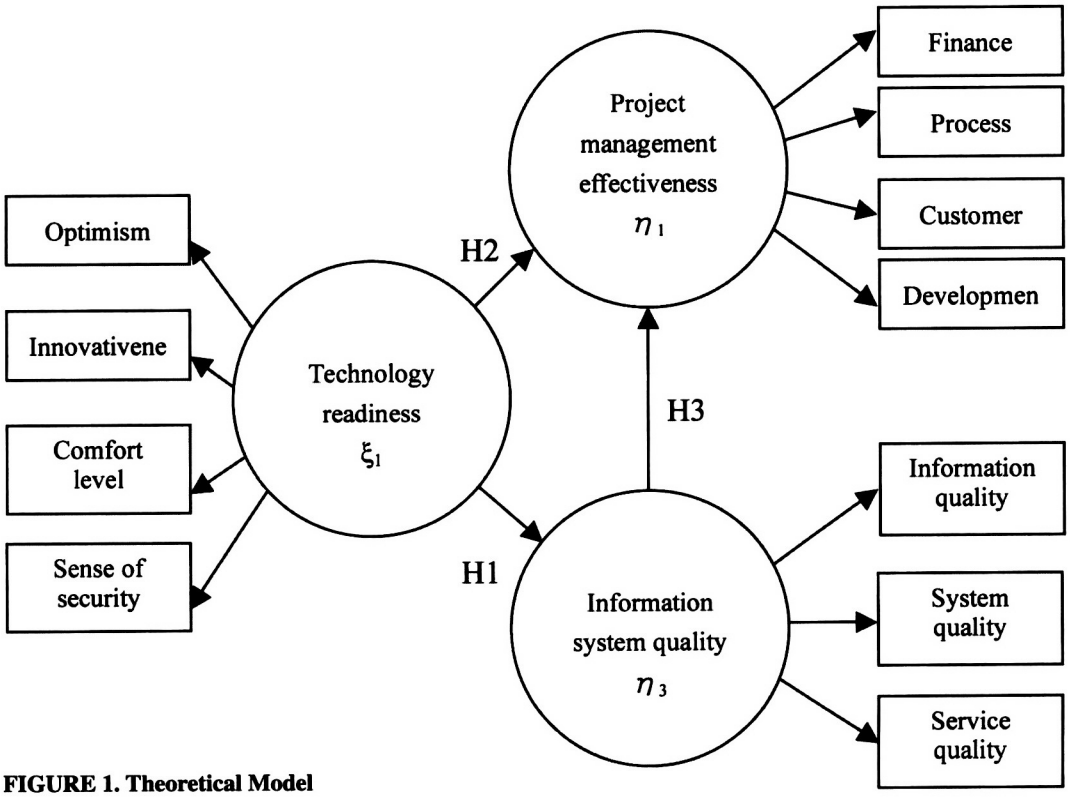

FIGURE 1. Theoretical Model

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or processes [96]. Effective use of information technology ensures timely access and exchange of knowledge to aid decision making [77]. There are a number of factors play important roles in successful project implementation. For example, Kendra and Taplin [41] pointed out that there are four dimensions of project success, namely project manager competencies, performance measurement system, business processes and project organizational structure. Existing studies show that there is a strong correlation between better project performance and information technology [6,87]. Of course, a system which may be supportive of better client/user support [38,94], team building [53], goal alignment [66], leadership [4], quality management [11], is also considered valuable to effective project management. Last but not least, Chakrabarty, Whitten, and Green [15] propose a conceptual model which illustrates the casualties in services and relationship quality of information systems. In the model, a service system which provides the better task-technology-structure fit results in higher project management effectiveness. Thus, the following hypothesis is proposed accordingly:

HYPOTHESIS 3: *A higher level of employees' self-perception of information system quality will facilitate higher levels of project effectiveness.*

Questionnaire Design

The questionnaire is composed of four parts including: technology readiness, Information system quality, project management effectiveness and personal background (i.e. gender, position type, age, and project management experiences). The questions were answered using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Details of the dimensions are described as follows.

I. Information system quality

This study adopts the three-factor model of IT quality dimension proposed by Medina and Chaparro [63]. The model includes the most studied elements in the modern world, namely the information quality, the system quality, and the service quality. While the quality of information refers to the appropriateness, up datedness, usefulness, accuracy, completeness, and relevance of the online content, the quality of system refers to the friendliness, flawlessness, efficiency, and adaptability of the web-based system. Finally, the service quality is defined as the tangible aspect of the system, which refers to reliability, responsibility, and empathy as well as the users' confidence in the online help.

II. Technology readiness

This study adapts Rarasuraman's [78] four-dimensions TR model which includes optimism, innovativeness, discomfort and insecurity, and makes some adjustments. The factors to be included are optimism, innovations, comfort level, and sense of security. While optimism refers to the positive view of technology and the belief that it offers more control to people, innovations refer to the tendency of the user to be a technology pioneer who has an open mind to accept or try new things or ideas. Comfort level is defined as the perceived control over technology, which refers to extent to which the users are adapted to using new technology. Finally, the sense of security refers to the trust of technology about its ability to work properly or as expected.

III. Project management effectiveness

This study adopts the collaborative project scorecard model proposed by Niebecker, Eager, and Kubitza [71]. The model includes four dimensions, namely finances, customers, process and development. The finances factor refers to the management of project budget, and the increase of business values. Customer refers to how customers satisfy with the product or the interaction they have with the project team. In addition, the process factor refers to how the project adheres to schedules and the quality of products or services. Last but not least, development refers to the strategy and outcome of individual development of project team members.

ANALYSIS AND RESULT

Sampling

The data used in this research consists of questionnaire responses from participants in 50 interior design companies which located in the northern, central and southern cities of Taiwan. The criteria of firm selection are: (1) the company has used the web-based decision support system for interior design projects for at least three months, (2) the company must be a member in the board of trade. There are 50 interior design companies that are qualified and willing to participate in the study. The study particularly targets the management, project leaders, and other professionals who have involved in interior design projects. Each firm received 20 questionnaires to answer. Thus, a total of 1,000 survey forms was circulated, of which 513 surveys were returned and 497 were valid for analysis (valid return rate is 49.7%). Table 1 presents the demographics of the sample. Table 2 shows the description statistics for the dimensions.

TABLE 1. Sample characteristics

Construct	Classification	Number	Percentage (%)
Gender	Male	340	68.410
	Female	157	31.590
Position	Management	116	23.340
	project leader	267	53.722
	other professional	114	22.938
Age	<30	31	6.237
	31-40	116	23.340
	41-50	148	29.779
	>50	202	40.644
Project management effectiveness	Yes	371	74.648
	No	126	25.352

TABLE 2. Survey structure and description statistics for dimension

Dimension	Number of items per dimension	Mean	Std. Dev.	Order	Cronbach's α
Technology readiness	16	3.413	0.571	3	0.936
Information system quality	12	3.464	0.435	2	0.891
Project management effectiveness	15	3.511	0.483	1	0.943

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Reliability and Validity Tests

Reliability and validity tests were conducted for each of the constructs with multivariate measures. Cronbach α reliability estimates were used to measure the internal consistency of these multivariate scales [74]. In this study, the Cronbach α of each constructs was greater than 0.8, which indicates a strong reliability for our survey instrument [22]. In addition, measures with item-to-total correlations larger than 0.6 are considered to have high criterion validity [42]. Since the item-to-total correlations of each measures were at least 0.622 (see Table 3), the criterion validity of each scale in this study is considered to be satisfactory. Meanwhile, to ensure that the instrument has reasonable construct validity, both exploratory and confirmatory factor analyses were used. The result of exploratory factor analysis is presented in Table 3.

The confirmative factor analysis which consists of the convergent and discriminant validity was analyzed following Campbell and Fiske's [13] criteria. The results show that the correlations are all greater than zero and large enough to proceed with discriminant validity. Furthermore, discriminant validity was examined by counting the number of times an item correlates higher with items from other factors than with items from its own factor [2]. Campbell and Fiske suggest that this number should be less than 50 percent. Results also show adequate discriminant validity. Jointly, the constructs in this study exhibit both convergent and discriminant validity.

Analysis of the Structural Equation Model

The structural equation modeling approach was applied to test the proposed model and hypotheses. The structural equation modeling approach is a multivariate statistical technique for testing structural theory [101]. This approach incorporates both observed and latent variables. The analysis for this study was conducted using LISREL 8.52 and utilizing the maximum likelihood method. In the proposed model (Figure 1), technology readiness quality is considered an exogenous variable, and project management effectiveness is considered an endogenous variable. Information system quality serves as both an endogenous variable (to technology readiness) and exogenous variable (to effectiveness project management). The individual questionnaire items were aggregated into specific factor groups. The following four rules were utilized for the hypotheses' structure: (1) each observed variable has a nonzero loading on the latent factor within the structure, but have a loading of zero towards other latent factors, (2) no relationship among measurement errors for observed variables, (3) no relationship among the residuals of latent factors, and (4) no relationship among residuals and measurement errors. The reliability results are illustrated in Table 4.

Additionally, the analytical results of the LISREL model reveal a satisfactory fit for our sample data. The final result of LISREL analysis is shown in Figure 2.

The final SEM model analysis is shown in Figure 2. The absolute fit measures (GFI = .99, AGFI = .98, and RMSEA = .044) indicate that the structural model either meets or exceeds recommended levels, and thus represents a satisfactory fit for the sample data collected. The Chi-square statistic divided by the degrees of freedom also indicates a reasonable fit at 1.95. It can be concluded that the proposed model maintains good construct validity (see Table 5 for the statistics of the fit test of the model).

TABLE 3. Factor analysis and internal consistency values for the questionnaire

Dimension	Factor	% of Variance	Cumulative %	Item-to-Total Correlations	Cronbach's α
Technology readiness	Optimism	50.393	75.547	0.758	0.906
	Innovativeness	9.565		0.718	0.904
	Comfort level	8.239		0.838	0.943
	Sense of security	7.349		0.695	0.866
Information system quality	Information quality	45.729	69.222	0.622	0.855
	System quality	13.076		0.634	0.854
	Services quality	10.417		0.629	0.836
Project management effectiveness	Finance	55.697	80.746	0.795	0.929
	Process	9.446		0.820	0.926
	Customer	8.647		0.736	0.900
	Development	6.956		0.727	0.876

TABLE 4. Observed indicator reliability of factors

Dimensions	Factors	Observed indicator reliability (R2)
Technology readiness	Optimism	0.60
	Innovativeness	0.67
	Comfort level	0.53
	Sense of security	0.60
Information system quality	Information quality	0.43
	System quality	0.61
	Services quality	0.60
Project management effectiveness	Finances	0.59
	Process	0.66
	Customer	0.72
	Development	0.53

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Based on Figure 2, two out of the three hypothesized relationships (H1 and H3) show statistical significance.

DISCUSSION

The following discussion is based upon the results of the LISREL analysis (see Figure 2). It is first noted that technology readiness has a significant and positive influence on how the user's perceive the quality of the information system which supports their work functions (H1 is supported). Secondly, the user's technology readiness is positively yet statistically insignificant impact on the effectiveness of project management (H2 is rejected). Moreover, information system quality is found to have a significant and positive impact on project management effectiveness (H3 is supportive). Finally, the results also show that the indirect effect of technology readiness on project management effectiveness (through information system quality, H1 and H3) is greater than the direct effect of technology readiness on project management effectiveness (H2).

The results of this study support the findings of prior studies concerning the influence of the user's technology readiness on their perception of information system quality [54,57,62,107]. In particular, Kwong and Park [47] propose a new model to investigate college students' online purchasing behaviors. In their new model, they incorporate the technology acceptance model and the perceived service quality and suggest the inter-dependent nature of both the user's perception toward information technology and the service quality of information technology. In addition, from a technology acceptance perspective [25], ease of use (i.e., system quality) is one of the most important factors influencing the user's enthusiasm toward information system. A number of studies have deliberated and established the correlation between user acceptance of technology and the system functionality [72,73,88,100], information quality provided by the system [108] and service quality [14,103]. These are in line with our findings.

Furthermore, the study concludes that technology readiness has a positive, yet insignificant, effect on project management effectiveness. Support for this conclusion can be found in existing studies, such as Choi, Kim, Goo, and Whitmore [20],

TABLE 5. Fit test of the model

Measures	Indicators
Absolute Fit Measures	Chi-Square with 41 Degrees of Freedom = 79.81 (P = 0.00) Goodness of Fit Index (GFI) = 0.99 Root Mean Square Error of Approximation (RMSEA) = 0.044 P-Value for Test of Close Fit (RMSEA < 0.05) = 0.75 Expected Cross-Validation Index (ECVI) = 0.26 90 Percent Confidence Interval for ECVI = (0.22 ; 0.32) ECVI for Saturated Model = 0.27 ECVI for Independence Model = 3.95 Adjusted Goodness of Fit Index (AGFI) = 0.98
Incremental Fit Measures	Normed Fit Index (NFI) = 0.96 Non-Normed Fit Index (NNFI) = 0.97 Comparative Fit Index (CFI) = 0.98 Incremental Fit Index (IFI) = 0.98 Relative Fit Index (RFI) = 0.94
Parsimonious Fit Measures	Parsimony Normed Fit Index (PNFI) = 0.71 Parsimony Goodness of Fit Index (PGFI) = 0.61 Critical N (CN) = 404.68 Normed chi-square 79.81/41 = 1.95

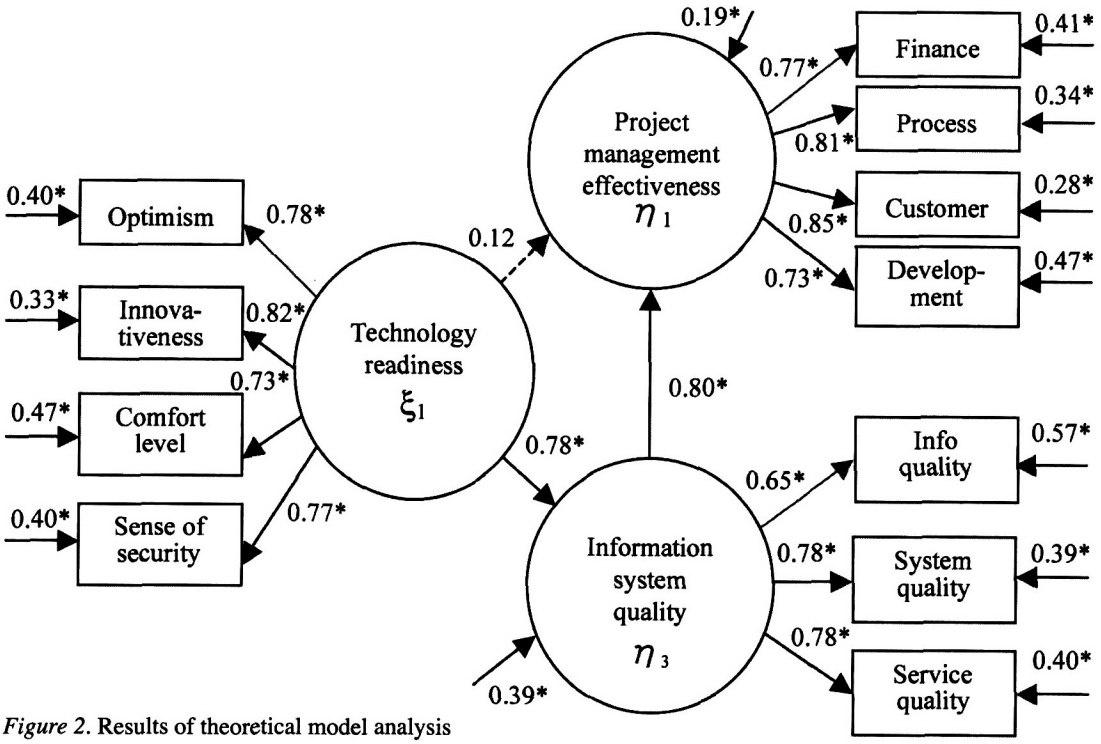

Figure 2. Results of theoretical model analysis

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Curtis and Payne [23], Lee and Park [51], Lin and Hsieh [57], and Hernandez, Jimenez, and Martin [34]. In particular, Lee and Jun [50] validate the mobile commerce consumers' repurchase intention model. They learn that the consumer's technology acceptance has an effect on their repurchasing intentions and their online satisfaction. In other words, in an e-commerce environment, the user's technology readiness plays an important role on company-customer relationship. From a business process point, when an information technology introduced in the work environment to support work tasks, the company must understand the factors affecting adoptions. In their study, Venkatesh and Bala [106] identify that technology readiness is one of the internal factors that influence the effective adoption and application of information technology. Furthermore, from a personal growth perspective, Park and Wentling [79] find out that the learner's computer attitudes influence the perception of the usability of e-learning courses, which consequently impact the learner's skill development and learning transfer. A number of researches present a positive correlation between computer attitudes and learning outcomes [55,91,93], which are supportive of our findings.

In concluding, from the perspective of information system quality, the study concludes that it has a significant and positive effect on project management effectiveness. Furthermore, it strengthens the effect of technology readiness on project effectiveness. From the literature, we realized that the existing literature demonstrates the profound influences of information system quality on project performance [6,15,37,75,96]. From a personal development perspective, in a study assessing the effectiveness of web-based lessons by teacher perceptions and outcome data of participating learners, Stewart [97] found that the design, content and usability of web instruction significantly influence learners' posttest scores. That is, well-designed information system applications can promote the full potential of emerging technologies to facilitate the achievement of the users [16,40,60,92]. As Proske, Narciss, and Körndle [83] point out, system functionality, such as interactivity, is positively related to learning achievement. Thus, existing literature in line for H3 concludes with the argument that quality information system plays a pivotal role in enhancing project effectiveness.

CONCLUSION

This study has focused on the discussion and analysis of using a web-based support system within interior design companies. Specifically, the study is designed to determine the effect of the users' technology readiness on their perception of the quality of the web-based support system. In other words, the effect of the web-based support system on interior project management effectiveness is also examined. An empirical investigation using structural equation modeling shows that the users' technology readiness is a positive driver in accommodating effective management of projects within interior design companies.

However, it must be highlighted that the users' technology readiness does not directly result in effective project management. Rather, the factor serves as a catalyst to facilitate and stimulate their perception of the web system. Increased perceptions of the quality of the web support system, in turn, serve as the means for better project management within these interior design companies. The user's technology readiness in a technology-supported environment can thus be seen as an antecedent factor of successful adoption of technology innovation [45,57,59]. However, quality information systems [9,52,82] form the middle ring which links personal factors with more effective and efficient outcomes of job tasks. Current literature, such as Lee, Kim, Paulson, and Park [49] also argue that there is a positive correlation among social alignment, technical alignment, IS effectiveness, and business performance. They conclude from empirical results that the alignment between business and information system groups increased information system effectiveness and business performance. In addition, business-technology alignment resulting from socio-technical arrangements in firms' infrastructure has positive impacts on business performance.

Under instances of depreciation of interior design market, interior design companies have to try to gain its advantages by providing just-in-time, cost-effective, fashionable products and services to meet the needs of customers through the support of information technology [90]. Therefore, from a managerial point of view, this study concludes and suggests that interior design companies can improve project effectiveness by investing appropriately in information technology infrastructures which supply individuals with quality information (e.g. for inventory control, classified interior design parts or customer information), functionality (e.g. international or local communications), as well as services (e.g. the availability of online help or product resource centers) [33,44], and at the same time strategically plan appropriate intrinsic (e.g. the promotion of self-management) as well as extrinsic motivators (e.g. rewards or recognitions) and to actively facilitate the users in accepting and adopting new technological job support tool [64,98].

While the empirical collected data have largely supported the proposed model, it is necessary to point out the limitations of this research. Even though the responding individuals consisted of well-informed and active members of the interior design companies, the existence of possible biases cannot be discounted. Furthermore, it is evident that technology-supported interior design approaches can differ among companies in different countries, continents, or even those in the same industry working on dissimilar interior design tools, such as AutoCAD, 3DSMAX, Sketch up combining with Visual Basic and Access or similar database technologies [21,46]. Therefore, the current data collected from the particular interior design companies in Taiwan may not be fully representative of other scenarios.

However, while direct replications of the result of the present study may be limited, it is valuable for potential adaptations at companies in similar context, especially in today's business environment, which emphasizes the same values (e.g. the selections of different products or product features, lower cost, etc.) and the same business concepts (e.g. standardized product development process, the importance of customer satisfaction, etc). Most businesses nowadays are also encountered the same types of challenges (e.g. faster production lines, shorter product life cycles, etc.) and problems (e.g. global economic recession). Therefore, the proposed model in this study may well be a viable template that can be adapted elsewhere.

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