American Journal of Business and Management
Vol. 1, No. 3, 2012, 140-153

The Relationships between Balanced Scorecard, Intellectual Capital, Organizational Commitment and Organizational Performance: Verifying a 'Mediated Moderation' Model

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This study aims to verify the relationships between the Balanced Scorecard (BSC) implementation, accumulation of intellectual capital, organizational commitment, and organizational performance implemented in Taiwan-listed LED manufacturers by the research model of Mediated Moderation, which verifies the moderating effect before the mediating effect. This study surveyed entry-level employees and those working in section-chief or higher-level positions at Taiwan-listed LED manufacturers' production, marketing, human recourse, research and development (R&D) and finance departments. Samples were selected from the population by simple random sampling. Structural Equation Modeling (SEM) was adopted to verify the goodness-of-fit effects of the overall model, structural model, and measurement model, with the models' path effects (of the mediator-moderator variable) tested by way of the General Path Analytic Approach (GPAA) and Control Non-Linear Regression (CNLR). The results indicated that the BSC implementation, intellectual-capital accumulation and organizational commitment exert a significant interaction effect on Taiwan-listed LED manufacturers' organizational performance. Hence, organizational commitment has the moderating effect (only among first-order constructs); intellectual-capital accumulation has no more than a mediating effect and remains un-moderated (among second-order constructs). However, the indirect effect of intellectual capital proved moderated, with the direct effect un-moderated and the total effect moderated.

Keywords: balanced scorecard, intellectual capital, organizational commitment, organizational performance

Introduction

In an age of Knowledge-based Economy (KBE), only through innovative, scientific technologies and new, high-level knowledge will the nature and real strength of KBE be demonstrated, and sustainable economic development facilitated (Yu, 2008).

Strategic integration is gaining in importance from the viewpoint of management accounting; it is shifting from the usually one-dimensional principle of performance evaluation toward a multi-dimensional one that is linked to the key success factors for all levels of the organization (Kaplan, 1984; Johnson, 1990; Hall, 1990). The BSC system comprises indicators in three non-financial perspectives (i.e., the "customer", "internal-business-process", and "innovation and learning" perspectives) besides those in the conventional, or financial, perspective. The four perspectives put an organization's vision and strategies together, and constitute a new system that measures performance on the basis of objectives and measures. All of the four perspectives are principal driving forces for future competitiveness. According to Chow and Haddad (1997) BSC is valuable mostly because it integrates a business organization's strategies, framework and vision, while transforming its long-term strategies and objectives (e.g., creating customer value) into tangible actions either internally or externally (Liu, 2002).

BSC, a measure of the driving forces behind a company's future performance, not only remedies inadequate measures for the past financial performance, but also is a strategic management tool integrated with corporate strategies and vision. Meanwhile, Intellectual Capital (IC) ensures a company's high Enterprise Value (EV) and an edge over rivals, and eventually the core competitiveness essential to survival (Chiang, 2006).

Intellectual capital has emerged as a company's key factor for future success and long-term profitability in the age of KBE, when tangible corporate assets are being replaced by intangible ones. For information reliability reasons, the conventional approach to financial accounting requires that Enterprise Value (EV) be measured on the basis of

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ISSN 2167-9606 Print/ ISSN 2167-9614 Online

transaction costs already incurred and that transaction details be objectively, faithfully represented, which however leaves many important intangible assets overlooked (Chen, 2005). The primary motive of this study is to address the growing percentage of EV not shown in the balance sheet (e.g., patents, customer base, and brand values) and intellectual capital's increasing importance as a crucial determinant of corporate success and long-term profitability, as mentioned earlier. The second motive, nevertheless, is the fact that the information and electronics sector has long been an integral part of Taiwan's industrial development. Among others, the output of Taiwan-listed LED manufacturers has contributed heavily to the initiation and expansion of national economy for nearly two decades, despite the recently intensified competitions in the broader global market. Therefore, the business operation must be more dedicated seriously and positively to create new values and explore potential growing opportunities; additionally, it is necessary to think about how the employees' loyalty toward the company will be stabilized through corporate transformation/upgrade initiatives. Thus, employees would like to make a commitment to the organization for increasing the organizational transformation and eventually form the accumulation of intellectual capital (Chen, 2001; Lee, 2008).

If the businesses are trying to dominate the advantages in the rapidly changing environment, they must implement the BSC as well as enhance the accumulation of intellectual capital through organizational commitment. Hence, it will guarantee the business sustainable operation and development. The business simultaneously implements the BSC and organizational commitment, which both can make interactive synergy effect on the accumulation of corporate intellectual capital or not, exactly bringing about the primary motive of this study. Therefore, this present study examines Taiwan-listed LED manufacturers and verifies the relationships between their BSC, intellectual capital, organizational commitment and organizational performance. Based on a literature review, this study's author built a mediated moderation model and tested its goodness-of-fit effect.

The specific objectives of the present study are: 1). To verify and understand whether the BSC implementation and employee organizational commitment both have a significantly interactive effect on the intellectual-capital accumulation of Taiwan-listed LED manufacturers. 2). To verify and understand whether intellectual-capital accumulation employee organizational commitment both have a significantly interactive effect on the organizational performance of Taiwan-listed LED manufacturers. 3).To verify and understand whether the BSC implementation and employee organizational commitment both have a significantly interactive effect on the organizational performance of Taiwan-listed LED manufacturers.

Literature Review

Balanced scorecard

Kaplan and Norton (1996) proposed the four perspectives of BSC: (1) financial perspective; (2) customer perspective; (3) internal-business-process perspective; and (4) learning-and-growth perspective. According to Chow and Haddad (1997) BSC is valuable mostly because it integrates a business organization's strategies, framework and vision to create corporate performance indices that mix the old with the new, while transforming long-term strategies and objectives (e.g., creating customer value) into tangible actions either internally or externally. Because the BSC system is centered on strategies, rather than control, some insightful managers used it to clarify, communicate and manage strategies. Apparently, BSC has been transformed from an improved measurement system into a core management system (Kuo, 2002).

Wu (1999) contended that the BSC system involves all functions of an organization, citing the relevance of financial perspective to corporate finance and accounting; the relevance of customer perspective to marketing; the internal-business-process perspective, value chain as a whole; the learning-and-growth perspective for employees, human resources.

From a BSC point of view, Lu (2000) explored how capital structure was relevant to the operating performance of IT & electronics firms publicly trade on the Taiwan Stock Exchange over the years between 1958 and 1999. Lu adopted the Cash Flow Adequacy Ratio, sales growth, operating profit margin and Return on Equity (ROE) as indicators for the financial perspective of BSC system; market share and product return rate for the customer perspective; research and development (R&D) benefit, average cash-turnover period, and percentage of maintenance costs for the internal-business-process perspective; revenue per employee and wage per unit for the learning-and-growth perspective.

In a case study of how the organizational learning model was connected to the performance of Taiwanese electronics technology companies' product development departments, Yeh (2001) valued the performance using three non-financial BSC perspectives (i.e., the customer, internal-business-process and learning-and-growth perspectives).

Apparently, companies in all industries consider both financial and non-financial perspectives when implementing the BSC. In the present study, BSC is conceptually defined as a performance measurement indicator that comprises four perspectives: (1) financial perspective; (2) customer perspective; (3) internal-business-process perspective; (4) learning-and-growth perspective. This study's author adopted the four BSC perspectives proposed by Kaplan and Norton (1996) to measure how BSC implementation affects the financial performance of Taiwan-based electronics SMEs.

Intellectual capital

In 1997 Stewart published Intellectual Capital: the New Wealth of Organizations, a book loaded with case studies in a bid to explain the three elements of Intellectual Capital: human, structural and customer capitals. Stewart (1997) argued that intellectual capital includes these three types of capital and defined human capital as the sum of innovations, employees' mindsets, seniority, turnover rate, experiences, and learning ability; structural capital as the existing knowledge efficiently collected, tested, organized and integrated, with irrelevant components sifted out for further diffusion; customer capital as the way a specific organization deals with all relevant parties, which involves the customers' satisfaction, retention rate and loyalty.

In their book "Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower" Edvinsson and Malone (1997) explained the intellectual-capital implementation process and measurement indicators at Scandia Inc. They agreed that intellectual capital comprises human, structural and customer capitals, with human capital being the sum of personal competencies, knowledge, skills and experiences of a company's entire staff, including the management, as well as the organization's capabilities in creativity and innovation. Structural capital is a framework, or organized capacity, that gives human capital a tangible, authoritative and supportive form, including the palpable system for communicating and storing intellectual materials. The customer capital, they said, involves customer satisfaction, durability, price sensitivity, and the long-term customers' financial conditions.

Sveiby (1998) noted intellectual capital comprises individual competencies besides a company's internal and external structures, with individual competencies being an employee's ability to take actions under various situations (e.g., explicit knowledge, skills, experiences, value judgments and social networks); the internal structure involves patents, concepts, patterns/models, computer and management systems; the external structure involves the brand, goodwill, trademark, and any other component of company-customer or company-supplier relationships.

Johnson (1999) argued that intellectual capital consists of human, structural and relationship capitals. He defined human capital as the idea capital (i.e., the manpower for knowledge-based tasks and employee aptitudes/attitudes) and leadership capital (i.e., the qualities of an expert/manager); structural capital as the innovation capital (i.e., patents, trademarks, copyright and knowledge archives) and process capital (i.e., work processes and trade secrets); relationship capital as a corporate organization's relationships with customers, suppliers and online-community members.

As Knight (1999) contended, intellectual capital comprises human, structural and external capitals besides financial performance, where human capital is the sum of employee turnover rate, employee satisfaction, the number of new products/ideas conceived and recommended for delivery/reception; structural capital involves the operating-capital turnover rate, the ratio of salespersons to general/administrative staff, and the length of time it takes to launch a new product; external capital is the persistency and satisfaction of customers, the list of customers that bring the greatest profits, indicators of suppliers' product quality and reliability; financial performance involves the Economic Value Added (EVA), the 90-day accounts receivable, and value added per employee.

Dzinkowski (2000) pointed out the complicated implications of intellectual capital often makes it a synonym of intellectual properties, intellectual assets, or knowledge assets. Intellectual capital may be either accumulated in the form of capital, or equated with the knowledge-based corporate processes.

Chen (2001) said the intangible intellectual capital is an important reference indicator of EV that comprises human, structural and relationship capitals. She defined intellectual capital as something that covers all the skills, knowledge, information, experiences, problem-solving capabilities and wisdom of a company, as incorporated into the human, structural and relationship capitals. According to Chen (2001), human capital, is the knowledge, skills and experiences of a company's entire staff and management; the structural capital is a company's overall system/procedures for problem-solving and value creation; the relationship capital is the establishment, maintenance and development of an organization's external relationships with customers, suppliers and business partners.

In a simple description, Edvinsson (2003) noted intellectual capital is something any company will rely on in the future and also an indicator of efficient business operations. No company will be able to gain

momentum for reforms without investing in intangible assets (Tsen & Hu, 2010).

In summary, this study's author adopted the conceptual definition of intellectual capital proposed by Chen (2001): "the sum of a company's skills, knowledge, information, experiences, problem-solving capabilities and wisdom, as incorporated into the human, structural and relationship capitals". The operational definition of intellectual capital is briefly stated as follows: (i). Human capital: the knowledge, skills and work experiences of a company's entire staff and management; (ii). Structural capital: a company's overall system/procedures for problem-solving and value creation; (iii). Relationship capital: the establishment, maintenance and development of an organization's external relationships with customers, suppliers and business partners.

Organizational commitment

The concept of Organizational Commitment is derived from Whyte's book [The Organization Man] (1965), in which he describes "The organization man is not only working for the organization, but also belongs to it." (Tsai, 2001), and organizational commitment is one of factors to understand employees' working behavior inside the organization.

Organizational commitment can be considered as the relative intensity of personal recognition and dedication to goals and missions in the organization (Porter et al. 1974). It will concentrate the centripetal force between employees and organization as well as create a sort of proudly organizational loyalty (Jaworski & Kohli, 1993). In addition, Mowday, Porter and Steers (1982) thought excellent individuals can connect to the organization by the organizational commitment that excellent interaction and effect will occur between both sides.

Meyer & Allen (1990) deemed organizational commitment is a pure loyalty, and a sort of emotional attachment, toward the organization. And, a relevant cost has been also considered by the organizational commitment while quitting the organization, which is an obligation of retention in the organization. As for the definition of organizational commitment, scholars have made various definitions based on different theories and research approaches.

Mowday et al. (1982) stressed on the research questionnaire of public enterprises to name these three inclinations three constructs of Value Commitment, Retention Commitment and Effort Commitment.

Porter et al. (1974) deemed the organizational commitment is the degree of individual recognition and dedication to specific organization with the focus of research results from employees in psychologist training center, which shows three inclinations of members toward the organization: (1) strong belief and acceptance of organizational goals and values; (2) longing for being part of the organization continuously, and (3) willingness to work for organizational interests.

Meyer & Allen (1991a) deemed the basis of definition for organizational commitment can be explained in three aspects: (1) Affective attachment generated by sentimental and psychological factors; (2) Affective attachment generated by perceived cost, and (3) Affective attachment generated by obligations and ethic factors. Besides, Mayer & Allen (1991b) had separately named these three phenomena as: (1) Affective Commitment, (2) Continuance Commitment and (3) Normative Commitment.

Robbins (2001) considered the organizational commitment one of working attitude, which is the degree of employee recognition to specific organization and its goals, as well as the degree of maintaining the relationship with organizational members.

It had been demonstrated by Wu (1993) that the degree of commitment shows personal recognition and loyalty toward the organization. Higher commitment indicates intension to be more eagerly a part of the organization, closely related to others.

It was viewed by Hsieh (1999) that organizational commitment expresses the degree of subjective feelings or emotional response from individual member in the organization while facing different constructs.

It had been suggested by Chen and Yu (2000) that organizational commitment is organizational members feeling proud of being part of the organization, behaving in loyalty to the organization and being willing to work hard for organizational goals in attitude and action.

In summary, definitions of organizational commitment vary owing to different research approaches, objects and purposes, and perspectives of these scholars above all manifest recognition and dedication as quite important concepts for organizational commitment. Many studies made by domestic scholars have mainly used retention commitment, value commitment and effort commitment (Mowdady et al., 1982) as major constructs (Ding, 2000), which have been proven to possess considerably high validity. Hence, this study also adopts the definition by Mowdady et al. (1982) to decide the conceptual definition of organizational commitment as "degree of members' recognition of organizational goals and values that they are willing to work extraordinarily hard to help the organization complete its goals" (Hsieh, 2006).

This study adopted the definition by Mowdady et al. (1982) to classify and define: (1) retention

commitment; (2) value commitment and (3) effort commitment to be major constructs with each operational definition: (1) value commitment: it means organizational members' faith to deeply believe and accept organizational goals and values, (2) effort commitment: it means organizational members' willingness to pursue benefits and make effort for the organization, and (3) retention commitment: it means organizational members' strong eagerness to maintain their organizational identity.

Organizational performance

There is a massive amount of previous studies on the measurement dimensions of organizational performance. Since the benefits of organizational performance will eventually be fed back to the financial dimension, most scholars adopt financial performance as one of the measurement indicators. In an environment characterized by convenient means of information delivery and fast-changing markets, nevertheless, a company nowadays shall never solely rely on financial performance for survival and competitiveness. That is to say, it is impossible to sufficiently gauge organizational performance using financial performance as the sole indicator (Ling & Hung, 2010). Moreover, Ling and Hung (2010) argued that organizational performance is the sum of accomplishments attained by all businesses/departments involved with an organizational goal within a given period of time, with the goal either meant for a specific stage or on the overall extent.

In order to measure both the financial and non-financial aspects of organizational performance, and to correctly gauge how job satisfaction and internal-service quality affect the organizational performance, Ling and Hung (2010) defined financial performance as output, in the financial accounting sense, measured by indices concerning corporate growth and profitability. For example, a company with satisfying financial performance is expected to exceed the sector average in either Earnings per Share (EPS) or Return on Sales (ROS). The non-financial aspect of organizational performance, on the other hand, is measured by means of innovation performance, which in turn is gauged from multiple perspectives of organizational innovation (e.g., technological and managerial innovations). While the technological innovation refers to technologies required by an organization for manufacturing products or providing services, a managerial innovation occurs within the organization's social system and is related to the hiring/management processes and organizational structure (Daft, 2006; Ling & Hung, 2010).

In the present study, organizational performance is measured in the two perspectives proposed by Ling and Hung (2010): financial performance and innovation performance (Chao, 2012).

Relationships between the BSC implementation, organizational commitment and intellectual capital accumulation

As for the relation between BSC and intellectual capital, Wu (2002) contended that BSC with its distinctive framework leads to both the formation and reinforced management of intellectual capital. Wu (2002) believed that the strategic topics and strategic objectives under BSC's learning-and-growth perspective are precursors of the innovation capital and human capital in intellectual capital; the strategic topics and strategic objectives under BSC's internal-business-process perspective, the process capital; the strategic topics and strategic objectives under BSC's customer perspective, the customer capital (or "relationship capital" in the present study).

Citing IC's contributions to a company's KM-related communications and the fact that BSC helps monitor the progress/results of projects, Bukh, Johansen and Mouristen (2002) suggested that IC and BSC be integrated for complimentary effects.

In "The relationship between balanced scoreboard and intellectual capital---A case study of Taiwan IC industry" Tseng (2006) said Taiwanese IC firms' common strategy of improving performance in the customer, internal-business-process, and learning-and-growth perspectives at the cost of short-term financial performance contributed to intellectual capital accumulation and consequently the long-term competitiveness.

Sun (2008) pointed out in "The research between organizational intellectual capital and organizational commitment-An empirical study of culture creative industries in Taiwan": (1) The human capital has a partially significant effect on employee organizational commitment; (2) The organizational capital has a negative and partially significant effect on employee organizational commitment; and (3) The social capital has no significant effect on employee organizational commitment. Therefore, it has a significant, partially significant and non-significant effect on organizational intellectual capital

Xu and Fong (2004) gave empirical findings in the "study on the relationships between internal marketing and intellectual capital －take organizational commitment and personality as moderator variables", citing the internal marketing mechanism has a significant effect on intellectual capital and organizational commitment; at the same time, has a significant moderating effect on employee organizational commitment.

Based on the evidence above, in spite of partial literature exploring a limited range of some constructs of this study topic, and even not covering the industry of Taiwan-listed LED manufacturers, partial conclusions mentioned above still can be the reference for this study's hypothesis. Herewith the following hypothesis will be boldly inferred from this study:

H1: The BSC implementation and employee organizational commitment both have a significantly interactive effect on the intellectual-capital accumulation of Taiwan-listed LED manufacturers.

Relationships between intellectual capital accumulation, organizational commitment and organizational performance

It was discovered by Benkhoff (1997) during the exploration of the relationship between organizational commitment and operating performance: organizational commitment has a significant influence on financial performance of bank's branch offices in spite of different results dependent on the measurement of organizational commitment and organizational performance. Tansuhaj, Randall and McCullough (1991) deemed internal marketing of the organization can encourage the positive attitude of employees toward organizational commitment, job involvement, work motivation and job satisfaction. Rashid, Sambasivan and Johari (2003) believed type of corporate culture and organizational commitment will influence financial performance (for example: return on assets, return on investment and the current ratio). Ferris and Aranya (1983) further deemed organizational commitment can be an effective index to measure organizational performance (Chao, 2012).

Chen (2001) noted the significantly positive effect of intellectual capital on the organizational performance.

According to Tsen et al. (2010), intellectual capital is made of human, structural and social capitals. Therefore it is imperative that an organization develop a human capital hardly imitable by competitors, transform the accumulated wisdom/capacity into its core capabilities, utilize the functions of structural capital to establish distinctiveness, and forge irreplaceable external relationships to strengthen its social capital. Tsen also noted that the synergy resulted from interactions among human, structural and social capitals is crucial to building an organization's competitiveness.

Based on the evidence above, in spite of the literature exploring a limited range of some constructs of this study topic, even not covering the industry of Taiwan-listed tourist hotels; however, partial conclusions mentioned above can still be the reference for this study's hypothesis. Herewith the following hypothesis will be boldly inferred from this study:

H2: Intellectual-capital accumulation and organizational commitment both have a significantly interactive effect on the organizational performance of Taiwan-listed LED manufacturers.

Relationships between the BSC implementation, organizational commitment and organizational performance

In a regression analysis of IC and non-financial BSC perspectives, Yu (2003) concluded that a good-fitting model is achievable by building the components of IC with non-financial BSC indicators, and that non-financial indicators have explanatory power regarding the financial ones. In other words, the increased value of non-financial indicators contributes to a company's financial performance. In his thesis entitled "exploring the effect of balanced scorecard on corporate performance: A before-and-after study of BSC implementation at Taiwan-based bank A" Tsao (2006) mentioned noticeable gaps among the vision, missions and strategic objectives of a BSC-implementing bank he studied and the objectives of individual bank workers. He went on to suggest that companies should better integrate the vision, missions and strategic objectives for better performance.

Cho (2011) in a study entitled "research on evaluating the performance improvement of organizational change for IC design house by the dimensions of balanced score card-A case study of F company" concluded that IC design houses are affected by technologies and tasks when it comes to organizational changes, and affected by the learning-and-growth and internal-business-process perspectives with regard to performance enhancement.

Based on from evidence mentioned above, in spite of the literature exploring a limited range of some constructs of this study topic, the partial conclusions mentioned above can still form a reference for this study's hypothesis. Herewith the following hypothesis will be boldly inferred from this study:

H3: The BSC implementation and organizational commitment both have a significantly interactive effect on the organizational performance of Taiwan-listed LED manufacturers.

Research Method

Research hypotheses and a conceptual research framework were derived from the above-mentioned research motives, objectives and literature review, as shown in Figure 1

Research framework

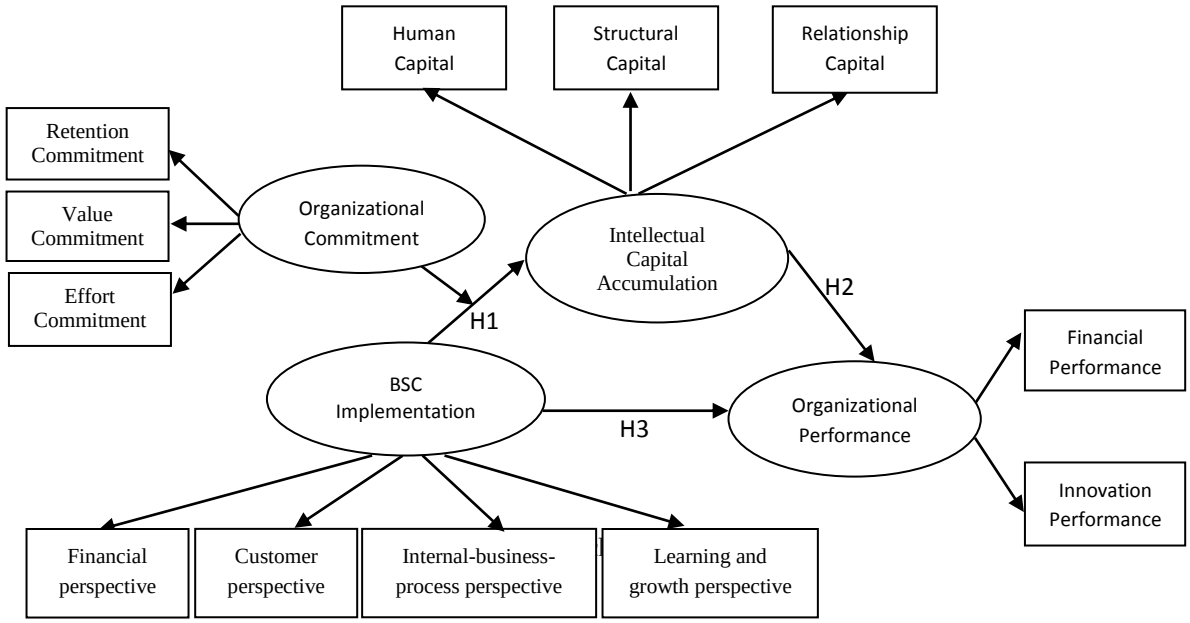

Figure 1. Research framework.

Designing the questionnaire and CMV test

Designing the questionnaire

Based on the afore-mentioned observable perspectives, a questionnaire was designed for this study by way of Multi-Dimension Measurement (i.e., parcel items) and all answers were measured on a 7-point Likert Scale, with 7 being Strongly Agree and 1 being Strongly Disagree. A higher score represents a greater degree of agreement, and vice versa. Data pertaining to the moderator variable was collected and "centralized" so the sum of scores given to all questionnaire items is zero after deducting the average. Centralization erases multicollinearity between the independent and extraneous variables, in order to test their interactions more accurately, as shown in the mathematical equation below (Lee, Lee, Chang & Lin, 2012):

$\Sigma(Xi -) = \Sigma Ni = 0$

The 16 questionnaire items for BSC were patterned after findings put forth by Kaplan and Norton (1996) with regard to four perspectives, namely the financial, customer, internal-business-process, and learning-and-growth perspectives.

The 12 questionnaire items for intellectual capital were patterned after findings put forth by Chen (2001), Tsen and Hu (2010) with regard to the three perspectives of human, structural and relationship capitals.

Furthermore, for the measurement index of "Organizational Commitment", this study adopted three-construct scale from Mowday, Porter and Steers (1982), including "Retention Commitment", "Value Commitment" and "Effort Commitment", which had been designed to make total 12 questionnaire items.

The questionnaire items for "organizational performance" was designed to integrate research findings put forth by Delaney and Huselid (1996), Wu (1998), Ling and Hung (2010) with regard to the two measurement indices of financial and innovation performance. While a multiple-perspective measuring technique is used to gauge the innovation performance, managerial innovations occur within an organization's social system and are related to the hiring/management processes and organizational structure (Kimberly & Evanisko, 1981; Damanpour & Evan, 1984 ; Ling & Hung, 2010). In this study, there are totally 8 questionnaire items pertaining to organizational performance.

CMV test

The questionnaire in this study do not exist common method variance (CMV) problems by CFA comparison method (Lindel & Whitney, 2001) to test as shown in the Table 1.

Table 1. The results of CMV test.

Model	$\chi 2$	DF	$\Delta\chi 2$	ΔDF	P
Single Factor	1343.3	148	1123.1	11	0.001
Multi-Factor	220.2	137			

Method of sampling

Based on simple random sampling, this study's author surveyed entry-level employees and those working in section-chief or higher-level positions at Taiwan-listed LED manufacturers' production, marketing, human recourse, research and development (R&D) and finance departments. After 50 copies of expert questionnaire were given out in a pilot-test, the questionnaire was revised and corrected according to the experts' advice. This study's author then sent out 550 copies of questionnaire in a post-test, out of which 202 copies were returned valid for a 27.2% response rate.

The data obtained from questionnaire and measurement model

Linear SEM was used in a Confirmatory Factor Analysis (CFA) of this study's research framework. The questionnaire was constructed on the basis of four latent variables (i.e., BSC, intellectual capital, organizational commitment and organizational performance), each divided into observable/explicit sub-variables that contain several questionnaire items. The data collected was processed to create a primary file for the questionnaire. As for the measurement model, this study designed the questionnaire by way of Multi-Dimension Measurement but adopted the Dual Measurement method to ensure successful data processing by computer software (Chen, 2010). Table 2 shows the number of questionnaire items under each implicit and explicit variable, along with the referential sources.

Table 2. Number of questionnaire items under each 'implicit variable' and 'observable variable'.

Implicit variables	Explicit variables	Total Number of questionnaire Items	Referential sources
BSC (XC)	Financial perspective	4	Kaplan and Norton (1996)
	Customer perspective	4	
	Internal-business-process perspective	4	
	Learning-and-growth perspective	4	
Intellectual Capital (MEC)	Human capital	4	Chen (2001); Tsen and Hu (2010)
	Structural capital	4	
	Relationship capital	4	
Organizational Commitment (MO)	Selflessness	4	Hsieh, Lang & Chen (2010)
	Dedication to job	4	
	Identification with the organization	4	
	Assisting colleagues	4	
Organizational Performance (Y)	Financial performance	4	Wu (1998), Ling and Hung (2010), Delaney and Huselid (1996)

Results and Analysis

Analysis of linear structure model

This study conducted a CFA, an analytical approach contrary to the Exploratory Factor Analysis (EFA), on each pair of the four unobservable/latent variables (i.e., BSC, intellectual capital, Organizational Commitment and organizational performance). Made up of structural and measurement models, SEM effectively addresses the cause-effect relations between implicit/latent variables. Models in this study were verified in three regards: (1) goodness-of-fit of the measurement model; (2) goodness-of-fit of the structural model; (3) whether the overall model conforms to the goodness-of-fit indices. In other words, goodness-of-fit indictors were used to determine the overall goodness-of-fit effect of SEM (Diamantopoulos & Siguaw, 2000). In addition, the General Path Analytic Approach (GPAA) and Control

Non-Linear Regression (CNLR) were both used in the analytical testing of the models' path effect (i.e., the mediator-moderator variable).

Analyzing fit of measurement model

The factor loading measures the intensity of linear correlation between latent/implicit and manifest/explicit variables. The closer the factor loading is to 1, the more capable an observable variable is in measuring the latent variables. The present study proves reliable with factor loadings ranging from 0.7 and 0.9 for all observable variables. That is, all observable/explicit variables in the proposed measurement model properly measured the latent/implicit variables. Meanwhile, the Average Variance Extracted (AVE) measures unobservable/implicit variables' explanatory power of variance regarding observable ones; a higher AVE suggests greater reliability and convergent validity of an implicit/latent variable. It usually takes an above-0.5 AVE to prove an observable variable's explainable variance exceeds the measurement error (Fornell & Larcker, 1981). As AVEs in this study invariably exceed 0.5, the explicit variables have excellent reliability and convergent validity.

It is imperative that the mediated-moderation model developed for this study be verified first with regard to the moderator (i.e., the effect of internal service quality on employee job satisfaction) using organizational culture as a moderator (see Table 3 and Figure 2).

Table 3. Judgment indicators of intra mode measurement system.

Unobservable/ latent variables	Observable variables: Centralized dual measurement	Factor loading	Average variance extracted (AVE)
BSC (XC)	XC1	0.81	0.66
	XC2	0.84	0.64
Organizational Commitment (MO)	MOC1	0.78	0.65
	MOC2	0.77	0.63
XCMO	XC*MOC	0.86	0.64
Intellectual Capital (MEC)	MEC1	0.84	0.66
	MEC2	0.83	0.67
Organizational Performance (Y)	YC1	0.84	0.66
	YC2	0.83	0.65

Analyzing good-fitness of structural model

Path analysis results of structural model

After the overall model passed the goodness-of-fit test, this study's author conducted a path analysis of the structural model with regard to the moderator's first order indirect effect. The parameter estimates, Standard Error (S.E.) and Critical Ratio (C.R.) among latent variables are shown in Table 4 Additionally, according to the Table 4, 5 and 6, it appeared: the Balanced Scorecard (XC) and Organizational Commitment (MO) made a significantly interactive effect on Intellectual Capital (MEC) (Estimate=0.621). Furthermore, the path analyses of the moderator's second order indirect effect in the structural model and direct effect in the structural model were carried out using the same method and steps as that of the moderator's first order indirect effect in the structural model. To sum up, Organizational Commitment has a moderating effect (only among first order constructs, hence the substantiated H1), and intellectual capital accumulation has no more than a mediating effect and remains un-moderated (i.e., an un-moderated second order effect, hence the non-substantiated H2), and remains un-moderated indirect effect. Additionally, the direct effect is un-moderated (hence the non-substantiated H3), but the moderated total effect is shown as in Figure 2, Tables 10 and 11.

Results of the path analysis and testing of indirect effects (among first- or second-order constructs), direct effect and total effect in the structural model are shown in Section 11.

T able 4. Path analysis results of structure model (un-standardized).

Path Coefficients between Implicit Variables			Estimate	S.E.	C.R.	P	Label
Balanced Scorecard (XC)	→	Intellectual Capital (MEC)	.972	.084	11.571	***	a
Organizational Commitment (MO)	→	Intellectual Capital (MEC)	.933	.062	15.048	***	b
XCMO	→	Intellectual Capital (MEC)	.999	.075	13.320	***	c

Note: * indicates P<0.05; ** indicates P<0.01; *** indicates P<0.001

Table 5. Standard regression weights: (Group number 1–Default model).

Path coefficients between implicit variables			Estimate
Balanced Scorecard (XC)	→	Intellectual Capital (MEC)	.542
Organizational Commitment (MO)	→	Intellectual Capital (MEC)	.632
XCMO	→	Intellectual Capital (MEC)	.231

Note: * indicates P<0.05; ** indicates P<0.01; *** indicates P<0.001

Table 6. Standard regression weights: (Group number 1–Default model).

Path coefficients between implicit variables			Estimate
Balanced Scorecard (X)	→	Intellectual Capital (ME)	.542
Intellectual Capital (ME)	→	Organizational Performance (Y)	.632
Balanced Scorecard (X)	→	Organizational Performance (Y)	.231

Note: * indicates P<0.05; ** indicates P<0.01; *** indicates P<0.001

Coefficient of determination

Also known as Squared Multiple Correlation (SMC), the Coefficient of Determination is the degree of explanatory power of "independent variable" regarding "dependent variable" under each implicit variable. In other words, the R^2 value shown in Table 7 indicates that the implicit independent variable has adequate explanatory ability on the implicit dependent variable respectively.

Table 7. Path coefficient of determination, Coefficients[a] (Hierarchical Regression) 】

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.856[a]	.749	.733	.317	.016	179.218	2	97	0.000
2	.865[b]	.763	.748	.412	.015	7.024	1	96	0.003

a. Predictors: (Constant), Mo and X b. Predictors: (Constant), Mo, X and Mo*X

Table 8 was derived from Table 7, as shown below:

Table 8. Coefficients.[a]

Coefficients of determination	R^2
Balanced Scorecard (XC), Organizational Commitment (MO) versus Intellectual Capital (MEC)	0.733
Balanced Scorecard (XC), Organizational Commitment (MO) and XCMO versus Intellectual Capital (MEC)	0.748

4.4 The indices of fit of the overall model

The purpose of adopting SEM in the modeling phase of this study was to explore the relationship between unobservable variables within the structural model, to examine whether the measurement model has measurement reliability or not, and also to measure the overall goodness-of-fit effects of this study using such indices as $\chi 2$, d.f., GFI, AGFI, NFI, CFI, RMR and RMSEA. In most cases, it is required that $\chi 2$/d.f. <5, 1>GFI>0.9, 1>NFI>0.9, 1>CFI>0.9, RMR<0.05 and RMSEA<0.05 (Bagozzi & Yi, 1988). The goodness-of-fit of the overall model in this study is satisfying, given the fact that $\chi 2$/d.f. <5 and GFI, AGFI and NFI all exceed 0.90, with RMR smaller than 0.05 (see 9).

Table 9. Assessment of fit of the overall model.

Determination Index	χ^2	DF	GFI	AGFI	NFI	CFI	RMR	RMSEA
Fit Value	220.200	137	0.923	0.912	0.911	0.905	0.028	0.025

Standardized results of SEM analysis

Figure 2 indicates the result of computer-aided standardization of the model's overall framework:

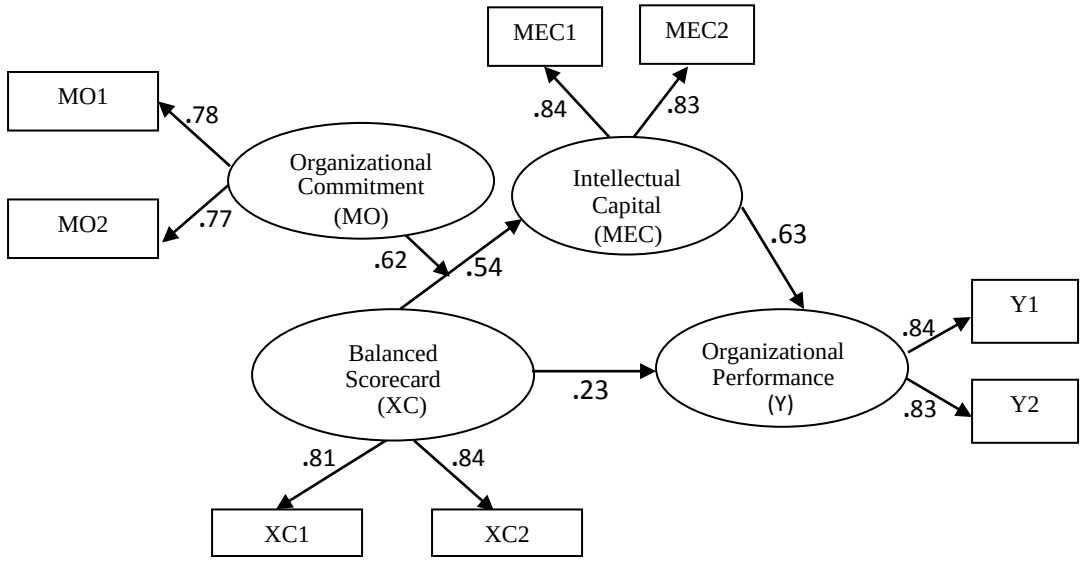

Figure 2. Standardized Results of SEM analysis.

Analytical testing of path effect for the structural model

The mediator-moderator variable in the model developed for this study was tested using two methods: 1. As shown in Table 7, a GPAA-enabled hierarchical regression analysis preceded centralization in two steps: (1) the effect of MC on XC, MO and XMO were verified in the regression analysis, the results of which are stated in Table 10; the effects of Y on XC, MO, XMO, MEC and XMO were verified, stated in Table 11.

Table 10. Coefficientsa

Model	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-4.078	.437		-9.318	.000
XC	1.793	.840	.542	11.571	.000
MO	10.167	.620	.632	15.048	.000
XMO	2.353	.750	.231	13.320	.000

a. Dependent Variable: MEC

With the Table 10 showing a t-value of MEC on XMO greater than 2, it indicates that Organizational Commitment (MO) has the moderating effect; that is, both employee Organizational Commitment (MO) and the Balanced Scorecard (XC) implementation have a significantly and positively interactive effect on the Intellectual Capital accumulation; as a result, H1 is substantiated.

Table 11. Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-4.078	.437		-9.318	.000
XC	1.793	.840	.542	11.571	.000
MO	10.167	.620	.632	15.048	.000
XMO	2.353	.750	.231	13.320	.000
MEC	.113	.031	.513	12593	.000
MECMO	.006	.058	.010	1.211	.932

a. Dependent Variable: Y

Table 11 indicates that the Intellectual Capital (MEC) merely has a mediating effect but un-moderated (the second order effect remains un-moderated and t-value less than 2), its direct effect remains un-moderated, too. It indicates the Intellectual Capital accumulation and employee Organizational Commitment of Taiwan-listed LED manufacturers didn't have a "significantly" interactive effect on the Organizational Performance.

Besides, the direct effect remains un-moderated (t-value less than 2), but the total effect is moderated, hence H3 is not substantiated. It indicates the BSC implementation and employee Organizational Commitment of Taiwan-listed LED manufacturers did not have a "significantly" interactive effect on the Organizational Performance.

2. The Table 12 below shows analysis results generated using the algorithm and operating system of CNLR.

Table 12. The results by CNLR.

		Differences				
		First stage	Second stage	Direct effect	Indirect effect	Total effect
		2.342	0.005	0.645	0.292	0.937
Bootstrap Results						
AVG		2.287	0.005	0.641	0.287	0.928
MEDIAN		2.296	0.011	0.641	0.275	0.916
MIN		1.733	0.171	0.352	0.432	0.784
MAX		2.721	0.181	0.451	0.463	0.914
STD		1.103	0.056	0.437	0.256	0.693
SKEW		0.111	0.082	0.138	0.233	0.371
KURT		0.116	0.007	0.035	0.386	0.421
T		2.136	0.104	1.473	1.143	2.616
Normal Approximation						
-1.960*STD		0.127	-0.108	-0.229	-0.223	-0.452
+1.960*STD		4.445	0.119	0.498	0.486	0.984
Percentil Method						
2.5%		0.069	0.111	0.231	0.193	0.424
97.5%		2.356	0.130	0.430	0.524	0.954
Bias Corrected Percentile Method						
BC 2.5%		0.216	0.111	0.122	0.184	0.306
BC 97.5%		3.178	0.112	0.413	0.577	0.990

Besides, Table 12 shows how the three methods (i.e., Normal Approximation, Percentile Method, and Bias Corrected Percentile Method) generated varying results for the 95% confidence interval but the same conclusions: (1) the first-order effect remained moderated; (2) the second-order effect was un-moderated but the indirect effect was not; (3) the direct effect was not moderated but the total effect was.

In summary, H1 is substantiated to show the result that both BSC implementation and employee Organizational Commitment of Taiwan-listed LED manufacturers have the significantly interactive effect on the Intellectual Capital accumulation. H2 is not substantiated to indicate both the Intellectual Capital accumulation and Organizational Commitment of Taiwan-listed LED manufacturers have the interactive effect on Organization Performance. Additionally, H3 is not substantiated to indicate both Balanced Scorecard implementation and employee Organizational Commitment of Taiwan-listed LED manufacturers have no significantly interactive effect on Organization Performance.

As mentioned above, CNLR and indirect GPAA generated the same results, despite the former's relatively complicated operating system.

Conclusions

The following specific conclusions were derived from the afore-mentioned data analyses and results: (i) As for SEM verification, this study's SEM has a satisfying goodness-of-fit in terms of the measurement, structural models and the overall structure, hence a good model fitting. (ii) Conclusions with regard to the verification of business practices at Taiwan-listed LED manufacturers: According to Chen (2010), if a moderator and an independent variable simultaneously exert a significant interaction effect on a dependent variable, neither the independent nor the moderator variable will have a significant effect on the dependent one. This study therefore proposed three hypotheses with a sole focus on "whether the moderator and independent variables exert a significant interaction effect on the dependent

variable," followed by an EFA of the model he developed.

While previous literature on Taiwan-listed LED manufacturers tends to be EFA in nature, this study performed modeling according to the literature review, and tested the proposed model for goodness-of-fit effects. That is, the present study is a CFA-based one that addresses a crucial topic regarding LED manufacturers' business practices; the research results provide a highly valuable referential basis for further research projects and also for the managerial decision-making at Taiwan-listed LED manufacturers.

A majority of the previous studies concerning LED manufacturers were exploratory research projects enabled by multi-regression analysis, with the implicit variables' moderating or mediating effect being the only concern in the CFA research framework. This study adopted a CFA research framework of mediated moderation effect, hence the relatively innovative methodology.

According to previous studies conducted in Taiwan, it is advisable that a simple verification model be built for CFA-based studies to avoid excessive complexity and the subsequently poor goodness-of-fit (Chen, 2010). This study tried to build and verify models of greater complexity, which were proved satisfying in goodness-of-fit but full of dilemmas. This study also focused solely on the CFA of Taiwan-listed LED manufacturers, and future researchers are advised to compare the goodness-of-fit effects of different models, or different industries in the same model. As simple random sampling left this study with a relatively low response rate resulted from sending questionnaires by mailing, it might create potential sampling bias; future studies may as well use stratified random sampling or convenient sampling instead.

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