The Effects of Organizational Performance on the Intellectual Capital Accumulation of Taiwan-listed Biotechnology Companies: Organizational Citizen Behavior as a Moderator

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ABSTRACT

This study is primarily intended to verify the effects of intellectual capital accumulation on the organizational performance of Taiwan-listed biotechnology companies, with organizational citizen behavior being the moderating variable. Interviews were conducted on the staff in section-chief or higher-level positions from financial and marketing departments at the afore-mentioned companies, obtaining the company ROE data from Taiwan Economic Journal database. This study's author used Simple Random Sampling to do the sampling from the population, and tested the goodness-of-fit effects of the overall model, structural model, and measurement model using Structural Equation Modeling (SEM) and identified a significantly positive interactive effect of organizational citizen behavior on the relationship between intellectual capital accumulation and organizational performance of Taiwan-listed biotechnology companies.

Keywords: Intellectual Capital Accumulation, Organizational performance, Organizational Citizenship Behavior

INTRODUCTION

Forward to the 21st century, biotechnology is recognized as one of the star industries for this century, holding numerous potential business opportunities, and being significantly applied to medical, agricultural, and environmental development (Chen, 2009). In other words, the 21st century is the century of biotechnology. To stimulate biotechnology development in Taiwan, the primary job is to have investment desires aroused. The top priority is to attract investors that will strengthen the company's intellectual capital accumulation in order to increase its operational performance and further create business values. Nevertheless, based on the properties of the biotechnology industry, the values of such companies particularly in the field of intellectual capital will not be completely shown in financial reports; therefore, the measure of intellectual capital is frequently neglected. In fact, intellectual capital is a primary source of competitive advantages for corporations’ survival chances (Lin, 2011). Intellectual capital is one of a company’s important intangible assets, which can increase the value of a company to make its current market value higher than original book value; instead, a company’s value will be enhanced by an intellectual capital accumulation where its business is constantly growing to strengthen the potentiality of business sustainable development and further improve operational performance (Chang, 2012). Therefore, the relationship between intellectual capital accumulation and organizational performance is truly one of the topics worth exploring in practice.

Additionally, according to many studies made by domestic and international scholars, there is a positive relationship between organizational citizen behavior and performance indices of organizational structure (Podsakoff, MacKenzie, Paine & Bachrach, 2000; Lin, 2007); therefore, this is another important topic worth exploring as to how a company currently strengthens employees’
organizational citizen behavior to increase organizational performance in a competitive environment, and ensure sustainable operation and development.

To ensure sustainable operations and growth in a rapidly-changing business context, companies seeking competitiveness must strengthen intellectual capital accumulation and further enhance corporate operational performance through organizational citizen behavior. The primary purpose of the present study is to examine whether both corporate intellectual capital accumulation and organizational citizen behavior will create interactions and synergy that benefit a company’s organizational performance. With a focus on Taiwan-listed biotechnology companies, therefore, this study’s author built a research model out of findings from previous studies, and verified it for goodness-of-fit effects. To be specific, this study was conducted for three purposes:

1. To verify and understand whether intellectual capital accumulation has a significantly positive effect on the organizational performance of Taiwan-listed biotechnology companies;
2. To verify and understand whether employees’ organizational citizen behavior has a significantly positive effect on the organizational performance of Taiwan-listed biotechnology companies;
3. To verify and understand whether the intellectual capital accumulation and employees’ organizational citizen behavior exert a significant and positive interactive effect on the organizational performance of Taiwan-listed biotechnology companies.

LITERATURE REVIEW

In this section, previous research results pertaining to this study’s topics are reviewed to establish hypotheses and a research framework. The relevant theories and studies are stated as follows:

Intellectual Capital Accumulation

Chen, Fang, Chen and Chien (2008) stated that intellectual capital is the professional knowledge, experience and centripetal force of all members in the organization, and effective procedures of operations, totals of good internal and external relations that can provide competitive advantages to achieve the organization’s goals.

Stewart (1997) published *intellectual capital accumulation: 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, work experiences, and learning ability; structural capital as the existing knowledge efficiently collected, tested, organized and integrated, with irrelevant components sifted out for further diffusion; and customer capital as the way a specific organization deals with all relevant parties, which involves the satisfaction, retention rate and loyalty of customers.

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

Intellectual capital, according to Sveiby (1998), is made up of individual competencies and the internal/external structure of a company, where “individual competencies” is defined as the employees’ capabilities of taking actions under varied circumstances with explicit knowledge, skills, experiences, value judgments, social networks, among others; the “internal structure” is defined as the sum of patents, concepts, patterns/models, computer and management systems; and the “external structure” is the sum of company-customer or company-supplier relationships such as brands, goodwill, and trademarks.

Johnson (1999) addressed intellect in three categories, namely the human, structural and relationship capitals, where “human capital” is defined as the combination of idea capital (or the labor force for knowledge-oriented tasks and employee aptitudes/attitudes) and leadership capital (or the personal qualities of an expert/manager); “structural capital” is defined as the combination of innovation capital (i.e., patents, trademarks, copyright and knowledge archives) and process capital (i.e., work procedures, trade secrets); “relationship capital” is the sum of a company’s relationships with customers, suppliers and online-community members.

While Knight (1999) tackled the issue of intellectual capital in four dimensions, namely human, structural and external capitals besides financial performance, he said human capital comprises the employee turnover rate, employee satisfaction, the number of new products/ideas conceived and recommended to be proposed/received; the structural capital comprises the operating-capital turnover rate, ratio of salespersons to general/administrative staff, and the length of time required to launch a new product; the external capital comprises customer persistency/satisfactions, the list of customers for maximum profitability, indices of suppliers’ product quality/reliability; and the financial performance comprises the Economic Value Added (EVA), the 90-day accounts receivable, and the value added per employee.

The intangible intellectual capital is a major referential indicator of enterprise value(EV), as contended by Chen (2001), who said intellectual capital consists of human, structural and relationship capitals while defining it as something that integrates into such capitals all the skills, knowledge, information, experiences, problem-solving abilities and wisdom of a company. She went on to define human capital as the knowledge, skills and experiences of a company’s employees and management; structural capital, a company’s overall system/procedures concerning problem-solving and value creation; and relationship capital as the initiation, maintenance and development of an organization’s external relationships with customers, suppliers, business partners, among others.

Edvinsson (2003) gave a simple description of intellectual capital: something all businesses will rely on for future growth, as well as an indicator of efficiency in business operations. It is impossible to implement any corporate reform without first investing in intangible assets (Tsen and Hu, 2010).

To sum up the literature above, this study’s author conceptually defined intellectual capital according to the argument of Chen (2001): “the sum of skills, knowledge, information, experiences, problem-solving abilities, and wisdom integrated into a company’s human, structural and relationship capitals”. Meanwhile, intellectual capital is operationally defined as the sum of:
A. Human capital: the knowledge, skills and experiences possessed by a company’s employees and management;
B. Structural capital: a company’s overall system and procedures concerning problem-solving and value creation;
C. Relationship capital: the initiation, maintenance and development of an organization’s external relationships with customers, suppliers, business partners, among others.
As for the measure of intellectual capital, the classification of intellectual capital from these scholars, Edvinsson & Malone (1997) and Johnson (1999), has been adopted to make three perspectives of human capital, relationship capital and structural capital.

**Organizational Citizenship Behavior (OCB)**

Employees’ behavior in an organization has been an implicit concern in the field of organizational behavior studies for their performance directly affects organizational performance and goal achievement (Lin & Chen 2006). Lin (2003) pointed out modern organizations are often confronted with rapidly changing environments inward and outward where they need to carry out the organizational citizen behavior by their employees, fixing failures of organizational norms and tasks. Organizational citizen behavior means individuals selflessly devote themselves to other members in the same organization, and contribute the most benefit to the organization they are working for (Hsiao, Yeh and Lin, 2004), without reward from the organization. Robbins and Colter (2005) believed organizational citizen behavior is employees willingly engaged in voluntary and unconditional behavior besides official job requirements.

Podsakoff, Aheame and Mackensize (1997) showed that members in the organization spontaneously performing contributive behavior toward the whole organization or other members without prescribed regulations nor rewards will be helpful to the enhancement of organizational performance. It is called the organizational citizen behavior (Chen, Lai and Lu, 2010).

Tsai (2008) mentioned employees of the tourism and hospitality industry not only provide clients with the best service in a busy working environment, fulfilling their parts and duties required by the organization, but also willingly devote their extra effort to the organization for higher operational performance. Productivity of peers and executives will be raised to lessen unnecessary waste, as well as promote intersectional collaboration, strengthen organizational capacity and assist the organization in dealing with environmental change and challenge when employees act out more organizational citizen behavior (Wang, 2009). Hsu, Lin and Chang (2010) defined the organizational citizen behavior as a personal behavior of employees, spontaneously engaged in favor of the organization beyond the working contract and without consideration of rewards and punishments. Hsieh, Lang & Chen (2010) indicated the organizational citizen behavior comprises these four perspectives: (1) Identification with the Organization; (2) Assisting Colleagues; (3) Selflessness; and (4) Dedication to Job perspectives.

To sum up the description from the above literature, this study’s author proposed a conceptual definition for “organizational citizen behavior” based on the definition from Hsiao, Yeh and Lin (2004), which means “individuals selflessly devote themselves to other members in the same organization, and contribute the most benefit to the organization they are working for, without reward from the organization”. This study has classified “organizational citizen behavior” into four sub-perspectives according to opinions of Hsieh, Lang & Chen (2010).

**Organizational performance**

Szilagyi and Wallar (1980) have indicated performance is an assessment tool for the effectiveness or efficiency of an organization’s resource utilization; it can also reflect a personal behavior for the achievement of organizational goals that can lead to the future resource allocation in the organization (Campbell, 1991). Venkatraman and Ramamnujam (1986) stated the measure of the organizational performance could be categorized to these perspectives: financial performance, business performance and organizational effectiveness.

Pointed out by Wang (1997), initially referring to how much the results of an endeavor are shown,
performance is a concept significant in the two different layers of efficiency and effectiveness. While efficiency is the output-to-input ratio, effectiveness is the degree of goal achievement for an organization, indicated by Hsieh (2006). Organizational operations are pursuits of results that are both efficient and effective. According to the motivation theory of management sciences, performance is interpreted as “a piece of work completed by an employee”. The science of organizational behavior, nevertheless, refers to performance as “an integrated success consisting of efficiency, effectiveness and efficacy”.

There is a massive amount of previous studies addressing 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 indices. Moreover, Ling and Hung (2010) also considered that organizational performance is the sum of accomplishments attained by all businesses/departments involved in an organizational goal during a determined period of time, with the goal either meant for a specific stage or on the overall extent.

To consider the financial perspective of organizational performance, Huang (2008) adopted the measure in his study using the indices of growth capacity and profitability. For example: Earnings Per Share (EPS) above the average in the same industry, Return On Equity (ROE) or Return On Assets (ROA) can be the measurement indices of financial performance (Ling and Hung, 2010; Chang, 2012). To sum up, this study referred to the financial perspective of organizational performance measure from Huang (2008) and, Ling and Hung (2010); therefore, “EPS” and “ROE” are the indices for measuring organizational performance.

The Effect of Intellectual Capital Accumulation on Organizational performance

Edvinsson and Malone (1997) indicated an intellectual capital could produce organizational value owing to the organization of high-density innovation and service capable of transferring knowledge to value. Besides, Chen (2001) also believed the organization’s intellectual capital affects organization performance in a significantly positive way.

It was indicated in the study by Tu (2002) that each intellectual capital was indeed affected by different corporate cultures, and the companies with more flexible and outward organizations will pay higher attention and make greater accumulation to each intellectual capital.

Moreover, Lai (2002) studied and pointed out there is a significant relationship between corporate culture, human capital, innovative capital and financial performance. Liu (2005) concluded that organizational culture affects human capital accumulation; human capital influences relationship capital accumulation; the relationship capital accumulation affects structural capital accumulation; and finally, structural capital accumulation creates organizational performance.

It was discovered after Young (2006) studied 211 public-listed companies that intellectual capital makes a great contribution to create organizational value and competitive advantages; meanwhile, capabilities can be exerted more effectively via the interaction between human, structural and customer capitals. Rudez and Mihalic (2007) also demonstrated that the hotel industry must encourage its intellectual capital development for a sustainable competitiveness; further, organizational finance performance will be more promoted by the interaction between human capital and information technology. Organizational performance is deeply affected by the intellectual capital, no matter whether in information technology, biotechnology, high-tech or emerging industries (Chang, Chen, & Lai, 2008). Particularly for the international tourist hotel industry which provides tangible products and intangible services, employees’ knowledge and organizational management procedures are intellectual capitals of the organization. Tsen, et al. (2010) indicated intellectual capital comprises “human capital”, “structural
capital” and “social capital”; therefore, the organization trains the “human capital” not easily duplicated by competitors to have accumulated intellect and ability transformed to a core ability of the organization; exerting the function of “structural capital” to create an organizational uniqueness; setting up an irreplaceable external relationship to strengthen an organization’s “social capital”; furthermore, the synergy generated from the interaction between “human capital”, “structural capital” and “social capital” is a crucial key for the organization building up its competitiveness (Chen, 2011).

From the afore-mentioned relevant literature, it can be discovered that there is a significantly positive relationship between intellectual capital and organizational performance; thence, this study proposed the following hypothesis:

**H1:** Intellectual capital accumulation affects organizational performance in a significantly positive way.

The Effect of Organizational Citizen Behavior on Organizational performance

From the studies on organizational citizen behavior versus organizational performance, Walz and Niehoff (2000) selected 30 fast-food chain restaurants as sample objects to verify the effect of organizational performance on organizational citizen behavior. An empirical result proved organizational citizen behavior significantly affected these items of performance: overall operational efficiency, incomes, purchase cost, customer satisfaction, service quality, etc. Meanwhile, the organization develops suitable organizational culture to make the workplace an entirely harmonious and excellent competitive environment, as well as leading to trust occurring between employees and the organization to encourage employees’ organizational citizen behavior and naturally form a connection in the organization; accordingly, organizational productivity will be enhanced, cost down, team work and service quality strengthened, furthering raised organizational effectiveness (Huang, 2006).

In the studies of Podsakoff and Mackebzie (1994), it was pointed out the organizational citizen behavior significantly affects the sales of all departments; additionally, it was discovered from the studies of Yen and Niehoff (2004) that organizational citizen behavior has a significantly negative relationship with the cost of human resource, but a positive relationship with perceived service quality.

From the afore-mentioned relevant literature, it can be discovered that there is a significantly positive relationship between organizational citizen behavior and organizational performance; thence, this study proposed the following hypothesis:

**H2:** Organizational citizen behavior affects organizational performance in a significantly positive way.

However, whether the effects of intellectual capital accumulation and organizational citizen behavior can simultaneously exert a multiplying effect or synergy on the organizational performance is an important topic worth exploring. Therefore, the third hypothesis is inferred from this study:

**H3:** Intellectual capital accumulation and organizational citizen behavior of Taiwan-listed biotechnology companies will exert an interactive effect on the organizational performance in a significant way.

**RESEARCH METHOD**

Figure 1 illustrates how motivations, research objectives and literature review cited in the previous passages led to this study’s hypotheses and conceptual research framework:
Designing the Questionnaire

The questionnaire in this study was compiled on the basis of Multi-Dimension Measurement and the afore-mentioned observable perspectives. On a 7-point Likert Scale, the answers were measured with 7 denoting Strongly Agree and 1 denoting Strongly Disagree: the score grows along with the degree of agreement. The sample data collected was then “centralized” so the sum of scores given to all questionnaire items is zero after deducting the average. Centralization erases multicollinearity between the independent and moderating variables, in order that their interactions are tested more accurately, as shown in the mathematical equation below (Lee, 2012; Chang, 2012):

\[ \sum (X_i - \bar{X}) = \sum Y_i = 0 \]

As for the 12-item questionnaire for “intellectual capital”, it is designed based on the intellectual capital viewpoints of Chen (2001), Tsen and Hu (2010) that these three perspectives should be considered: “human capital”, “structural capital” and “relationship capital” perspectives.

As for the 12-item questionnaire for “organizational citizen behavior”, it is designed based on the organizational citizen behavior viewpoints of Hsieh, Lang & Chen (2010) that these four perspectives should be considered: (1) Identification with the Organization; (2) Assisting Colleagues; (3) Selflessness; and (4) Dedication to Job perspectives.

As for the 8-item questionnaire for measurement indices of “Organizational performance” including EPS and ROE, it is designed based on the scales of Huang (2008), Ling and Hung (2010).

Sampling Method

While the respondents of questionnaire survey (i.e., the staff in section-chief or higher-level positions from financial and marketing departments at Taiwan-listed biotechnology companies) were selected by simple random sampling, 30 copies of questionnaire were given out to experts in a pilot-test. After revising or removing unsuitable items as per the experts’ advice, the study’s author sent out 800 copies of the questionnaire in an official post-test, and received 296 validly completed copies for a 37% response rate (Fritz and Mackinnon, 2007).

The Data Obtained from Questionnaire and Measurement Model

This study’s author adopted Linear SEM in a Confirmatory Factor Analysis (CFA) of the research framework, and based the questionnaire design on three latent variables (i.e., intellectual capital,
organizational citizenship behavior and organizational performance), each of which was divided into observable/explicit sub-variables containing several questions, as shown in the table below. After processing the collected data, the author created a primary file that preceded the design of questionnaire, using Multi-Dimension Measurement for the construction of this study’s measurement system. However, Dual Measurement was adopted to ensure the computer software efficiently handled and/or measured all data (Shun-yu Chen, 2010). Table 1 shows the number of questions under each implicit or explicit variable.

<table>
<thead>
<tr>
<th>Implicit Variables</th>
<th>Explicit Variables</th>
<th>Total Number of Questionnaire Items</th>
<th>Referential Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellectual capital (X)</td>
<td>Human capital</td>
<td>4</td>
<td>Chen (2001); Tsen and Hu (2010)</td>
</tr>
<tr>
<td></td>
<td>Structural capital</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relationship capital</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Organizational citizenship behavior (MO)</td>
<td>Identification with the organization</td>
<td>3</td>
<td>Hsieh; Lang &amp; Chen (2010)</td>
</tr>
<tr>
<td></td>
<td>Assisting colleagues</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Selflessness</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dedication to job</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Organizational performance (Y)</td>
<td>EPS</td>
<td>4</td>
<td>Huang (2008), Ling and Hung (2010)</td>
</tr>
<tr>
<td></td>
<td>ROE</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

RESULTS AND ANALYSIS

Linear Structural Model Analysis

This study includes a CFA, an analytical method contrary to the Exploratory Factor Analysis (EFA), on the three unobservable/latent variables of intellectual capital accumulation, organizational citizenship behavior and organizational performance. SEM is made up of structural and measurement models to efficiently tackle the cause-effect relations among implicit/latent variables. The three parts of model-testing in this study are: (1) goodness-of-fit of the measurement model; (2) goodness-of-fit of the structural model; (3) the overall model’s conformity with goodness-of-fit indices. In other words, goodness-of-fit indices were applied to a test of the overall goodness-of-fit effect of SEM (Diamantopoulos & Siguaw, 2000).

Analyzing Fit of the Measurement Model

To a large extent, factor loading is intended to measure the intensity of linear correlation between each latent/implicit variable and a manifest/explicit one. The closer the factor loading is to 1, the better an observable variable is in measuring latent variables. Since this study’s reliability is supported by the fact that factor loadings for all observable variables range between 0.8 and 0.9, all observable/explicit variables in the measurement model appropriately gauged the latent/implicit ones. The Average Variance Extracted (AVE), on the other hand, gauges an unobservable/implicit variable’s explanatory power of variance with regard to an observable one, with the VE value growing in proportion to the reliability and convergent validity of that particular implicit/latent variable. As a rule, VE must be larger than 0.5 for an observable variable’s explainable variance to exceed the measurement error (Fornell and Larcker, 1981). As Table 2 and Figure 2 show that all AVEs in this study exceed 0.5, the explicit variables have excellent reliability and convergent validity.
Table 2: Judgment Indices for the Measurement Model

<table>
<thead>
<tr>
<th>Unobservable (Latent variables)</th>
<th>Observable Variables: Centralized Dual Measurement</th>
<th>Factor loading</th>
<th>Variance Extracted (VE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellectual Capital Accumulation (X)</td>
<td>X1C, X2C</td>
<td>0.84, 0.83</td>
<td>0.64, 0.63</td>
</tr>
<tr>
<td>Organizational Citizenship Behavior (Mo)</td>
<td>M1C, M2C</td>
<td>0.83, 0.82</td>
<td>0.63, 0.65</td>
</tr>
<tr>
<td>X*Mo</td>
<td>X1M1C, X2M2C</td>
<td>0.83, 0.84</td>
<td>0.66, 0.67</td>
</tr>
<tr>
<td>Organizational performance (Y)</td>
<td>Z1C, Z2C</td>
<td>0.83, 0.84</td>
<td>0.64, 0.66</td>
</tr>
</tbody>
</table>

ANALYZING FIT OF STRUCTURAL MODEL

1. Path Analysis Results of Structural Model

This study’s author made sure that the overall model passed the goodness-of-fit test before calculating the parameter estimates, Standard Errors (S.E.) and Critical Ratio (C.R.) among latent variables (see Table 3). According to the results, the interaction between an intellectual capital accumulation and organizational citizen behavior (X*Mo) affects organizational performance (Y) significantly (c=0.686). That is, a company can simultaneously consider organizational citizen behavior while it is brewing the effect of an intellectual capital accumulation on organizational performance, and multiplied synergy will be accomplished by this way.

Table 3: Path Analysis Results of the Structural Model

<table>
<thead>
<tr>
<th>Path Coefficients between Implicit Variables</th>
<th>Estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellectual Capital Accumulation (X) → Organizational performance (Y)</td>
<td>.462</td>
<td>.071</td>
<td>6.507</td>
<td>***</td>
<td>a</td>
</tr>
<tr>
<td>Organizational Citizenship Behavior (Mo) → Organizational performance (Y)</td>
<td>.373</td>
<td>.066</td>
<td>5.652</td>
<td>***</td>
<td>b</td>
</tr>
<tr>
<td>X*Mo → Organizational performance (Y)</td>
<td>.663</td>
<td>.053</td>
<td>12.509</td>
<td>***</td>
<td>c</td>
</tr>
<tr>
<td>X1 → X1C</td>
<td>.843</td>
<td>.161</td>
<td>5.236</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>X2 → X2C</td>
<td>.834</td>
<td>.162</td>
<td>5.148</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>M1o → M10C</td>
<td>.833</td>
<td>.311</td>
<td>2.678</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>M2o → M20C</td>
<td>.822</td>
<td>.321</td>
<td>2.561</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>X1*M1o → X1M1C</td>
<td>.831</td>
<td>.283</td>
<td>2.936</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>X2*M2o → X2M2C</td>
<td>.843</td>
<td>.282</td>
<td>2.989</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Y → Z1C</td>
<td>.842</td>
<td>.143</td>
<td>5.889</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Y → Z2C</td>
<td>.833</td>
<td>.141</td>
<td>5.908</td>
<td>***</td>
<td></td>
</tr>
</tbody>
</table>

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

2. Coefficient of Determination

The Coefficient of Determination, also known as Squared Multiple Correlation (SMC), indicates the explanatory power of an implicit independent variable with regard to an implicit dependent one. That is, the R² values shown in Table 3 indicate that the implicit independent variables have adequate explaining power on the implicit dependent variables, respectively.
Table 3 Path Coefficient of Determination

### Table 3.1: Coefficientsa

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>R Square Change</th>
<th>F Change</th>
<th>df1</th>
<th>df2</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.593</td>
<td>.352</td>
<td>.341</td>
<td>.217</td>
<td>.011</td>
<td>169.181</td>
<td>2</td>
<td>97</td>
<td>0.001</td>
</tr>
<tr>
<td>2</td>
<td>.692</td>
<td>.479</td>
<td>.462</td>
<td>.312</td>
<td>.017</td>
<td>27.242</td>
<td>1</td>
<td>96</td>
<td>0.002</td>
</tr>
</tbody>
</table>

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

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

Table 3.2 was derived from Table 3.1:

### Table 3.2: Coefficientsa

<table>
<thead>
<tr>
<th>Coefficients of Determination</th>
<th>Adjusted $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellectual capital (X), Organizational citizenship behavior (Mo) versus Organizational performance (Y)</td>
<td>0.341</td>
</tr>
<tr>
<td>Intellectual capital (X), Organizational citizenship behavior (Mo) and X*Mo versus Organizational performance (Y)</td>
<td>0.462</td>
</tr>
</tbody>
</table>

Indices of Fit of the Overall Model

This study’s author adopted SEM for modeling in order to explore how unobservable variables connect to one another in the Structural Model, whether the measurement model has measurement reliability, and how the overall model’s goodness-of-fit effect is. While $\chi^2$, d.f., GFI, AGFI, NFI, CFI, RMR and RMSEA are the goodness-of-fit indices for the overall model, it is usually 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). In this study, the overall model has a satisfactory goodness-of-fit effect because $\chi^2$/d.f. <5 and the values of GFI, AGFI and NFI all exceed 0.90, with a below-0.05 RMR, as shown as in Table 4 (Lee, 2012 & Chang, 2012).

### Table 4: Assessment of Fit of the Overall Model

<table>
<thead>
<tr>
<th>Determination index</th>
<th>$\chi^2$</th>
<th>DF</th>
<th>GFI</th>
<th>AGFI</th>
<th>NFI</th>
<th>CFI</th>
<th>RMR</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit value</td>
<td>12.705</td>
<td>14</td>
<td>0.913</td>
<td>0.901</td>
<td>0.904</td>
<td>0.903</td>
<td>0.023</td>
<td>0.024</td>
</tr>
</tbody>
</table>

Standardized Results of SEM Analysis

The model’s overall framework was resulted from computer-aided standardization, as shown in Fig. 2.
Analytical Testing of Path Effects for the Structural Model

To test the moderating variable, this study’s author performed a hierarchical regression analysis (see Table 3.1), followed by centralized regression analyses and t-tests of Y versus X, Mo and X*Mo in order to examine whether the hypothesis about a significant regression coefficient was substantiated (i.e. whether c is zero or not). The test results are shown in Table 5.

Table 5 Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>3.814</td>
<td>.972</td>
<td>.455</td>
<td>3.924</td>
</tr>
<tr>
<td>X</td>
<td>9.742</td>
<td>.913</td>
<td>.481</td>
<td>10.670</td>
</tr>
<tr>
<td>Mo</td>
<td>6.883</td>
<td>.431</td>
<td>.296</td>
<td>15.970</td>
</tr>
<tr>
<td>2 (Constant)</td>
<td>5.034</td>
<td>1.262</td>
<td>.451</td>
<td>3.989</td>
</tr>
<tr>
<td>X</td>
<td>9.193</td>
<td>.824</td>
<td>.481</td>
<td>11.157</td>
</tr>
<tr>
<td>Mo</td>
<td>6.361</td>
<td>.636</td>
<td>.296</td>
<td>10.002</td>
</tr>
<tr>
<td>X*Mo</td>
<td>14.404</td>
<td>.732</td>
<td>.686</td>
<td>19.678</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Organizational Effectiveness(Y)

As shown in Table 5, the 0.686 Path Coefficient of Mo*X versus Y suggests a moderating effect of Mo*X on Y.
The following results were derived from analyses mentioned above:
1. An intellectual capital accumulation affects organizational performance in a significantly positive way, with a 0.46 standardized path coefficient that supports H1 (Hypothesis substantiated);
2. Organizational citizen behavior affects organizational performance in a significantly positive way, with a 0.37 standardized path coefficient that supports H2 (Hypothesis substantiated);
3. An intellectual capital accumulation and organizational citizen behavior exert an interactive effect on organizational performance in a significantly positive way, with a 0.66 standardized path coefficient that supports H3 (Hypothesis substantiated).

CONCLUSION AND SUGGESTIONS

Conclusions
This study’s results and conclusions were derived from the afore-mentioned data analyses, as detailed in the following passages:
1. Regarding the verification of SEM, this study has made goodness-of-fit between SEM, Measurement Model, Structural Model and the overall models to show a good model fit.
2. Conclusions regarding the verification of business practices at Taiwan-listed biotechnology companies:
   The interaction between a sound intellectual capital accumulation and organizational citizen behavior affects the organizational performance of Taiwan-listed biotechnology companies in a significantly positive way. In other words, the “organizational citizen behavior” variable in this study displays a positive moderating effect. According to Shun-yu Chen (2010), if an moderating and an independent variable both exert a significant interactive effect on a dependent variable, neither the independent nor the moderating variable will have a significant effect on the dependent one (Chang, 2012).

Contributions of the Present Study
1. Contributions to the business practices of Taiwan-listed biotechnology companies:
   Unlike the previous studies that were largely based on EFA, this study’s author performed modeling in accordance with the summarized literature review and then verified the model’s goodness-of-fit effects. The present study, consequently, is a CFA-based one addressing topics that are both important and innovative in terms of business practices, with the research results providing a reference for further studies in relevant fields, and for the decision makers of Taiwan-listed biotechnology industries with great management significance.
2. Innovative Applications of Research Methodology
   Exploratory research enabled by the multi-regression analysis accounts for a majority of the literature, leaving the implicit variables’ moderating effect in a CFA-based research framework rarely considered. Since the present study’s main perspectives are implicit variables, CFA and linear SEM appear to be suitable measurement tool and model framework, respectively. That explains why this study is relatively innovative in terms of research method.

Limitations and Recommendations
1. This study uses Confirmatory Factor Analysis (CFA) where a simpler verification model should be designed while building a model for abstaining from poor model’s goodness-of-fit generated by an overly complicated model (Shun-Yu Chen, 2010). Thence, this study is solely considering the effect of
intellectual capital accumulation on organizational performance using a Moderating Variable of
organizational citizen behavior.

2. This study was based on Simple Random Sampling to have slightly lower valid response rate of
samples; therefore, the selected samples were likely to be less representative of the population than by
use of the Stratified Random Sampling Method as a recommended method of sampling for further
research projects.

3. This study is limited to the CFA of Taiwan-listed biotechnology companies, and future researchers can
consider verifying different industries to compare whether the goodness-of-fit will be different between
those industries in the same model.

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