

Investigation of Intellectual Capital and Organisational Performance in Supply Chain Management: Modification of the Diamond Specification Model

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Abstract—This study aims to examine the association between intellectual capital—which is described as the interrelationship between human capital, customer capital and structural capital—with organisational performance in supply chain managements of the banks and financial institutions in Bali Province, Indonesia. Data were collected using a self-administered questionnaire by considering the supply chain process. A total of 500 questionnaires was sent to general managers of banks and financial institutions in Bali Province. A total of 109 questionnaires was returned and analysed (a 21.80% response rate). The analysis was performed using covariance-based structural equation modelling with AMOS 21.0 software. The findings show that human capital is positively significantly associated with customer capital and structural capital. The findings also show that customer capital is positively not significantly associated with structural capital. Whereas, human capital, customer capital, and structural capital are positively not significantly associated with organisational performance.

Keywords; *intellectual capital, human capital, supply chain management, customer capital, structural capital, organisational performance*

1. Introduction

In a knowledge-based economy, organisational success cannot be separated from the important role of intellectual capital. Focal firms in supply chains conduct innovation practices not only by applying internal knowledge, but also by leveraging external sources of intelligence such as their suppliers and customers. That is because in this economy the knowledge-intensive industry is growing fast, so that there is an increase in the creation and exploitation of knowledge and information in all fields [1]. In a knowledge-based economy, intellectual capital is the key to creating organisational value; the ability to manage these assets determines the success or failure of an organisation [2].

Although the important role of intellectual capital in a knowledge-based economy has been recognized by academics and practitioners and has become an interesting topic of discussion, until now intellectual capital did not have any models. One of the intellectual capital models suggested by [3] is known as the diamond specification

model. According to reference [3] intellectual capital is the interaction of human capital, customer capital and structural capital. In the diamond specification model, human capital is related to customer capital and structural capital, while customer capital and structural capital are related to organisational performance. This study examines the model by modifying it. Modifications are made by testing the associated customer capital and structural capital, and testing each element of intellectual capital—human capital, customer capital, structural capital—related to organisational performance.

There are several reasons for doing research by expanding the diamond specification model. First, the results of the existing research are inconsistent. Second, to obtain an acceptable model of intellectual capital, repetitive testing is needed, including the development of a model so that a logical intellectual capital model is found. Third, there is not much research in Indonesia that examines the model of the association between intellectual capital and organisational performance. Research on intellectual capital is dominated by Western countries, especially North America and Europe [4].

The modified diamond specification model was tested at banks and financial institutions in Bali Province, Indonesia, to determine the association of intellectual capital and organisational performance. Banks and financial institutions are companies with high intellectual capital intensity. Companies considered high intellectual capital intensity are those that utilise intellectual assets well to improve company performance and create competitive advantage.

2. Literature Review and Hypotheses Formulation

2.1. Theories Underlying Intellectual Capital Thinking

There are several theories that underlie intellectual capital thinking, including resource-based theory, human capital theory and resource dependency theory. Resource based theory developed by [5], views companies as a collection of heterogeneous, non-homogeneous resources and available productive services derived from company resources that provide a unique character for each company. Various forms of resources, such as physical,

financial, human, or organisational, are needed for strategic action; the ability to obtain and maintain these resources are the key to achieving competitive advantage [4].

Human capital theory was developed by [5] who suggested that investing in training and increasing human capital was important as an investment in other forms of capital. Economic value for the organisation is obtained from the skills, experience and knowledge, which enables the organisation to be productive and be able to adapt. Skills, knowledge and health are not only beneficial for an individual, but will also increase resources for entrepreneurs, a nation and potential productivity. Contextual factors—market conditions, trade unions, business strategies, technology—received attention in human capital theory. These factors affect costs related to alternative approaches to the use of human resource management in order to increase the value of an organisation's human capital and anticipated return on value, such as achieving productivity [6].

Reference [7] suggests a resource dependency theory that discusses an organisation's dependence on its environmental resources. A company responds and becomes dependent on other actors, organisations or companies where resource control is critically directed to operations, and where the company has limited control. The organisation is continuously looking for resources from its environment in order to survive.

2.2. Intellectual Capital Concept

Until now the definition of intellectual capital has been ambiguous. There is no single definition for a specific entity; it tends to be broad and the concept is vague so that it requires support and relationships between various elements [7]. Intellectual capital is not easy to understand, but when an organisation can find and be able to exploit, it will provide the organisation with a basis for new resources to win the competition [8]. Intellectual capital is the name for a combination of intangible assets, whether originating from markets, intellectual property, infrastructure, or human centres, that make a company function. Intellectual capital is intellectual material, which can be in the form of knowledge, information, intellectual property, or experience, for wealth creation [9] and the effective use of knowledge (finished products) as opposed to information (raw material) [10-13].

In general, researchers classify intellectual capital into three elements, namely human capital, customer capital, and structural capital.

a. Human capital

Human capital is the knowledge, skills and experience of an employee. When he leaves the company, it will be brought with him [14]. Human capital includes knowledge within employees, including the provision of services. Employees share their expertise or skills, knowledge and experience with the company to add value to the organisation [9]. Intellectual capital is produced through competence, attitude and intellectual intelligence.

b. Customer capital

Customer capital is formed from marketing channels and customer relationships. Some of these are image, customer loyalty, customer satisfaction, supplier relations,

commercial strength, negotiating capacity with financial entities and environmental activities. Customer capital shows the potential of the company because it is ex-firm intangible [10].

c. Structural capital

Structural capital is company knowledge and remains in the company. Structural capital includes organisational routines, procedures, systems, culture, and databases. There is structural capital that is protected by law, legally belongs to the company, and becomes an intellectual property right. Even though the employee has left the company, structural capital will remain in the company. This capital is the infrastructure and process of the organisation in providing its products and services [11].

2.3. Hypotheses Formulation

Market orientation for consumers can be built by organisations involving human capital. Competent employees will be able to better understand what consumers need, which has an impact on the development of customer capital including the emergence of customer loyalty. This is in accordance with reference [3] and [12], which found the relationship between human capital and customer capital to be positive and significant. Based on this, we formulate the following hypothesis:

H1: Human capital is positively associated with customer capital.

Tacit knowledge available to employees is a key innovation and renewal strategy. Creative and intelligent employees will be able to change practices and obtain innovative solutions if there is a problem. This will strengthen company knowledge (structural capital) such as systems, organisational routines, procedures, databases, culture, and so on. The description is in accordance with reference [3] who found human capital related to structural capital positively and significantly. In another study, reference [12] identifies the relationship of the two variables as positive but not significant for the service industry, whereas for non-service industries it is positive and significant. This inconsistency of the findings prompted the following hypothesis:

H2: Human capital is positively associated with structural capital.

Companies that prioritize consumers and become market creators, will create efficient organisational routines in order to provide the best service to consumers. This is consistent with resource dependency theory in that there is a dependency between organisations and resources in the respective environments. A company responds and becomes dependent on other actors, organisations or companies where resource control is critically directed to operations, and where the company has limited control. To maintain its sustainability, the organisation continues to look for resources from its environment. In addition, reference [12] also shows that in both the service and non-service industries, the relationship between customer capital and structural capital is positive and significant. Based on this, we formulate the following hypothesis:

H3: Customer capital is positively associated with structural capital.

With their competence, employees will also determine an increase in profits and sales growth. Support from

competent employees is expected to be able to support the company in launching new products. This is consistent with the resource-based theory which assumes that the organisation is said to be successful when the organisation can achieve and maintain competitive advantage. Exchange and efficient use of resources becomes a driver in achieving competitive advantage and better performance [13]. This was proven by [15-20] who found human capital to contribute significantly in improving organisational performance. Associated with the organisation, in resource-based theory, human resources—experience and employee knowledge—are recognized as a form of resource that encourages and is a determinant of competitive advantage and improved performance. Based on this, we formulate the following hypothesis:

H4: Human capital is positively associated with organisational performance.

Organisational performance can be improved by making investments that focus on consumers so that organisations can be market determinants. Consumers are the key to survival of a company. Organisational performance will be maintained with loyal customers. New product launches will not succeed if the company is unable to obtain knowledge embedded in marketing channels and customer relations [17]. Other knowledge that is needed includes knowledge embedded in supply chains and partner relationships. This underlies the existence of various forms of relationships—such as supply chain partnerships, networks, and strategic alliances. Through the network, the organisation obtains the knowledge, competencies and resources that are needed [17]. This is in accordance with [3, 14, 15, 16], and [21] who found a positive and significant contribution from customer capital to the achievement of organisational performance. Based on this, we formulate the following hypothesis:

H5: Customer capital is positively associated with organisational performance.

The ability of organisations to codify organisational knowledge and develop structural capital—such as practicing and developing great ideas, building innovative systems and procedures, and increasing cost per dollar of income—drives the achievement of competitive advantage with higher organisational performance. This shows that the role of intellectual capital cannot be ignored in improving company performance [18]. Reference [3, 12, 14, 15, 16], and [22] found the association between structural capital and organisational performance to be positive and significant. Structural capital is infrastructure that can help initiate new ideas, innovate new products, and manage them into company income [17]. Therefore, good management of structural capital can improve company performance. Higher organisational performance is obtained when the organisation has a good organisational structure, which is supported by skilled employees and can provide efficient and quality services [19]. Based on this, we formulate the following hypothesis:

H6: Structural capital is positively associated with organisational performance.

3. Methodology

3.1. Research Setting and Sample

This research focused on banks and financial institutions as the primary population. Banks and financial institutions are classified as a highly knowledge-intensive industry. To test the hypothesis, we used a sample of 200 banks and financial institutions in Bali, Indonesia. The sample size according to the adequacy scale of the sample size proposed by [20] is included in the category of fairly and has met the requirements for data processing using structural equation modelling (SEM) with the maximum likelihood estimation (MLE) technique.

Assuming a response rate of 40%, the number of sent questionnaires was 500. The questionnaires were accompanied by a request letter explaining the study's purpose, asking that financial managers fill out the questionnaire and assuring the participants of confidentiality. We sent the questionnaires directly to each member of the research sample. Within two months of the requests being sent, we began to receive the completed questionnaires.

3.2. Instruments

Intellectual capital consisting of human capital, customer capital and structural capital variables was measured in our study using a five-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'. The questionnaire contained 14 statements to which respondents indicated the extent of their agreement on that scale. The instrument was adopted from [12]. Human capital was measured using five items: (1) employees are bright; (2) employees give their best; (3) employees think about their actions; (4) we get the most out of employees; (5) employees give it their all.

Four items were used to measure customer capital: (1) market share is highest; (2) meets with customers; (3) understands target markets; and (4) is confident of a future with the customer. Structural capital was measured using five items: (1) revenue per employee is best; (2) implements new ideas; (3) develops more ideas in the industry; (4) the company operates efficiently; and (5) the system facilitates access to info.

Our research also adopted five items from [12] to measure organisational performance, using the same five-point Likert scale as above: (1) sales growth; (2) return on sales after tax; (3) response to overall competition; (4) success rate in launching new products; and (5) comprehensive organisational performance. To test the hypotheses of this study, covariance-based structural equation modelling (CB-SEM) was used with AMOS 21.0 software.

4. Discussion/Analysis

Of the 500 questionnaires sent, 109 were returned (a 21.80% response rate). A non-response bias test of the respondents who returned the questionnaires on time or late showed that there were no issues of non-response bias. We divided the responses into two groups based on the time of arrival. We then conducted a *t*-test on the differences between the answers for each research

variable. Between the two groups, no significant differences were found. Demographic analysis of the respondents showed that the respondents of this study were mostly male (63.30%), had a working life of more than five years (55%), had an undergraduate educational background (81.70%); and were over 40 years old (52.30%).

The results of the composite reliability (CR) and the average variant extracted (AVE) are presented in Table 1. Reference [23-30] suggested that to be considered adequate, the loadings must be at least 0.60 and ideally

0.70 or higher. All indicators in Table 1 have a loading value above 0.60, which indicates adequate loading. The CR values in Table 1 are between 0.808 and 0.857, showing that the CR coefficients for the constructs are all above the accepted level of 0.70 [21]. Convergent validity is assessed using average variance extracted (AVE). Table 1 indicates the fulfilment of the AVE value, with the AVE value greater than 0.50. This is in accordance with reference [22] and [31] which stated that in order to be considered to have an adequate convergent validity, a construct should have a AVE value of 0.50 or higher.

Table 1. Composite reliability and average variance extracted results

			Std Loading	Std Loading ²	Measurement Error	Composite Reliability	Average Variance Extracted
X1	<---	HC	0.752	0.566	0.434	0.836	0.506
X2	<---	HC	0.681	0.464	0.536		
X3	<---	HC	0.606	0.367	0.633		
X4	<---	HC	0.796	0.634	0.366		
X5	<---	HC	0.707	0.500	0.500		
X6	<---	CC	0.663	0.440	0.560	0.808	0.514
X7	<---	CC	0.751	0.564	0.436		
X8	<---	CC	0.775	0.601	0.399		
X9	<---	CC	0.673	0.453	0.547		
X10	<---	SC	0.672	0.452	0.548	0.857	0.547
X11	<---	SC	0.703	0.494	0.506		
X12	<---	SC	0.788	0.621	0.379		
X13	<---	SC	0.778	0.605	0.395		
X14	<---	SC	0.749	0.561	0.439		
X15	<---	OP	0.763	0.582	0.418	0.856	0.546
X16	<---	OP	0.727	0.529	0.471		
X17	<---	OP	0.840	0.706	0.294		
X18	<---	OP	0.770	0.593	0.407		
X19	<---	OP	0.776	0.602	0.398		

The overall model fit criterion needs to be evaluated in SEM. This shows the consistency between the developed model and the data. When the implied-model covariance matrix is equivalent to an empirical covariance matrix, the

model is said to be in accordance with the observed data [23]. Figure 1 shows the results of the full latent variable model.

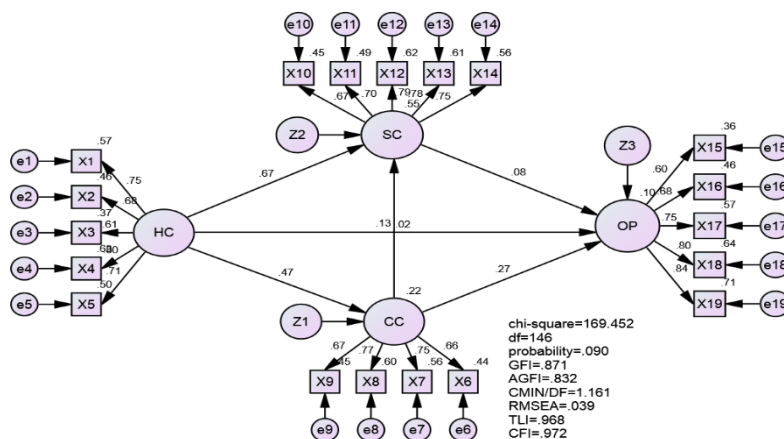


Figure 1. Structural equation modelling results

The evaluation of the criteria for goodness-of-fit models is shown in Table 2. The Chi-square for the model has another name as the discrepancy function, likelihood ratio chi-square, or chi-square goodness of fit. The chi-square value in AMOS is called CMIN. The model is accepted as "fitting", if the difference (expressed as a chi-square variant) between the implied covariance model and the observed covariance sample is smaller than the expected distribution value with a probability usually

decided at a threshold of 0.05 [32]. This study found that if the fit statistic (169.452) is less than the value expected (175.197), with a probability of occurrence > 0.05 , then the model is accepted as "fitting". Reference [33] argues that although there is no consensus, the minimum recommended ratio acceptable for CMINDF ranges from as high as 5.0 to as low as 2.0. Therefore, the CMINDF value of 1.161 shows an acceptable fit.

Table 2. Overall model fit evaluation

Fit Measure	Default Model	Saturated	Independence	Cut off	Macro	Explanation
Discrepancy	169.452	0.000	1018.140	Low chi-square relative to degrees of freedom with an insignificant p value ($p > 0.05$)	CMIN	(146;0.05)=175.197*
Degrees of freedom	146	0	171		DF	Good
P	0.090		0.000		P	Good
Discrepancy/df	1.161		5.954	$\leq 2,00$	CMINDF	Good
GFI	0.871	1.000	0.346	$\geq 0,90$	GFI	Good
Adjusted GFI	0.832		0.274	$\geq 0,90$	AGFI	Good
RMSEA	0.039		0.214	$\leq 0,08$	RMSEA	Good
Tucker-Lewis index	0.968		0.000	$\geq 0,95$	TLI	Good
Comparative fit index	0.972	1.000	0.000	$\geq 0,95$	CFI	Good

The GFI (0.871) and AGFI (0.832) values of this sample are below 0.90. However, the sample size determines the values of GFI and AGFI [25]. The GFI and AGFI indicates a relatively good fit because it has a value close to 0.90. Reference [39] and [26] suggests that the RMSEA value is said to be good if it has a value of less than 0.05. Therefore, the RMSEA value (0.039), which is less than 0.05 in this sample, indicates that the value is an acceptable fit.

According to reference [27], in order to be considered to have a good fit, the TLI value must be more than 0.95. In this sample, the TLI index (0.968) is above that criterion so it can be accepted. Reference [27] also suggested that the values for the CFI range between 0.0 and 1.0, with values greater than 0.95 are recognised as indicative of a good fit. The CFI in this sample shows an acceptable fit with a value of 0.972.

The results of the hypothesis testing are presented in Table 3 and show that human capital is positively associated with customer capital (coefficient = 0.467; $p < 0.001$). Therefore, hypothesis H1 which states that human capital is positively associated with customer capital is

supported. These results indicate and illustrate that human capital and tacit knowledge of banks and financial institutions in Bali Province are able to create value creation for companies and do the job in the best way. Thus, the company feels it has gotten the best from its employees, which makes the company different from the others and it is confident that consumers will continue to do business with the company.

Creativity and intelligence make human capital able to establish relationships within and outside the organisation. That ability can stimulate people outside the organisation to work with the company so that the company believes that consumers will continue to do business with the company. That is because human capital is a characteristic and intellectual quality of the people of the company who must react to changes in the market and customer needs [11]. Good management of human capital causes banks and financial institutions to be able to transform tacit knowledge that is personal, difficult to formulate, communicate and share knowledge with others that is inherent in the company's external relations. These findings are similar to the findings of [3] and [12].

Table 3. Hypothesis testing results

			Estimate	S.E.	C.R.	P	Conclusion	Result
CC	<---	HC	0.467	0.149	3.603	***	Significant at $p < 0.001$	H1 is supported
SC	<---	HC	0.672	0.170	4.684	***	Significant at $p < 0.001$	H2 is supported
SC	<---	CC	0.128	0.112	1.179	0.239	Not significant at $p < 0.05$	H3 is not supported
OP	<---	HC	0.020	0.177	0.107	0.915	Not significant at $p < 0.05$	H4 is not supported
OP	<---	CC	0.265	0.115	1.871	0.061	Not significant at $p < 0.05$	H5 is not supported
OP	<---	SC	0.077	0.146	0.417	0.677	Not significant at $p < 0.05$	H6 is not supported

The finding of the strong effect of human capital on structural capital in the hypothesis 2 testing of this study shows that banks and financial institutions in the Province of Bali have a good ability to transform the knowledge of individual employees—which are not articulated—into non-human knowledge that is more concrete. For example, into written documents or electronic documents. The company realises that human capital is the most important resource for the company. If all employees leave, the company will lose its activities. With their intelligence, employees give all their efforts including great ideas to the company. By implementing and developing these great ideas, the company becomes more efficient and information can be accessed more easily.

The company also realises that employee knowledge is a source of innovation and a renewal strategy. With creativity, intelligence, constant thought about actions as a whole, and working in the best way, an employee has encouraged companies to develop more ideas and new products than other companies in similar industries. The existence of potential, creative, smart, and well-managed human capital in banks and financial institutions in Bali Province has been proven to be able to improve and enhance corporate knowledge (structural capital). For example, organisational routines, procedures, systems, culture, databases, etc. These findings are similar to the findings of [32,33].

The Hypothesis 3 test results illustrate that customer capital in banks and financial institutions in the Province of Bali has not been able to improve structural capital. Achieving market share, meeting with consumers, understanding the target market, and the belief that consumers will continue to do business with the company, has not made the company more efficient. The finding of a positive and insignificant relationship can be understood because compared to human capital and structural capital, customer capital is the most difficult to codify [3]. The company's inability to codify external knowledge into company knowledge can be caused by managers who are not aware that customer capital (in a broad sense) can enrich company knowledge. In their strategic policy, managers are not market oriented which results in consumer dissatisfaction.

The Hypothesis 4 and 5 test results illustrate that human capital and customer capital in banks and financial institutions in the Province of Bali that do not have the support of other elements of intellectual capital have not been able to support better organisational performance. Even though employees are creative, smart and always work in the best way, without structural capital as a medium for creativity—for example, a supportive and comfortable corporate culture and atmosphere and good

employee income ratios—optimal organisational performance cannot be fully realised. These findings support the findings of [28, 29] who did not find a significant positive effect of human capital on organisational performance.

Despite having a high market share, the time to solve consumer problems has been reduced, and confident consumers will continue to do business with the company. However, that has not been able to encourage increased corporate profits. Mastery of market share, the reduction of time to solve consumer problems and the belief that consumers will continue to do business with the company does not have a significant impact without a good company process. These findings support the findings of [28] who found that customer capital did not have a significant positive effect on organisational performance.

The Hypothesis 6 test results illustrate that structural capital in banks and financial institutions in the Province of Bali has not been able to play a role in significantly increasing organisational performance. The company's efforts to codify company knowledge and subsequently develop more ideas and new products compared to other companies in similar industries and the existence of a data system that makes it easy to access relevant information has not been able to provide a significant competitive advantage for the company. These findings support the findings of [30] and [32], who did not find a significant positive effect of structural capital on organisational performance.

An in optimal role of structural capital in supporting organisational performance is often triggered by the lack of use and management of company knowledge. Often the system and bureaucracy are bad. Even members of the organisation are still reluctant to take advantage of company knowledge such as existing technology. This causes the intellectual capital as a whole to not reach its fullest potential, so that organisational performance is not optimal. Isolated knowledge cannot positively affect organisational performance.

5. Conclusion

Considering the important role of people in SCM, investigation of the antecedents of SCI from a human resources perspective is needed. Human capital is significantly positively related to customer capital and structural capital shows that with its tacit knowledge, human capital supports value creation; namely customer capital for the company. The company transforms tacit knowledge into knowledge inherent in the company's external relations and transforms the knowledge of individual employees into non-human knowledge. Customer capital that is not positively and significantly

associated with structural capital shows that external knowledge obtained from relationships with consumers, suppliers, government or industry associations has not been well codified in company knowledge.

Human capital that was not found to be positively and significantly associated with organisational performance indicated the need for media or tools to be creative for human capital, so that it could support the achievement of better organisational performance. Customer capital is positively not significantly related to organisational performance, reflecting that external knowledge has not been used optimally to support the achievement of organisational performance. Structural capital was found to be positively related, but not significantly related with organisational performance. This shows that the company's efforts to codify company knowledge and develop structural capital have not been able to support the achievement of better performance.

The results of this study have implications for academics and researchers to conduct a deeper exploration of intellectual capital, so that theories about intellectual capital and its effects on supply chain management can be obtained. To be able to generalise the results of this study in a broader scope, the next theoretical implication as future research is that academics and researchers can conduct similar research by taking on broader objects. Future research can also expand the intellectual capital model by adding other variables as elements of intellectual capital, such as social capital, technological capital, and spiritual capital.

The results of this study have several implications for bank managers and financial institutions in Bali Province: 1) to build a stronger orientation for consumers; 2) to utilise human capital to transform knowledge into non-human knowledge, so knowledge can be improved in organisations, including routines, procedures, systems, culture, databases, and so on; 3) to be more market-oriented by investing and focusing on consumers and becoming market determinants so that organisations will be able to create routines and organisational processes that are efficient and can serve consumers well; 4) to realise that the individual existence of human capital and customer capital cannot create a better competitive advantage; and 5) to realise, utilise, codify and develop organisational knowledge so that long-lasting competitive advantage can be achieved.

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