Dynamic System Simulation Approach between Tacit Knowledge against Innovation

(Case Study: SMEs Leather Works, Yogyakarta)

Robin Christianto, Augustina Asih Rumanti, and M Nusem Hudiantoko

***Abstract*—Individual tacit knowledge into a powerful weapon for the organization in developing products in terms of innovation and cannot be replicated by other organizations because of the knowledge inherent in individuals of the organization concerned, especially those in small and medium level (SMEs). This study will be conducted in SMEs Leather Work, Special Region of Yogyakarta.**

Indicators of tacit knowledge which affect the improvement will be useful innovation into product development stages, namely innovation. Stages in promote innovation is a necessary stage by an organization, especially SMEs to innovating product. The purpose of this study is to provide a step-by-step what to do to increase innovation through the influence of tacit knowledge existing in individuals of SMEs Leather Work.

The results of this study are proposed innovation, based on the highest leverage indicators of tacit knowledge for innovation by using simulation of dynamic systems.

***Index Terms*—Tacit knowledge, innovation, SMEs, dynamic system simulation, product innovation.**

I. Introduction

The world economy is growing rapidly has the effect of increasing competition in every organization. Intense competition requires each organization that have similar products to survive and develop their business. Business development must be accompanied with a good knowledge management, one of which individual knowledge is a factor in improving innovation in order to develop their business and can compete with other businesses that have similar products. Organizations that are able to manage his knowledge optimally be able to survive in a competitive environment. This study was conducted in small and medium enterprises (SMEs) by the leather in the area of Yogyakarta. Products produced in SMEs work this leather consists of chandeliers, spot lights, leather works, key chains, miniature puppets, bookmarks, leathers fan. The company is just focus on making chandeliers, spot lights, leather work and key chains.

The study was conducted on SME leather works is because the business is classified as a medium leather work and still in need of improvement and individual development knowledge useful for developing product innovation efforts. Looking at the destination SME leather work to develop innovative products, leather work SMEs should know what are the steps that can be taken and used in order to achieve the desired level of innovation which SMEs work of the leather to grow and remain competitive in a competitive environment.

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II. Theory

A. Definition of Knowledge

Knowledge is a mixture of experience, values, contextual information, and expert view of the fundamental intuition that gives the environment and framework to evaluate and integrate new experiences and information [1].

B. Tacit Knowledge

Tacit knowledge is one type of human knowledge is very difficult to be disclosed in full (complete), it can even be said that the characteristic of tacit knowledge is the difficulty of knowledge to be described with words [2].

C. Relationship Tacit Knowledge and Explicit Knowledge

The process of knowledge creation is a spiral process which is the interaction between tacit and explicit knowledge. The interaction of this knowledge generates new knowledge. [3] describes the four processes of knowledge conversion: socialization, externalization, combination and internalization. Each process involves changing one form of knowledge *(tacit* or *explicit)* to other forms of knowledge *(tacit* or *explicit).* This model focuses on how knowledge and identify and assess the activities of particular importance in knowledge management. There are four steps the creation of knowledge, namely:

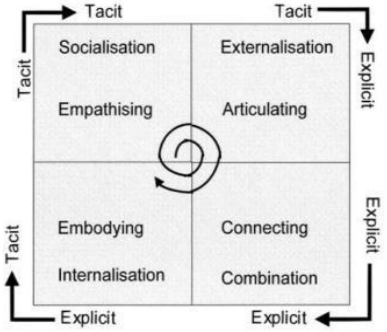

Fig. 1. Conversion of knowledge.

1) Socialization

Socialization activities include a variety of tacit knowledge between individuals. The term socialization is used, because the *tacit* knowledge disseminated through joint activities such as living together, spend time together not through written or verbal instructions.

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2) Externalization

Externalization requires the presentation of *tacit* knowledge into a more general form that can be understood by others. In this externalization stage, the individual has a commitment to a group and become one with the group.

3) Combination

The combination includes the conversion of explicit knowledge into explicit knowledge in the form of a set of more complex.

4) Internalization

Internalization of new knowledge is the conversion of explicit knowledge into tacit knowledge organization. Individuals must identify the relevant knowledge to the needs in the organizational knowledge.

Each stage of knowledge conversion to impact the following:

- *Tacit to tacit knowledge:* impact on innovation;
- *Tacit to explicit knowledge:* impact on standardization;
- *Explicit to explicit knowledge:* impact on control;
- *Explicit to tacit knowledge:* impact on empowerment.

D. Innovation

Innovation can be regarded as a process whereby organizations identify problems that occur and seek new ways to solve the problem [2].

Innovation is very important for the success and survival of the company. Innovation is a process when companies identify their own problems and get new solutions (new knowledge) to solve the problem [4].

Innovation is the economic success thanks to the introduction of new ways or new combinations of old ways of transforming inputs into outputs (technology) that produce large or drastic changes in the ratio between use value perceived by consumers on the benefits of a product (goods and / or services) and the price set by the manufacturer. Successful innovation is innovation that create greater value for the consumer, or the community, and the environment at the same time [5].

E. Dynamic System

System Dynamics developed as a method, system dynamics study the problem with the system point of view. The system elements interact in a feedback structure (causal loop) so as to produce a particular behavior. System dynamics can incorporate aspects of the environment outside the organization to be taken into account as a factor of cause and effect [6].

System dynamics is a methodology for understanding a complex problem [7], [8]. This methodology focused on policy making and how these policies determine the behavior problems that can be modeled by the system dynamically [8].

III. MATH

This research methodology outlines a complete stage of stages or steps required in the manufacture of the final project report. These stages are encountered during the process of preparing reports, ranging from the determination of the research topic, by giving advice to SMEs Leather Works. The purpose of the research methodology is to limit the research and make research focused on the main goal of research made.

Scheme overall research methodology, ranging from the determination of the research topic to conclusions and suggestions can be seen in Fig. 2 below.

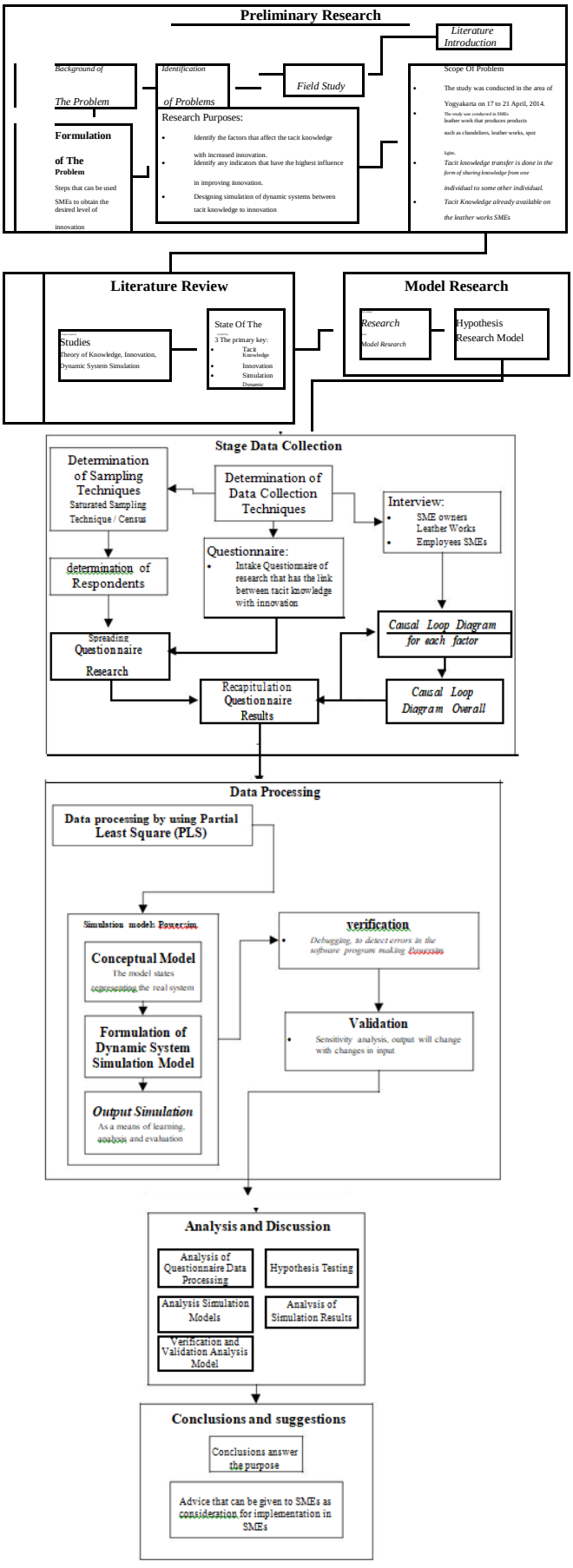

Fig. 2. Problem-solving systematics.

IV. Data Processing

These are the data collecting and processing explained in detail:

A. Pilot Testing

The research is processed by *smart software PLS,* the following Fig. 3. Line Research Model with *Partial Least Square.*

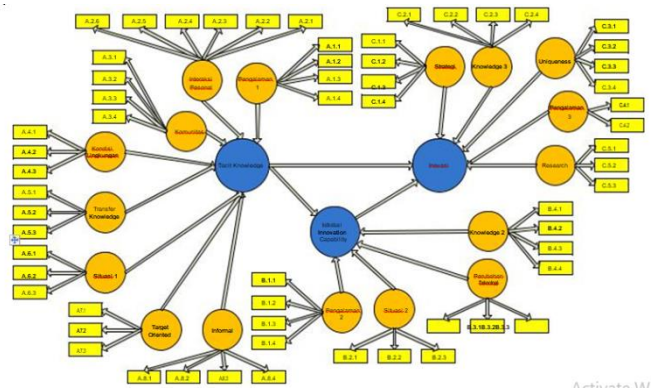

Fig. 3. Line research model with partial least square.

Below is a summary table of data processing by using the Smart PLS.

TABLE I: Table Recapitulation SmartPLS

Endogen	Path (endogen)	Eksogen	t.effect (eksogen)	Indicator	F.Loading	Cross Loading	AVE	CR
Individual Innovation Capability	3.322838	Knowledge 2 (B4)	4.348233	B.4.1	-0.791	X	0.566301	x
				B.4.2	0.741	fit		
				B.4.3	-0.804	X		
				B.4.4	0.667	X		
Innovation	3.322838	Experience 3 (C4)	4.018607	C.4.1	0.877	X	0.808301	fit
				C.4.2	0.921	fit		

From the table on the experience of exogenous constructs only endogenous innovation constructs are valid in order to get the model results with the Smart PLS processing.

B. Simulation of Dynamic Systems

Of the conceptual model is seen that the Innovation Capability Individual variables do not have the constituent variables and indicators. The indicators used should have an input in the form of value that will run on Powersim, so that the conceptual model in this study can not be simulated. Simulation models are incorporated into the software Powersim in Fig. 4 below:

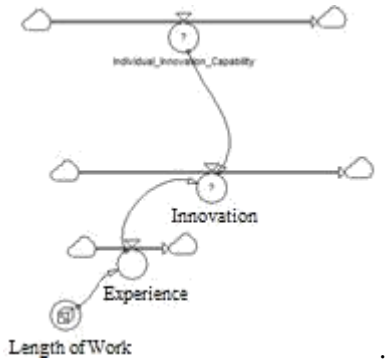

Fig. 4. Dynamic system simulation model.

The model that has been disposed of some constructs endogenous, exogenous and indicators it can not proceed with the tools powersim, it would be predicted constructs that have the highest influence on innovation with tools powersim proceed with the initial model illustrated below that had previously been attempted by *fitting* the model to the software SmartPLS. The simulation model is formed can be seen in Fig. 5.

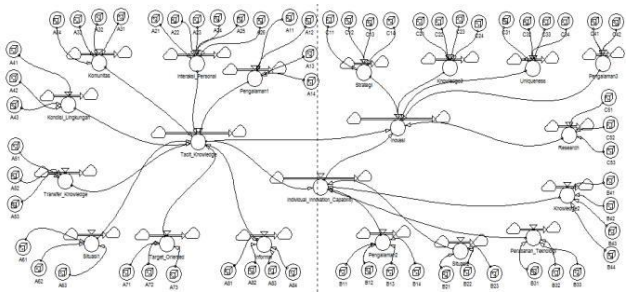

Fig. 5. Dynamic system simulation model.

The output of the initial model simulations tacit influence on innovation in SMEs Leather work can be seen in Fig. 6.

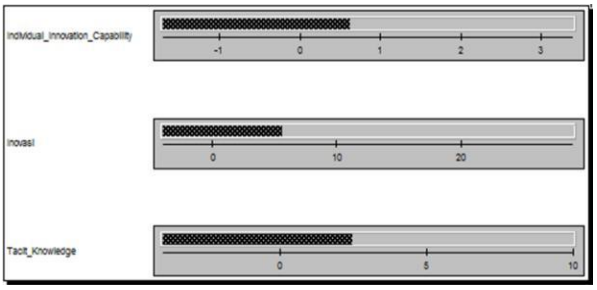

Fig. 6. Output simulation results.

As it can be see in Fig. 6. The simulation results constructs endogenous innovation value for 10 times with an average of 11:15 which is the initial value. Furthermore, researchers aimed to identify any indicators that when enhanced to provide the maximum increase in the value of innovation. The identification is done by maximizing the value of the indicator, where the maximum value for the indicator is 5. The indicators included in the simulation model in this study were 12 8 indicators derived from endogenous construct *tacit knowledge,* and 4 of the construct of *individual* endogenous *innovation capability.* The process of maximizing the value of the indicator will notice combinations that may occur from the 12 indicators.

Combinations that may occur in the process of maximizing the indicator is divided into 3 stages include maximizing each one indicator, maximizing 2 indicators, and maximize the 4 indicators of each construct endogenous *individual tacit knowledge* and *innovation capability.* In order to maximize the first indicator there are 32 combinations, then to maximize the two indicators are 168 combinations, and maximize the 4 indicators there are 70 combinations.

In any process of maximizing this indicator, it will be observed that the value of the innovation generated. If the difference between the value of the innovation process is to maximize the value of the indicator with the initial innovation is positive then the value of innovation has increased, whereas if the difference value is negative then the value of innovation has decreased.

Of maximizing process can be seen best in combination to maximize two exogenous constructs give rise to innovation is to maximize the value of the indicator "personal interaction" and *"transfer of knowledge"* which resulted in an increase in the value of the highest innovation of 65.14%.

V. Analysis

A. Partial Least Square

Of treatment with exogenous constructs *Smart PLS* only experience on innovation endogenous constructs are valid. To test the hypothesis, it can be seen the value of the T-statistic. Limits to reject and accept the proposed hypothesis is ± 3182, where if the value of the T-statistic is in the range -3182 and 3182 the value of the hypothesis will be rejected or, in other words accept the null hypothesis (H0). The hypothesis in this study were divided into three, namely:

- The first hypothesis (H1) stated that *Tacit Knowledge* positive effect on *individual innovation capability*. The test results of the parameter coefficients between *Tacit knowledge* on *innovation capability Individual* showed no effect whatsoever, with the value of the T-statistic of 0.001107 is the value range -3182 and 3182, thus the first hypothesis is rejected.
- The second hypothesis (H2) stated that the *Individual tacit* knowledge to provide support for innovation. The test results of the parameter coefficients between *Individual tacit knowledge* to innovation shows no effect whatsoever, with the value of the T-statistic of 0.586897 is the value range - 3182 and 3182, thus the second hypothesis is rejected.
- The third hypothesis (H¬¬3) states that the *Individual innovation capability* positive effect on organizational innovation. The test results of the parameter coefficients between *Individual innovation capability* to show there are significant innovations, with the value of the T-statistic of 3.322838 is outside the range of values -3182 and 3182, thus the third hypothesis is accepted.

B. Simulation of Dynamic Systems

Conceptual model obtained from the Smart PLS can be seen that the model can not run on software PowerSim as constructs that affect innovation that does not have the capability of individual innovation constituent variables and indicators. The indicators used should have an input in the form of value that will run on PowerSim, so that the conceptual model in this study can not be simulated.

Results Smart PLS software that constructs a model that has been discarded and the indicator and can not be simulated by using the software powersim, then made predictions using [2] to identify any indicators that have the highest influence in promoting innovation. The identification is done by running a simulation model of [2] with the output value of innovation as a benchmark early. The identification is done by maximizing the value of the indicator, the indicator included in the model amounted to 12. The process of maximizing the value of the indicator is divided into three stages, namely maximizing each indicator 1, 2 and 4 indicator indicator of endogenous constructs each individual tacit knowledge and innovation capability.

The highest indicator value in the process of maximizing one indicator contained in a combination of 2 indicators, namely the indicator "personal interaction" and "knowledge transfer" with the increase in the value of the highest innovation of 65.15%. From the summary table maximizes indicator with 1, 2 and 3 indicators can be seen that there is a percentage change is negative. The percentage change is negative means a decline in the value of innovation, a positive value means an increase of the value of innovation.

VI. Conclusions and Suggestions

A. Conclusions

Here are the summary of the research:

1) Tacit Knowledge a negative impact on innovation.
2) Individual innovation capability provides a positive influence on the improvement of innovation
3) Work experience of each employee can provide a direct influence on the increase in innovation
4) Knowledge gives a positive influence on individual innovation capability that also affect the increase in innovation.
5) Personal interaction and knowledge transfer of the highest impact in improving innovation.

B. Suggestions

1) The number of question items should be made sufficient to be able to measure constructs that exist.
2) Filling in the questionnaire should be guided in order to obtain answers to each question in accordance with the actual situation.
3) Invalid indicator should be eliminated and then replaced with the indicator questions in a language that is more understandable respondents.

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