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## **The Application of Soft System Methodology (SSM) in Extraction of Knowledge in the Field of Research [Case Study: Faculty of Information Communication and Technologies (ICT) in Institute of Business University Dili Timor Leste]**

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### ***Abstract:***

*The provision of higher education should participate in the development of science and technology directed to strengthen national research centers on their core competencies each of the partnership of national research institutions will get new findings of a characteristic in academic excellent, economy impact even social benefit. In the process of its application, the researchers found some difficulties in doing the extraction of knowledge in the field of research. The differences in the level of knowledge, understanding, character and environment that affect each individual student and lecturer in order to the researchers cause potential problems in applying research knowledge. The method known as Soft System Methodology (SSM) is applied in this study to help solve problems and as a reference to knowledge extraction modeling. The result of the application of this method is that problems in organizing knowledge of knowledge extraction in the field of research have been identified. The next step of this research will be explained in the Rich-Picture supported by CATWOE analysis which will be compared with real-world conditions to model the knowledge extraction model. The extraction of knowledge for this institute is in applying knowledge extraction in the field of research has been successfully modeled using the Soft System methodology.*

***Keywords:*** Knowledge management, extraction of knowledge, research, soft system methodology, IOB, CATWOE.

### **1. Introduction**

According to the decision of law No.2 / 2008 dated January 16, which defines the structure of the education department, it is reaffirmed in paragraph 1 of article 6, universities and institutes, is general, education at a university or institute endowed with administrative, patrimonial, scientific and educational under the authority of the government, relegating explicitly to have decisions and explanations of the organization and operation.

The educational aspect, especially in the field of science and research, certainly plays an important role, therefore East Timor Institute of Business (IOB) is the highest and largest educational institution in Timor Leste that concentrates on knowledge resources in the field of business economics, research and information of communication (ICT).

The importance of the extraction of research knowledge in an institute encourages the development of knowledge management systems with features that facilitate the knowledge process as it has been before. The institute's wealth is expected to be stored and used in an effort to optimize research. The main concern of the model of extraction of knowledge at the institute to be designed is a model that can facilitate the process of capture and documentation in the process of knowledge in the field of research, so it is expected and utilized in order to impact the quality improvement of knowledge extraction activities at the Institute of Business (IOB). Improving the quality of knowledge in the field of research at IOB is currently an ongoing activity undertaken to maintain the survival and competition of the institute, this study aims to identify, describe and analyze the process of quality improvement and create a model that can be used for knowledge extraction process fields research that is by utilizing the SSM method is designed to handle situations where humans are faced with problems especially real-world problems in the organization.

## 2. Literature Review

Soft System Methodology (SSM) as one of the approaches to find and solve problems in the organization has been done by many researchers before. Glenda (2010) entitled "Using Soft Systems Methodology to Approach the Complexity of Innovation in Educational Technology" where the results of this study can define innovation as a new and useful way to solve existing education problems, such as improving students' understanding of content. The case study focuses on rebuilding research and professional skills modules to provide support for students through the use of formative feedback in order to improve academic research and confidence skills.

From Niu's jurnal (2011) titled "*Using Soft System Management to Improve requirements practices: an exploratory case study*", investigate and find hypotheses that SSM approach will identify all the deficiency in requirement practice and give suggestion and correction which are suitable with organization context. This research analyses problematic requirements in software-intensive practice, the ongoing socio-technical project, model change potential, and ask project team to review changes suitable with the organization. The conclusion result is SSM can define and reveal occurring deficiency although it is not completely answered, and its implementation has given positive contribution to organization development. (4)

Luciana and friends (2012) in "Knowledge Capture based on SSM in Satya Wacana Christian University promotion section which the research result gives role model which can facilitate capture process and documentation knowledge from promotions events which affect in increasing the quality of promotions events in UKSW (5)".

From research "The Increase of Public Library Service Quality by Soft System Approach" by Purboningsih (2014) can be concluded that the numbers of staff, employee and librarian are inadequate, a lot of services programs cannot be afforded because there is a finance problem, the manager has difficulty to give information about book's availability because it still uses manual system in circulation services, some facilities are not effective and these are not being used by visitors (6).

## 3. Methodology

The methodology in this extraction knowledge uses SSM (Soft System Methodology) by several steps added on case study. Overall, this research is done by doing several steps shown in Figure1.

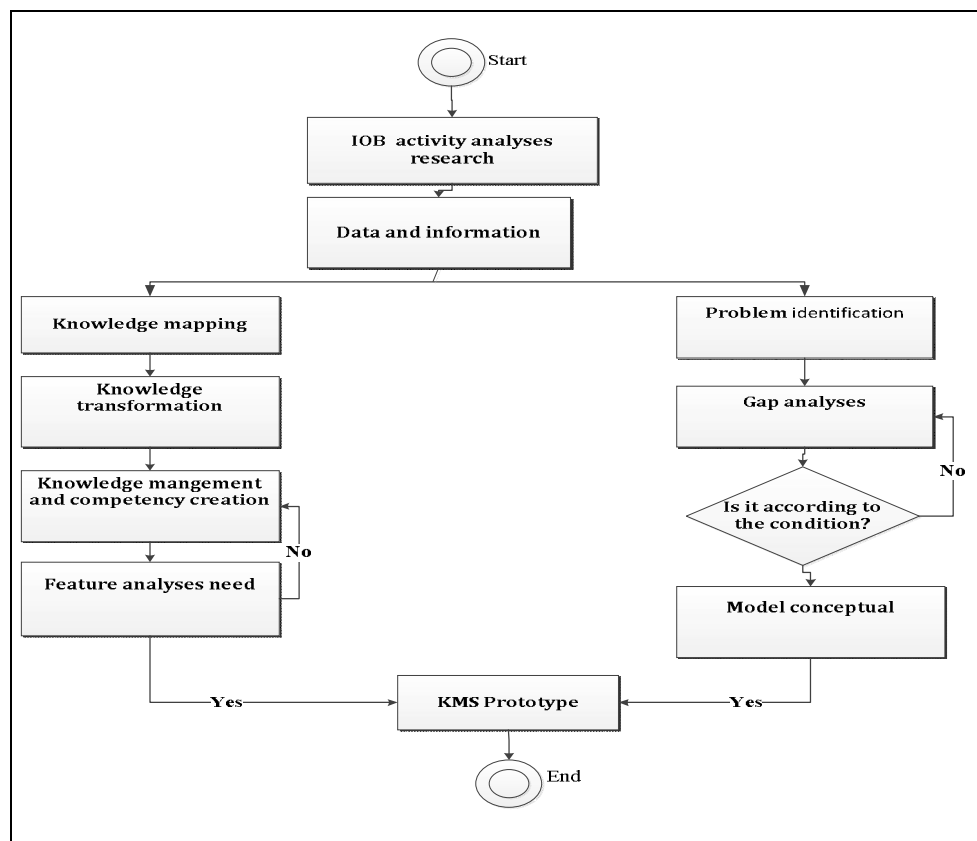


Figure 1: Research Stages

1. IOB activity research analysis. This is the first activity used by the author to know picture and research process. In the step of Figure 1 also will be focused about problem in research conducted by SJ-IOB. This activity aims to understand the type, process, research procedure and also to get first impression about knowledge needs.
2. The data collection. This final project uses primer and secondary data. The primer data taken directly from SJ-IOB and IOB's management and the secondary taken from Focus Group Discussion (FGD) and interview to get research's problem.

3. Problem identification. All the premier data gained through observation, it is used to identify the problem in the research.
  4. The gap analyses. From the identification result will be arranged a conceptual model to research activity.
  5. Knowledge Mapping. The author will do mapping on data and information also knowledge needed to increase the research activity.
  6. Knowledge transformation. Identification on knowledge type collected whether it is tacit or explicit identification type.
  7. Competency creation and knowledge management. The explicit step will easily be identified and given support, infrastructure by create an artifact, while tacit knowledge will identify people who take key role.
  8. Feature need analyses. By doing knowledge mapping, competency creation and analyses through the next knowledge management.
- The last step is KMS prototype. KMS prototype making is an analysis from feature gained from SSM process and also analyses through research infrastructure support.

This research is qualitative research which applies method called SSM to extract the knowledge in research development at IOB Dili, Timor Leste especially in ICT faculty. SSM consists of seven steps. The steps and method implementation are described in the Figure 2.

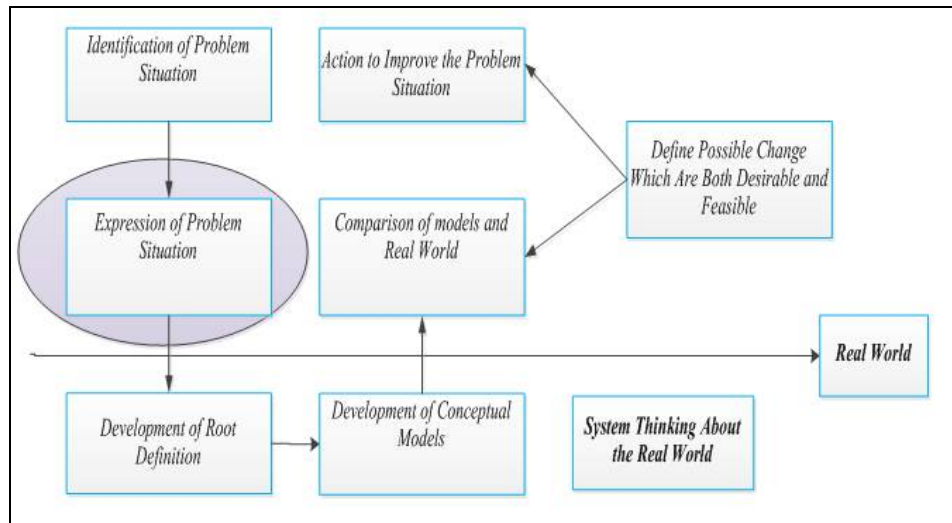


Figure 2: Soft System Methodology Step

The explanation of Figure 2 can be described as follows:

1) Finding Out

On this first step, it is made by identification and short description about situation or problem happen in the organization. The problem intended to be more suitable called as problem situation, because generally there are more than one problem to be solved so the identification is needed one by one. To get to know about the problem, the interview, observation and workshop are done.

2) Expressing the Problem Situation.

Second type, collect the data and information. Data and information are collected by observation, interview, and discussion then formed in to Rich-Picture (9).

3) Root Definitions of Relevant Systems

The third step is make Root Definition (RD), explaining the transformation process. RD's transformation analyses done by using mnemonic CATWOE to identify the stakeholder, transformation, the way of thinking, and environment which are then used build the definition of activity system needed to solve the problem. CATWOE is mnemonic from six very important characters which well formulated in RD. The common model used is Peter Checkland's idea which is modeled in table 1 (9)

<i>C</i>	<i>Customer</i>	Lecturer, SJ-IOB, IOB Management
<i>A</i>	<i>Actor</i>	Lecturer, SJ-IOB Chief, Secretary of SJ-IOB, Reviewer, SJ-IOB Administration Staff, Academic Chief
<i>T</i>	<i>Transformation</i>	To realize research system which get full support from IOB and to involve lecturer's active role in keeping and sharing knowledge and also experience had.
<i>W</i>	<i>Weltanschauung (World view)</i>	The realization of research system which can integrate numbers of supporting system which give positive affect through the increase of researcher numbers and quality.
<i>O</i>	<i>Owner</i>	IOB
<i>E</i>	<i>Environmental Constraints</i>	The system that will be built needs accuracy in catching researcher need, the system development needs active role from all stakeholder at IOB, it needs various socialization and various research activities, adaptation on learning pattern change based on the personal to be based on the community, it needs active role from researcher for program success.

Table 1: CATWOE Analysis Table

Table 1 shows the relevant system built in order to get the full support of IOB. It involves the active role of the lecturers to store and to share the knowledge and experience they have by integrating a number of support systems. So that it will positively impact the increasing number of researchers and improve the quality of the research.

#### 1) Conceptual Models

The fourth stage is modeling system of conceptual system for each system. The model is illustrated by activity model, followed by determining and measuring the performance, efficacy, efficiency, and effectiveness of the model.

#### 2) Comparison with Reality

The comparison between the conceptual model and the reality were conducted in the fifth stage and new ideas for change will usually rise.

#### 3) Debate about Change

In the sixth stage, the results from the previous stages are discussed together with the stakeholders. The results include systematic changes (way and purpose) and it must be feasible to be implemented.

#### 4) Taking Action

This stage provides treatment not only to apply the model and fix the problem but also to take action to fix the problem. From the explanation of SSM approach, we know that SSM is one of analysis method with a system of thinking to analysis the real-world situation which are complex and problematic.

### 4. Analysis, Discussion and Result

The field data obtained by the researcher shows the difficulties and the deficiencies in IOB institute are lack of research conducted by students and lecturers. It happens because facilities and infrastructure are not available and lack of research activities within the institute and lack of lecturers who do not guide in research.

#### 4.1. Problem Identification

From the description above, background is due to less or not optimal research in the IOB then the authors can do some identification problems are done with the fish bone analysis on the Figure three

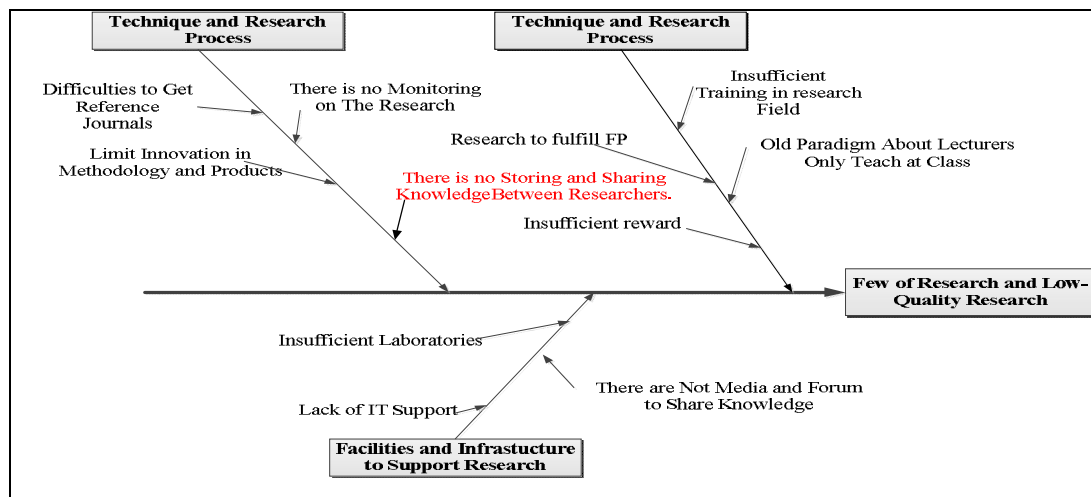


Figure 3: Fish bone analysis

#### 4.2. Human Resources

Figure 3 shows the transmission process of lecturers who are teaching oriented. It increased not only in teaching but also research. First of all, they are provided with training about research. They should know how to make proposal and how to make a research report which is conducted. Most of the research proposals rejected are because of the absence of relation between the part of the research proposal such as the background, the problem, the objectives, the results and the report.

The FP (*Funcao Public*) requires the lecturers to do research in three credits for each semester. This obligation motivates lecturers to do research in order to increase the amount of research. It is unavoidable that many researchers were able to leave their names in young researchers' research who are actually actors in the studies.

The other factor causing few lecturers do research is no appreciation to researcher.

#### 4.3. Research Process

Lecturers or researchers are required to conduct research based on existing research guidebooks and research models (schemes). Each guidebook consists of the way of making the proposal to the way of making reports on research conducted. Besides that, there are guidebooks for researchers and SJ-IOB who conduct interviews.

Lack of innovation means there are difficulties in finding references such as journals and research report conducted by previous researchers. Therefore, researchers should go to the IOB library to find references and to select the appropriate. IOB and lecturers are expected to establish a good synergy among researchers, even though the synergy expected is still far from the expectations.

The results of the study are often different from the previously proposal. For example, the background of the study or the purpose in the proposal are different with the results of the research.

SJ-IOB has not been able to monitor the research conducted because the monitoring process is only done by the ministry of education of East Timor. The monitoring research has a great amount of fund.

#### 4.4. Facilities and Infrastructure

Proposal of research result is done entirely by SJ-IOB Administration Management. Since 2012, They have been saving the documents in softcopy. The research data have done and stored in CDs. The data are in MS. Word or PDF format and can be found in computer laboratories in SJ-IOB. Researchers have to attach their hardcopy file. The hardcopy proposal and the research result are still stored in SJ-IOB then used as an archive for a period of two years.

Support and utilization of IT for research has not been optimal by IOB because IT utilization by the IOB is only limited to IOB website. IOB management states that the lack of IT support makes the searching of references taking longer time and becoming more difficult.

#### 4.5. Description and a Brief Overview of the Expression of the Situation of Knowledge Extraction

To obtain information, researchers conduct interviews with informants involved in the research and obtain information such as tasks and goals stakeholder and its role. This process is also expressed into a real situation of the rich pictures which is depicted in Figure four. The Figure will describe all the existing *actors* on the current situation and also describe some knowledge owned on each need. It occurs when the existence of knowledge extraction by the *actor* has not been fulfilled.

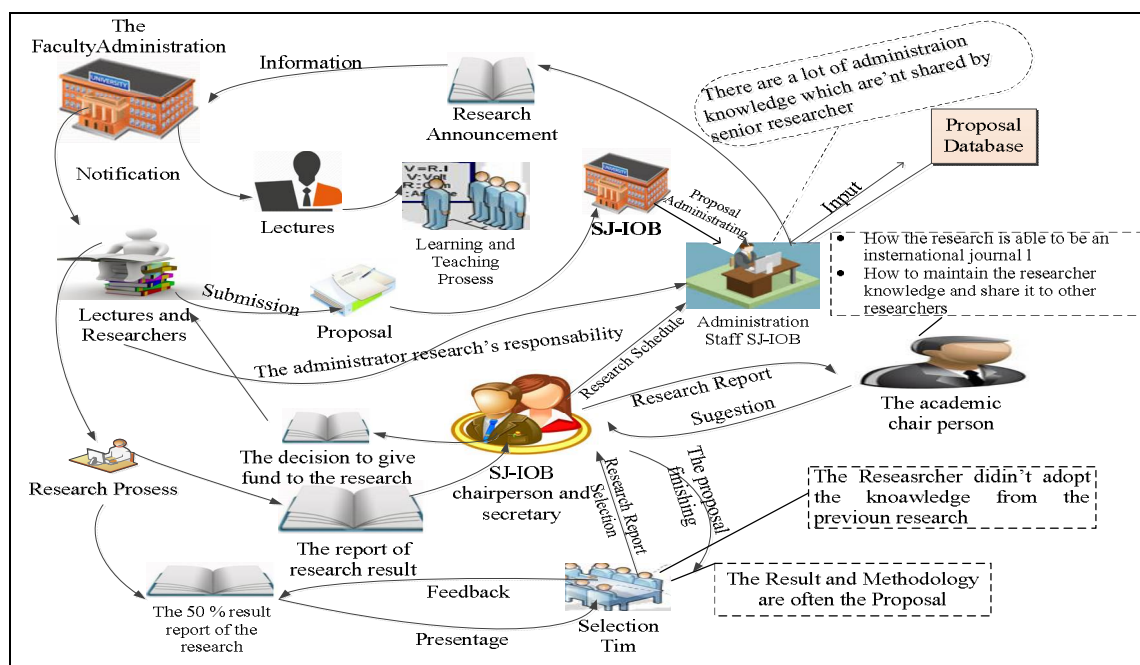


Figure 4: Rich Picture

Figure four shows a rich picture. There is some difference perspective related to the research situation in IOB. Some of them are:

- IOB lecturers have two characteristics, lecturers who are interested in conducting research and lecturers who are only interested in teaching.
- The researchers have insufficient knowledge to conduct a research, so they face difficulties to find the data source, references and to whom they ask the research material.
- The incoming research proposal are still lacking of innovation and methodology.
- The concept of the research conducted are not done well, so the expected results are different from the initial goals as in the proposal
- Many things should be published to researchers in managing of research administration.

#### 4.6. Conceptual Model of Extraction

The modeling concept is the result of the CATWOE analysis and the defining activity of *root definition* that has been previously defined. This conceptual model also consists of things done according to the procedures for transforming *inputs* through the transformation process and producing *output* for IOB research activities explained in Figure five.



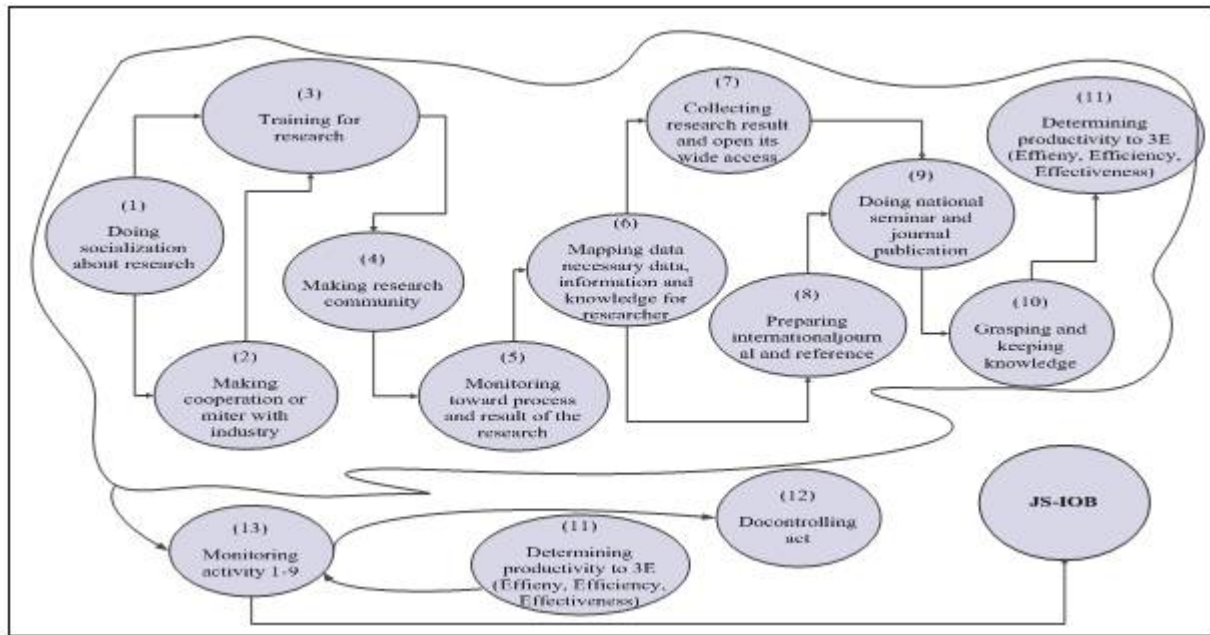


Figure 5: Extraction Conceptual Model

This conceptual model is done by comparing conceptual model which has been made with the real condition of the research in IOB. The aim of this stage is to evaluate the lack of problematic situation in the real world. However, it is more far different because of the conceptual model which has been made is an instrument which is based on a pure side sight, while the real world is colored by various side sight. This conceptual model is done by the researcher through interview with the head of SJ-IOB research Mr. Marlim da Silva, the IOB researcher and the structural on the research center and society devotion in IOB.

#### 4.7. IOB Knowledge Extraction Model

As what has been explained in the part of conceptual model which mentioned that knowledge extraction which wants to reach in this research is the root of conceptual model, then the Figure 6 will describe the concept of knowledge extraction model which can be applied in IOB institute for knowledge extraction process on research field.

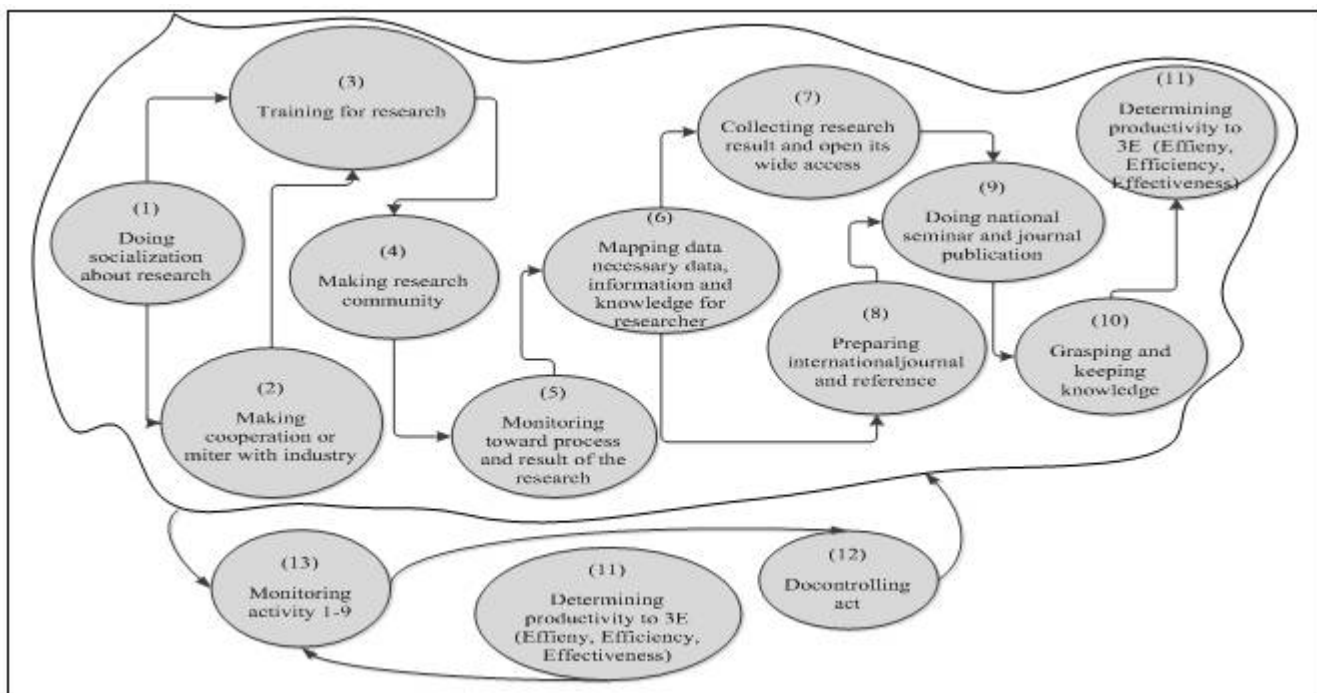


Figure 6: Knowledge Extraction Model

That conceptual model describes a number of process and human activities to do the research in IOB. The summary description from those numbers of process becomes material of discussion with *stakeholder*.

Conceptual model which has been built is rooted from the aim of knowledge extracting in organization in the case of to gain knowledge on the research field in IOB, this conceptual model consists of eleven activities which is done in those extraction model so that the knowledge process on the research field will define some main activities on knowledge which can't be separated from system effect and role.

The purpose of it is to know and to extract various knowledge gotten during handling various knowledge prospected to be knowledge assets of organization.

As what have been explained in the part of conceptual model which mentioned that knowledge extraction which wanted to be reach in this research is the root of conceptual model described the concept of knowledge extraction model which can be applied in organization for knowledge extraction process in research field. This process more focuses on knowledge process in research field because this part is believed as the severe point of knowledge creation and extraction process.

On knowledge process, there are some main steps to extract research knowledge before it becomes knowledge to determine this performance, such as 3E (Efficiency, Efficacy, Effectiveness) to determine the result of discussion and research toward ongoing research process then the extracted result is evaluated in the discussion and interview and also giving opinion. The result of evaluation is arranged and saved to be explicated later as new knowledge.

#### 4.8. The Comparison Model with Real Life

NO	THE CONCEPT OF MODEL'S ACTIVITY	THE PRESENT ACTIVITY	CHANGING PLAN	PARTIES INVOLVED
1	Socialization of research activity	- Announcement through pamphlet to each department - Announced on IOB website	- Arrange a one-year research plan - Conduct an evaluation of the socialization activity that has been done.	- Sentifico Journal of IOB - Head of Department
2	Establish cooperation and partnership with industry	- The activity has not been done yet.	- Seeking potential industries for cooperation and concern for scientific development - Explore all the needs of industry that can support by IOB	- Sentifico Journal of IOB - Head of Academic - Head of Corporation
3	Conduct training for research	- The training of proposal writing - The training of report writing - The training of online journal writing	- Making list the needs of training knowledge - Arrange the schedule of training - Arrange the material of training - Documentation of research result	- Sentifico Journal of IOB - Proposal reviewer
4	Create the research community	- The activity has not been done yet.	- Conduct discussion forum or group virtual as a means for discussion - Renewal the epigram enlightenment journal	- Sentifico Journal of IOB - IOB Lecturer
5	Monitor the process and research result	- The activity has not been done yet.	- Form the monitor team of research activity	- IOB
6	Mapping needs of data, information, and knowledge for researchers	- The activity has not been done yet.	- Logging all the needs of data, information and knowledge related to research activity - Grouping all of the data, information and knowledge based on mapping result - Disseminate the data, information, and knowledge	- Sentifico Journal of IOB
7	Collecting research results and opening its wide access	- Report of research result in the form of hardcopy is collected in SJ-IOB and library. - Softcopy is collected in SJ-IOB	- Doing scan of all research results - Categorize the research result according to the fifth grouping - Showing the softcopy link of research result on IOB website or another IT facility	- Administrative staff - Sentifico Journal of IOB
8	Provide journal and international reference	- The activity has not been done yet.	- Log the journal needs for research - Subscribe that journal - Disseminate that journal through IOB website or another It facility	- Sentifico Journal of IOB - Head of Academic - IOB Lecturer

NO	THE CONCEPT OF MODEL'S ACTIVITY	THE PRESENT ACTIVITY	CHANGING PLAN	PARTIES INVOLVED
9	Organize national seminar and journal publication	- Organize national seminar as well as publication of IOB research results at the beginning or end of the year	- Conducting socialization of national seminar and publication of research result - Invite speakers from the entire colleges - Capturing and storing all	- Sentifico Journal of IOB - Head of Academic - IOB Lecturer
			- Knowledge that appears during seminar and journal publication	
10	Capturing and storing knowledge	- The activity has not been done yet.	- Documenting all knowledge that appears during the research process - Manage the documentation of data, information and knowledge for research	- Sentifico Journal of IOB
11	Evaluation research activity	- Conducting evaluation of research implementation for one year	- Readjustment research road map with implementation of research and result activities - Arrange a changing plan for readjusting research activity with the road map of research result - Spread the questioner to researcher for suggestion and correction	- Sentifico Journal of IOB - Head of Academic

Table 2: Table of Model Comparison

Table 1 describes the comparison model with real life that is done by comparing between conceptual model that has been made with reality condition on research activity that have been done by IOB. This stage is also not intent to assess the shortcomings of problematic situation in the real life, but furthermore that the conceptual model is made as a relief tool based on a pure point of view.

#### 4.9. Alteration/Transformation

The application of research extraction knowledge mechanism is not optimal yet and still uses book recording seen in the IOB institute. This way is considered still manual in the present era and difficult to monitor the level of researchers and lecturers as well as knowledge that is created from the actors are still tacit knowledge.

A conceptualized process based on SSM to model a way of knowledge in the extraction of knowledge that can be recorded and stored well in order to become one source of wealth knowledge in IOB. This concept will offer an ease in monitor and maximize the next level of knowledge. This concept model that has been created map the actors that involved in the process of knowledge extraction, the flow of knowledge mechanism and its integration with the system that can transform tacit knowledge into explicit knowledge.

#### Action



MODEL ACTIVITY	ACTIVITY DESCRIPTION	REQUIRED INFORMATION	MEASURE OF SUCCESS
<b>THE ACTIVITY IN THE SCALE OF SYTEM</b>			
Socialization the research activity	Give the announcement about the research activity to all IOB lecturers through pamphlet that sticks on the department wall magazine	Type of research scheme, the amount of financing in each research, prerequisite of proposal submission	The enhancement number of research proposal submission and the more easily accessible about research announcement
Organize the research of training	JS-IOB conducting training related to proposal preparation, research methodology, online journal writing and report preparation	The rules of proposal preparation and research report, variety and kind of methodology research, technique of report writing	The minimal mistake made by lecturer at the time of proposal creation, research process, writing report, more variety of the methodology that is used
Create the researcher community	JS-IOB creating a community for researcher along with medium discussion forum that facilitated by electronic and technology discussion forum	Lecturers are actively doing research, expertise in each lecturer, forum and the type of information that can be shared	The existence of forum sharing session, the IT support in the form of forum discussion
Improve reward for researcher	IOB making a breakthrough in the form of rewards for researchers such as the provision of honorarium for researchers and the provision of intensive	The model of additional honorarium, the budget of honorarium	Increasing the amount of incoming proposal
Improve reward for researcher	IOB making a breakthrough in the form of rewards for researchers such as the provision of honorarium for researchers and the provision of intensive	The model of additional honorarium, the budget of honorarium	Increasing the amount of incoming proposal
Mapping the needs of data, information and knowledge	All of the data, information and knowledge that is needed for research is mapping and collected	Data, information and knowledge for research process	Obtaining all the needs of data, information and knowledge for the needs of research
Collecting result and opening its v	Collection of all hardcopy and softcopy research	Research that has been done, facilities and infrastructure for research publication	Researcher easier to get the result of research that has been done before
Providing journal and internation	Provision of journals, magazines, and other reference books	The type of journal, and the other relevant references	Availability of journal and other references
Socialization the research activity	Give the announcement about the research activity to all IOB lecturers through pamphlet that sticks on the department wall magazine	Type of research scheme, the amount of financing in each research, prerequisite of proposal submission	The enhancement number of research proposal submission and the more easily accessible about research announcement
<b>THE ACTIVITY OUT THE SCALE OF SYSTEM</b>			
Determine the criteria for 3E (Eff	Define and explain the criteria for 3E (Efficiency, Efficiency, Effectiveness)	The result of discussion and observation of the ongoing research process	Description from the 3E criteria from the system
Monitoring the 1-9 activity	Monitoring of all process activities within the constraints of the system continuously	The achievement of each process activity within the limit of the system	Able to monitor until the system keep to run continuously according to the role
Take the measure of control	Controlling the system as a manifestation of integrated system management	The achievement of each process activity within the limit of the system	Able to control until the system keep continuously and according to its function

Table 3: Table of Model Activity and Result

Table 3 describes the action which is operated from the applying o conceptual model have been made and can be answered and also done because the extraction process which resulted knowledge in form of knowledge document. This action is divided into 2 model's activity consists of:

- Activity on system or on range, there are nine activities begin from doing socialization about research, training for research, increasing reward for researcher, mapping necessary data, collecting result and also opening this wide access, providing journal and reference, grasping and keeping knowledge, and the last is evaluating the research.
- Activity from outside of system or out of range of the system range are determining criteria for 3E (Efficiency, Efficiency, Effectiveness), monitoring activity 1-9, taking action and controlling based on its integrated function and process.

## 5. Conclusion

The conclusions which can be taken are from previous research which has been done toward this work are:

- a. The construction of this final work is done by using soft system methodology. SSM results eleven human activity systems that are doing socialization about research, making relation with another institute or corporation, training for research, making research community, increasing reward for researcher, mapping necessary data; information and knowledge, collecting and keeping knowledge, making publication and national seminar, providing international journal and reference, monitoring process and result of the research.
- b. The process of research knowledge extraction processing for every element was arranged based on the purpose of knowledge, those because accomplishment toward every knowledge is accomplishment toward root definition also.

On this knowledge extraction model, the researcher also gets some findings that are the differences between the stage of knowledge; understanding; character and area which affects every student or research lecturer so it causes potential problem on applying research knowledge.

This knowledge extraction research also gives change and results components also makes components which is believed that it gives knowledge along with the plot which have to be followed to give new knowledge. The new knowledge is documented and kept on repository or proposal database as material of evaluation and maintenance.

## 6. Suggestions

Knowledge designing for this research is still far from perfectness, so it is needed some constructed advices in order to the resulted knowledge becomes more perfect. There are some advices, that are:

- a) The next researcher is expected to develop research information research to accommodate all of knowledge on research field in IOB especially in SJ-IOB.
- b) Observation and adjustment toward culture and organization structure of IOB is needed, so the modeling application with SSM which is resulted can support the mechanism of knowledge transfer through organization structure.
- c) SJ-IOB is expected to always make routine discussion and evaluation to discuss various research topic in IOB.
- d) Evaluation toward the implementation of the applied knowledge designing is important, so that it can evaluate the affectivity and efficiency of knowledge exchange.
- e) IOB institute or government is expected to help researchers on injection to accelerate research process.

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