



APPENDICES

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright© by Chiang Mai University

All rights reserved

APPENDIX A
QUESTIONNAIRE

Organization Name.....

Name of the Interviewee.....

Designation..... Years of Experience.....

Part 1: Acquisition Phase

For: Planning Engineers of Power Utility

1. How do you plan power transformer in order to acquire it?

i.) Designed Load Demand ii.) Actual Load Demand

2. List all the major activities that are performed to acquire new power transformer.

.....
.....
.....

3. How do you derive designed load demand of each power transformer for the next 20 years?

.....
.....
.....

4. What are the factors associated with the load violation of power transformer in the early stage of their life cycle?

.....
.....
.....

5. List all the services provided by the supplier that you have included in the bidding documents.

.....
.....
.....

6. What are the documents and drawings of power transformer that you have received from the supplier during procurement?

.....
.....

For: Manufacturer/Supplier of Power Transformer

7. What are the factors associated with the total cost of power transformer?

.....
.....
.....

8. List all the activities that you have done during the acquisition phase of power transformer.

.....
.....
.....

9. What is the contribution of each factor (*in percentage*) to the total cost of power transformer?

.....
.....
.....

10. For how long, you need to hire supervisor or experts for conducting the following tasks of each power transformer. (Express in days)

i.)..... Installation

ii.)..... Commissioning

iii.)..... Training

Does it depend on the capacity of power transformer?

i.) Yes ii.) No

Part 2: Operation and Maintenance Phase

For: Operation & Maintenance Engineers/Technicians of Power Utility

11. How much have you planned yearly for the normal operation and maintenance of power transformers? Express in percentage.

.....

12. How do you operate and maintain the power transformer on the network?

.....

.....

.....

13. List all the skills that are required for the operation and maintenance engineers/technicians.

.....

.....

.....

14. What are the necessary information/knowledge required about the power transformer for better operation and maintenance?

.....

.....

.....

APPENDIX B

KNOWLEDGE REPRESENTATION of PT

The knowledge associated with power transformer is captured from interviewing with senior engineers, supervisors and technicians who have been operating on power transformers and is represented with knowledge-mapping. It is categorized into three parts: domain, task and inference knowledge based on hidden or reusable knowledge of power transformer.

B.1 Domain Knowledge

B.1.1 Commissioning

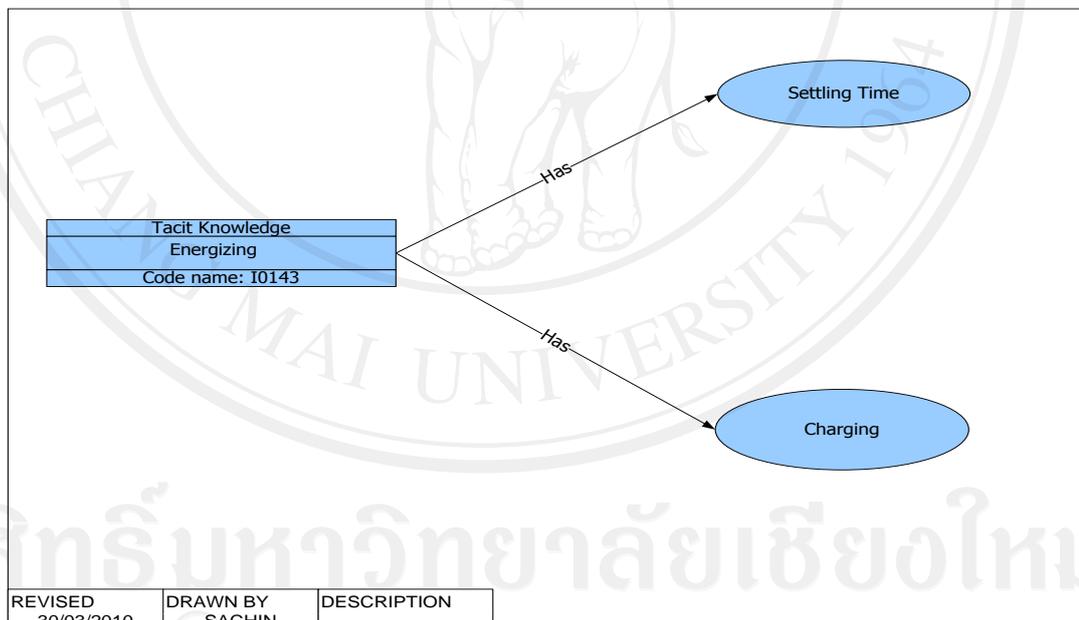


Figure B.1 Energizing Knowledge of PT.

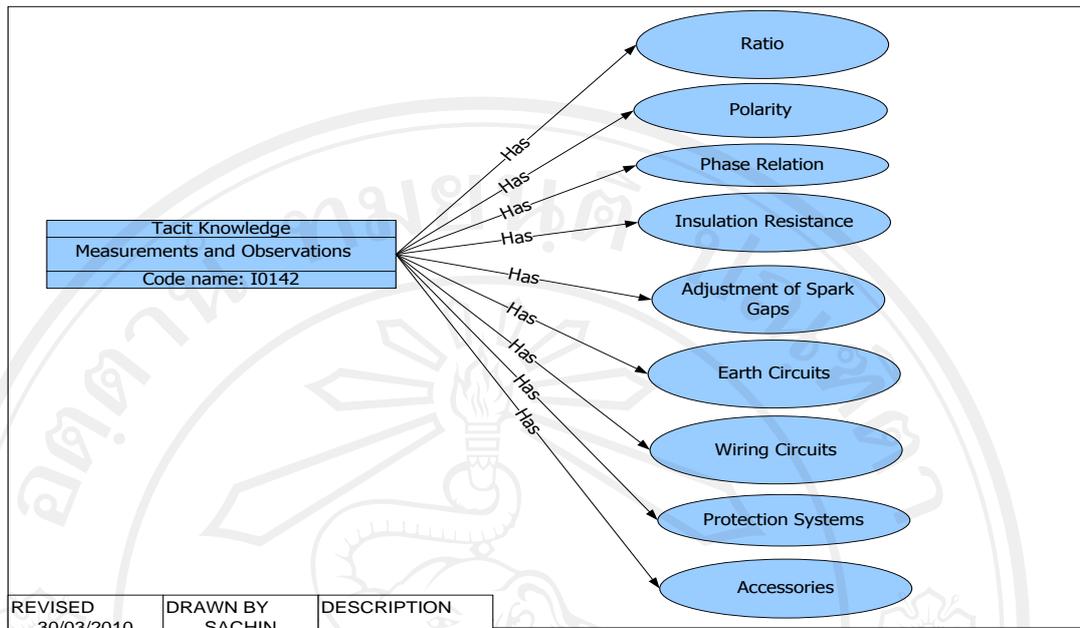


Figure B.2 Measurements and Observation Knowledge of PT.

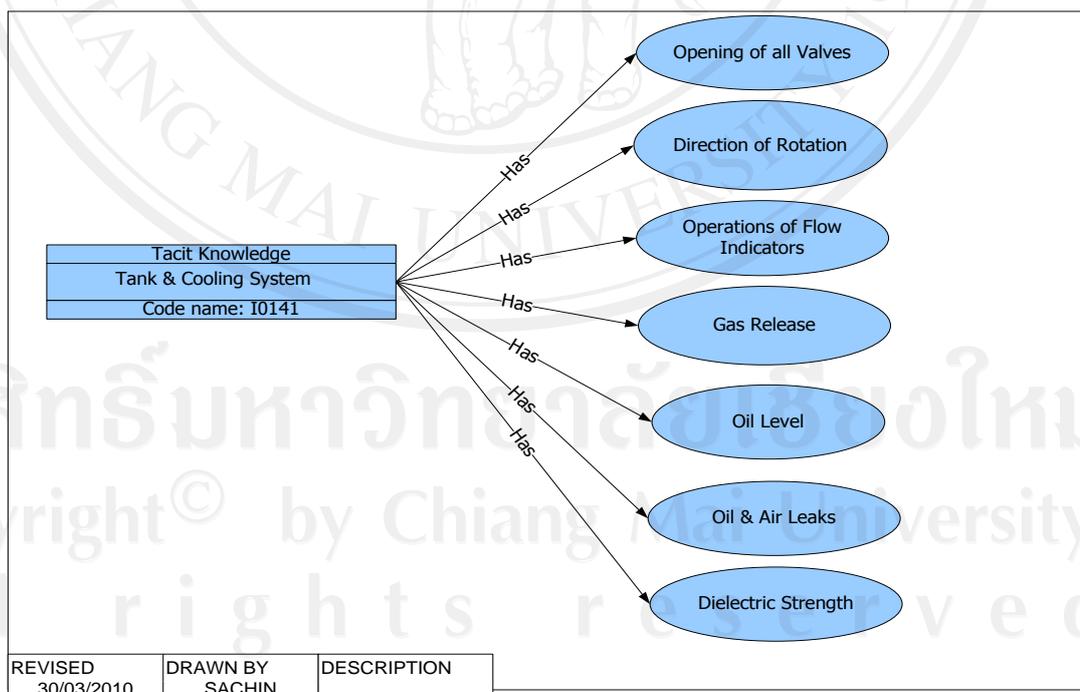


Figure B.3 Tank and Cooling System Knowledge of PT.

B.1.2 Engineering

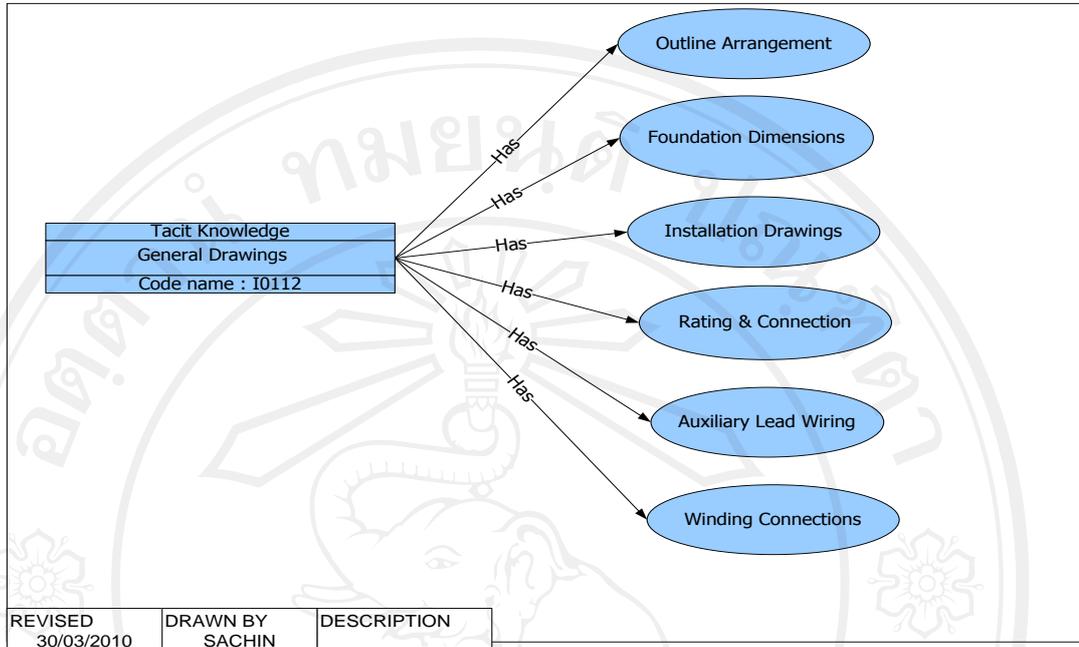


Figure B.4 General Drawings Knowledge of PT.

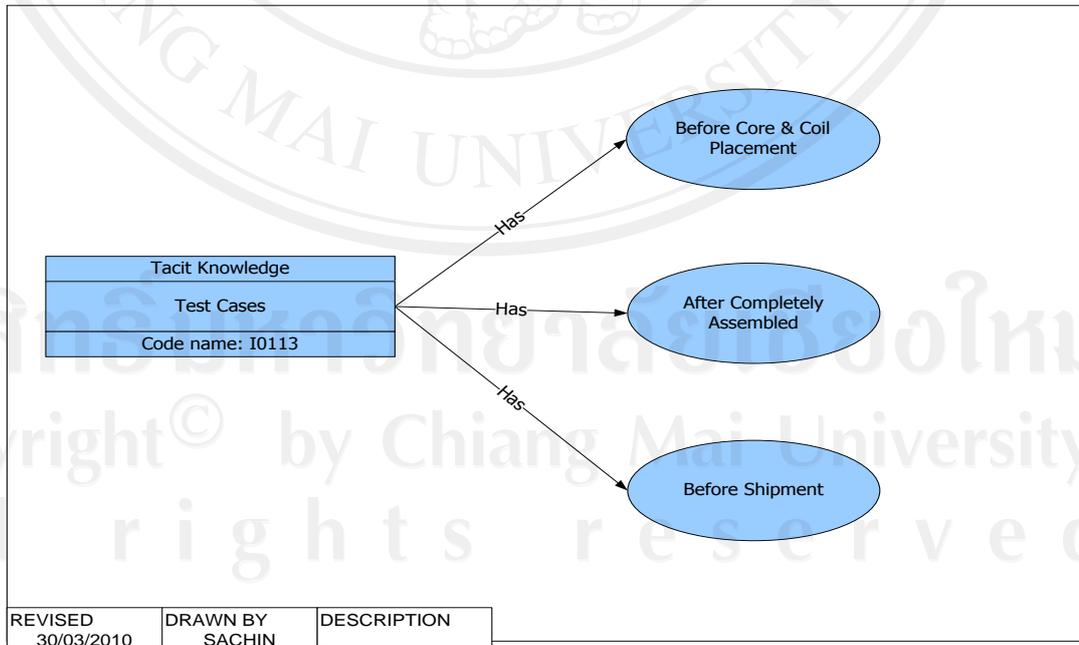


Figure B.5 Test Cases Knowledge of PT.

B.1.2 Transportation

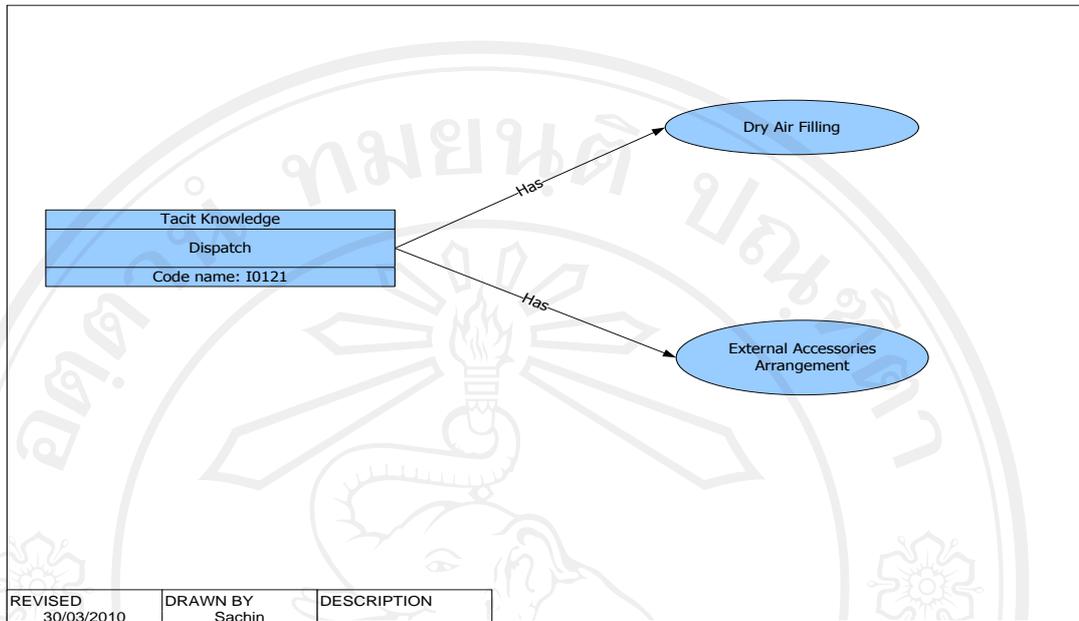


Figure B.6 Dispatch Knowledge of PT.

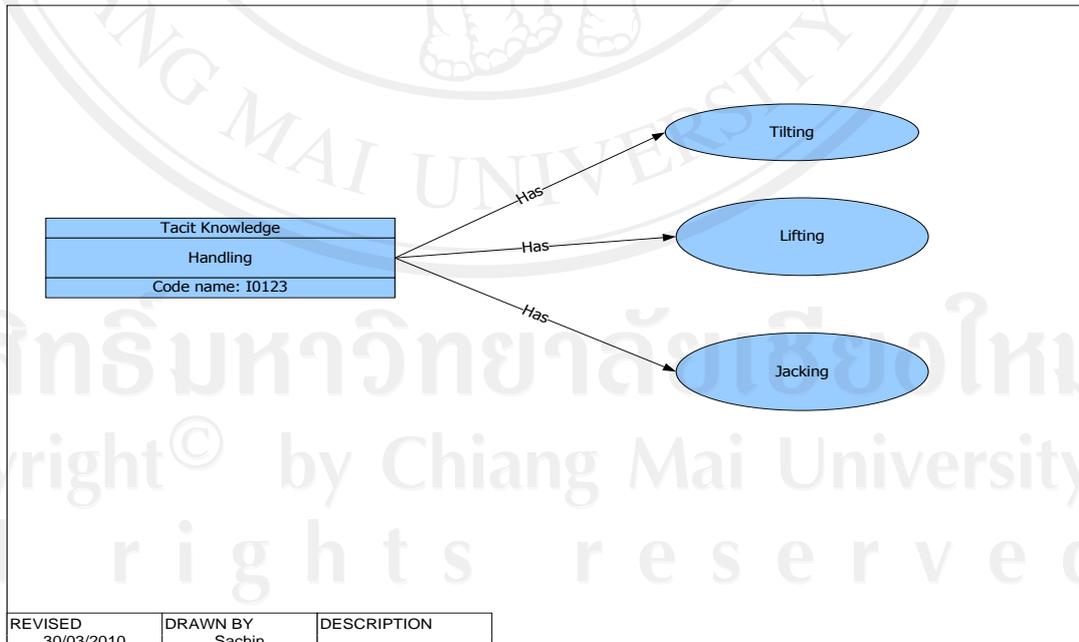


Figure B.7 Handling Knowledge of PT.

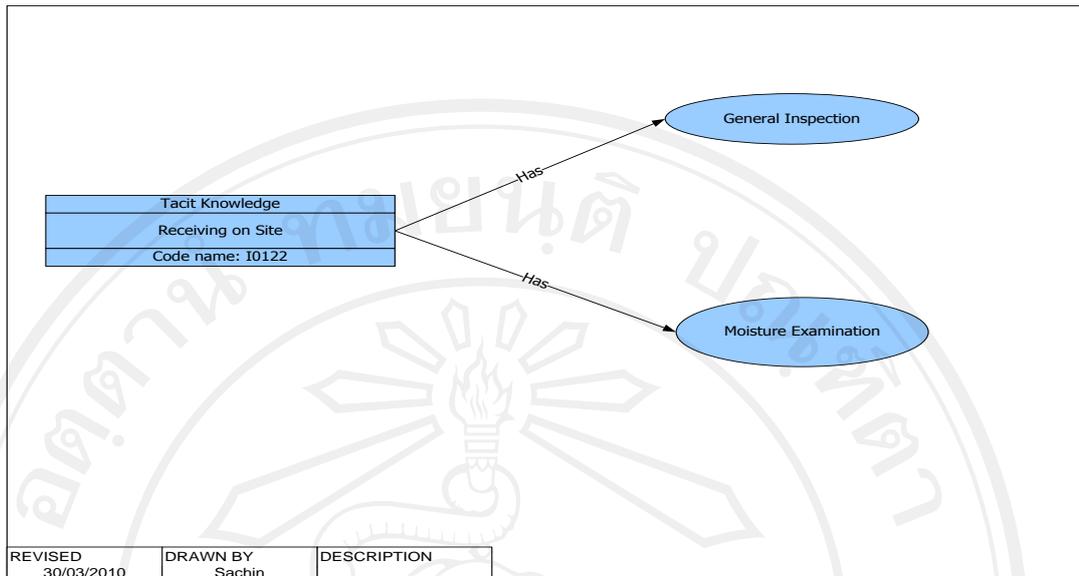


Figure B.8 Receiving on Site Knowledge of PT.

B.1.3 Installation

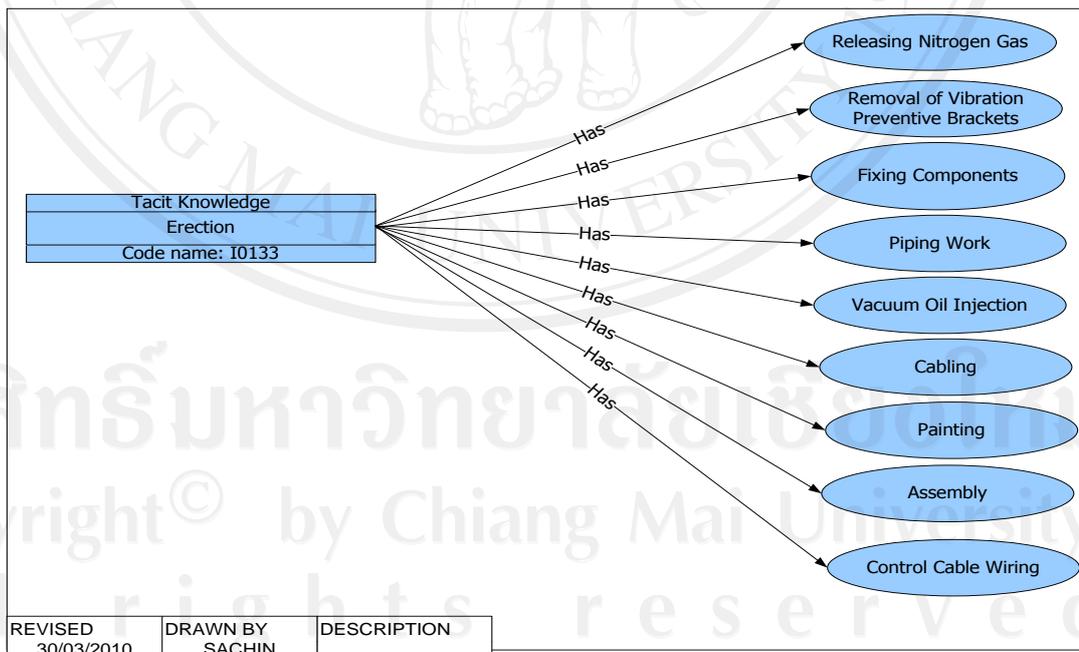


Figure B.9 Erection Knowledge of PT.

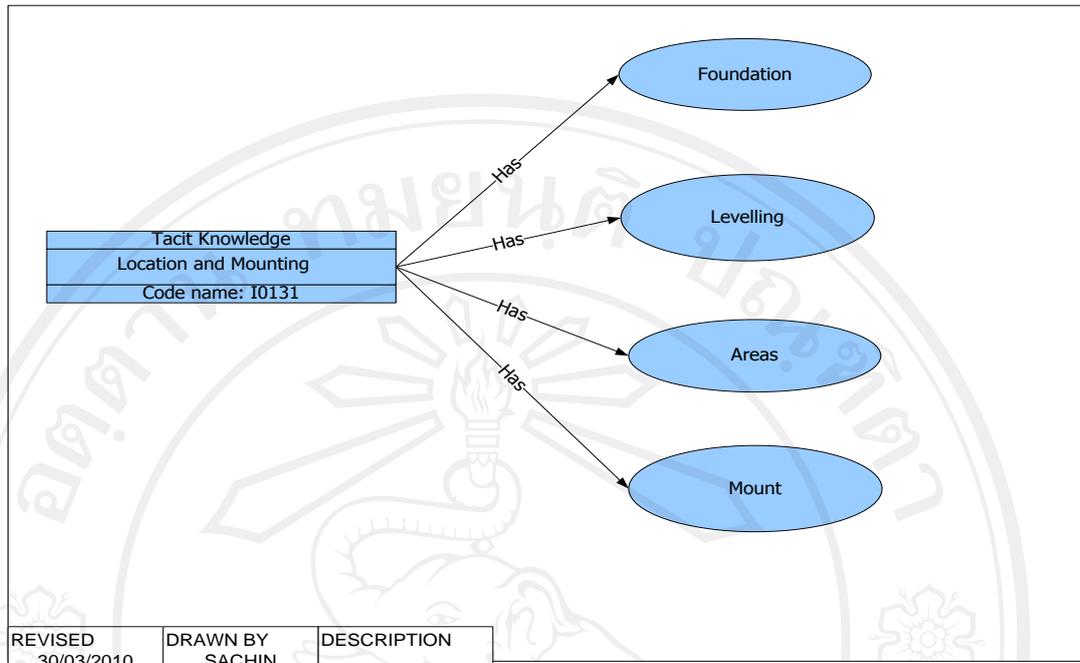


Figure B.10 Location and Mounting Knowledge of PT.

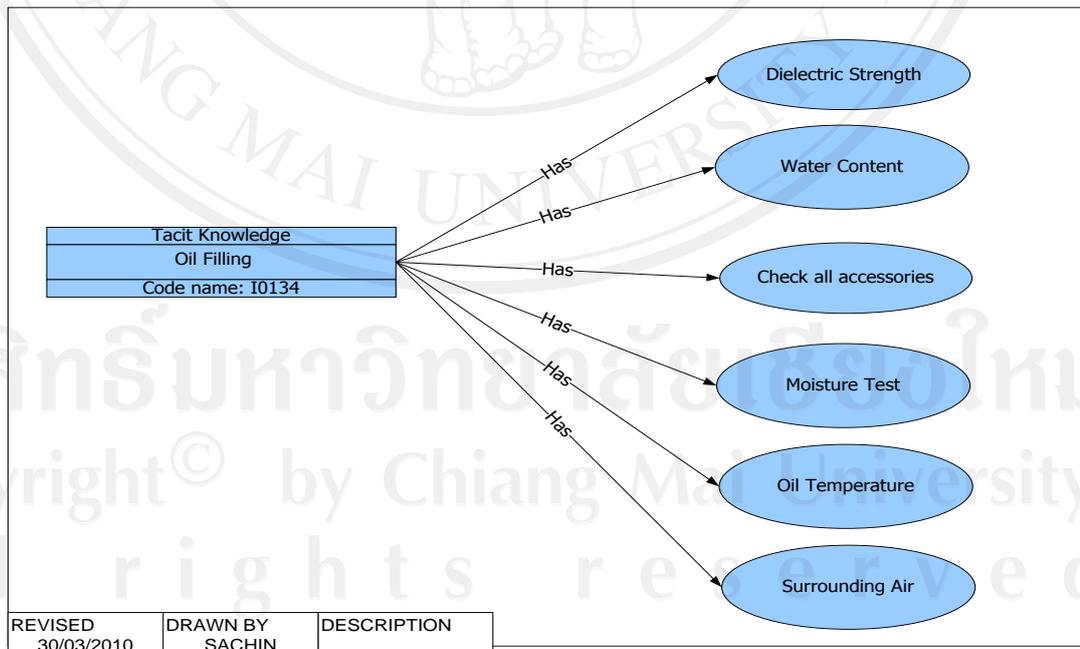


Figure B.11 Oil Filling Knowledge of PT.

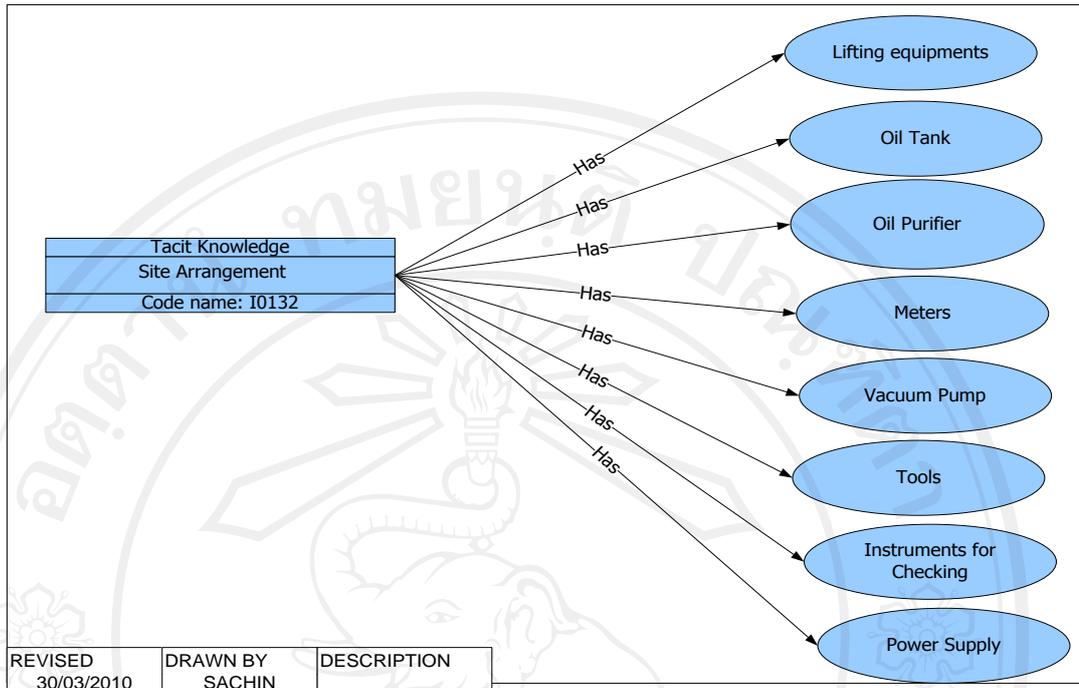


Figure B.12 Site Arrangement Knowledge of PT.

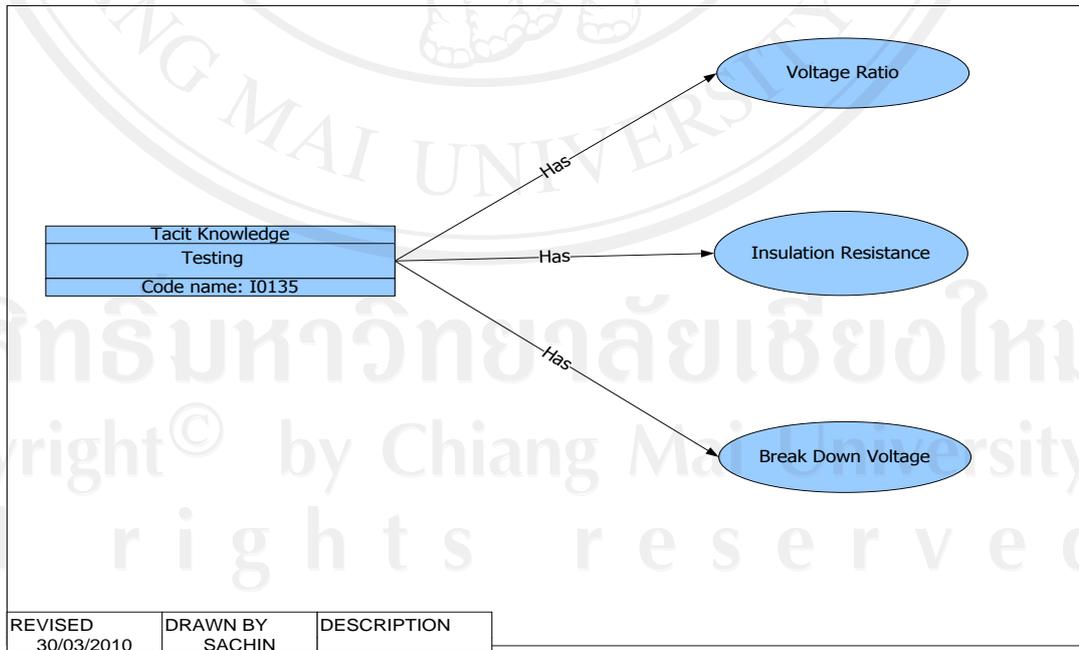


Figure B.13 Testing Knowledge of PT.

B.1.4 Corrective Maintenance

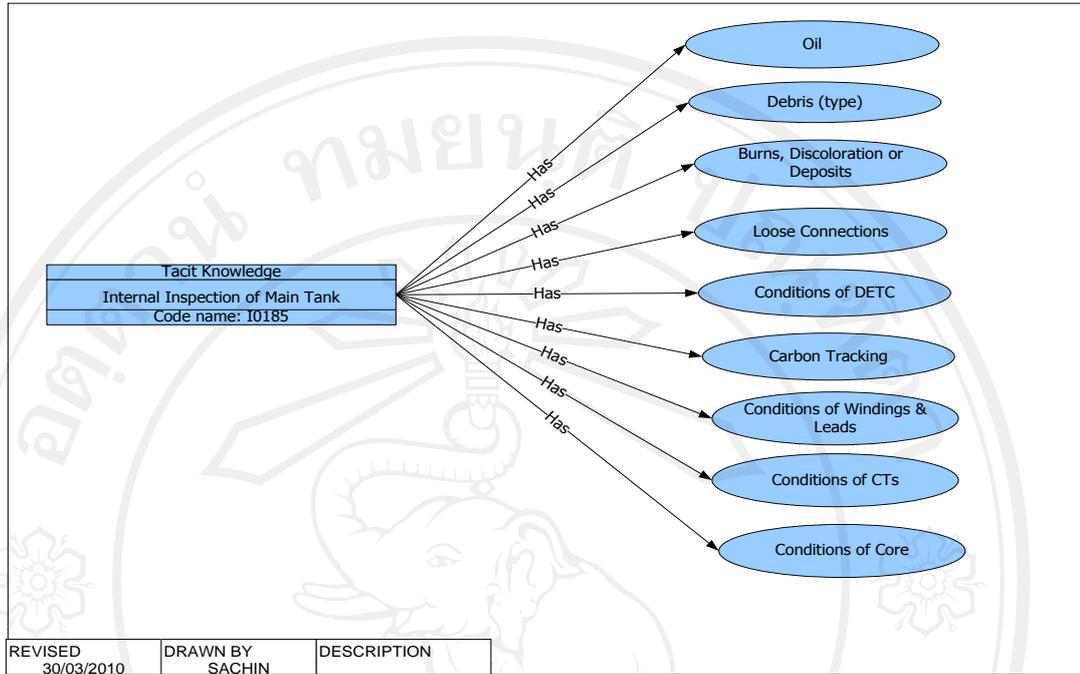


Figure B.14 Internal Inspection of Main Tank Knowledge of PT.

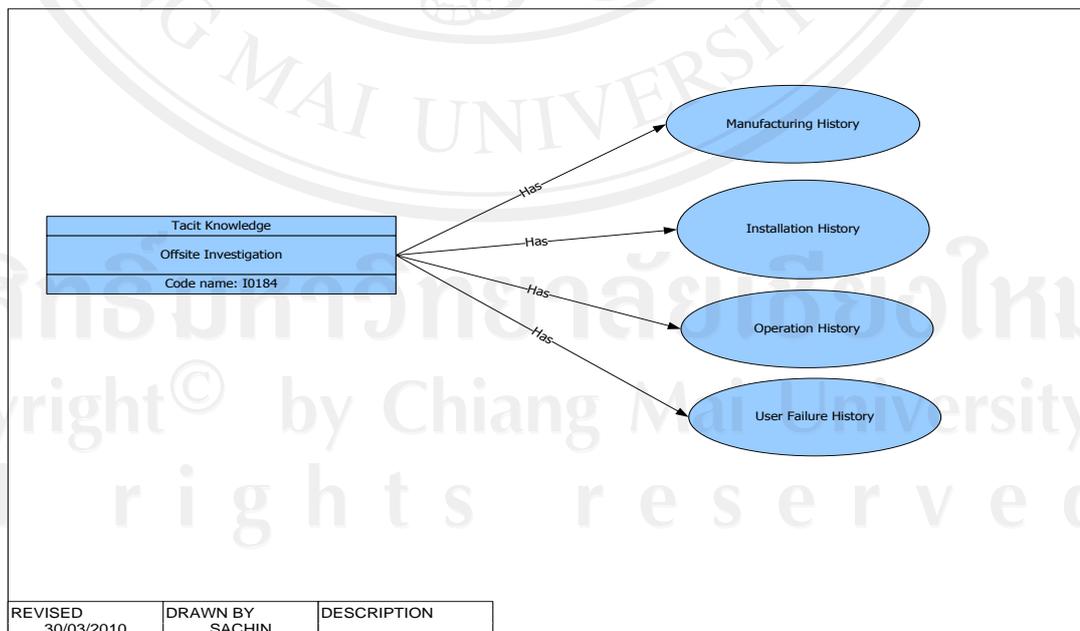


Figure B.15 Onsite Investigation Knowledge of PT.

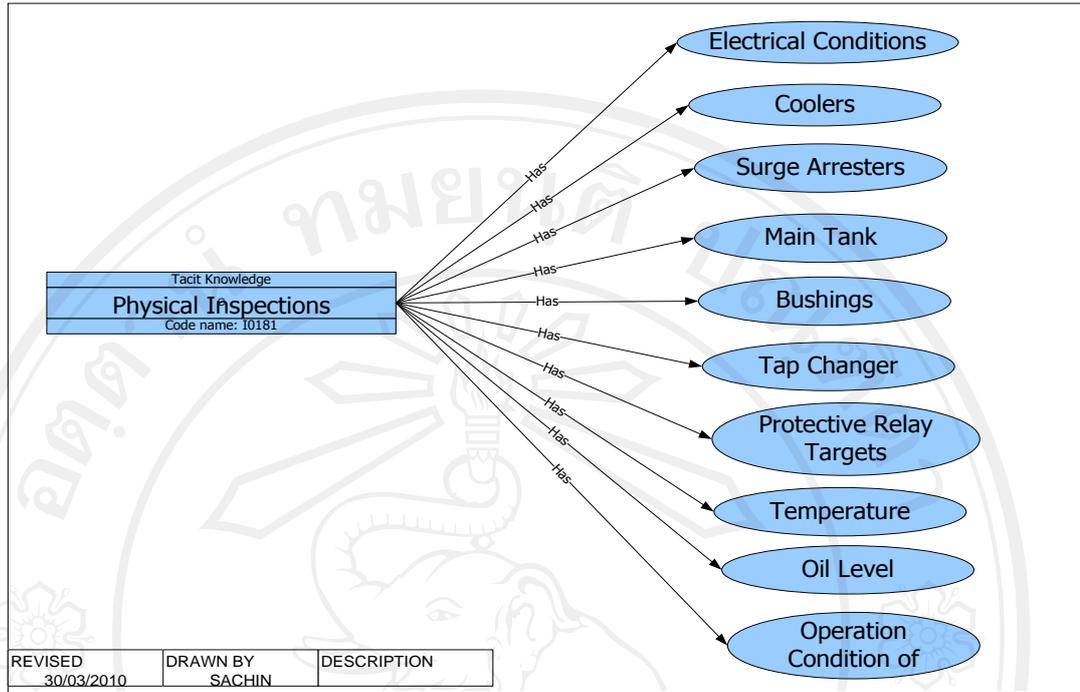


Figure B.16 Physical Inspections Knowledge of PT.

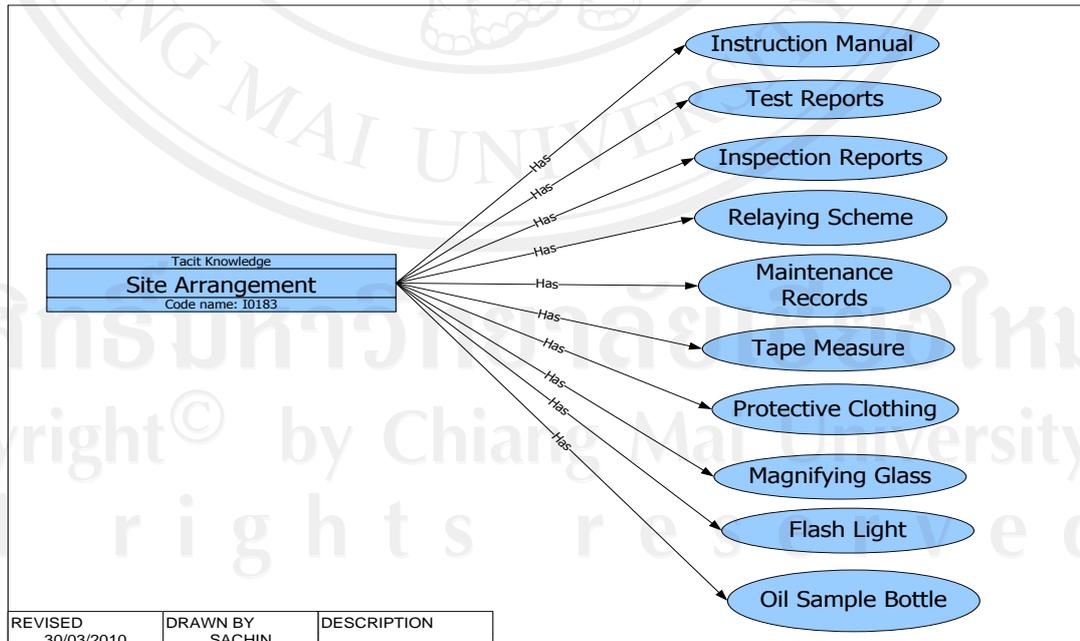


Figure B.17 Site Arrangement Knowledge of PT.

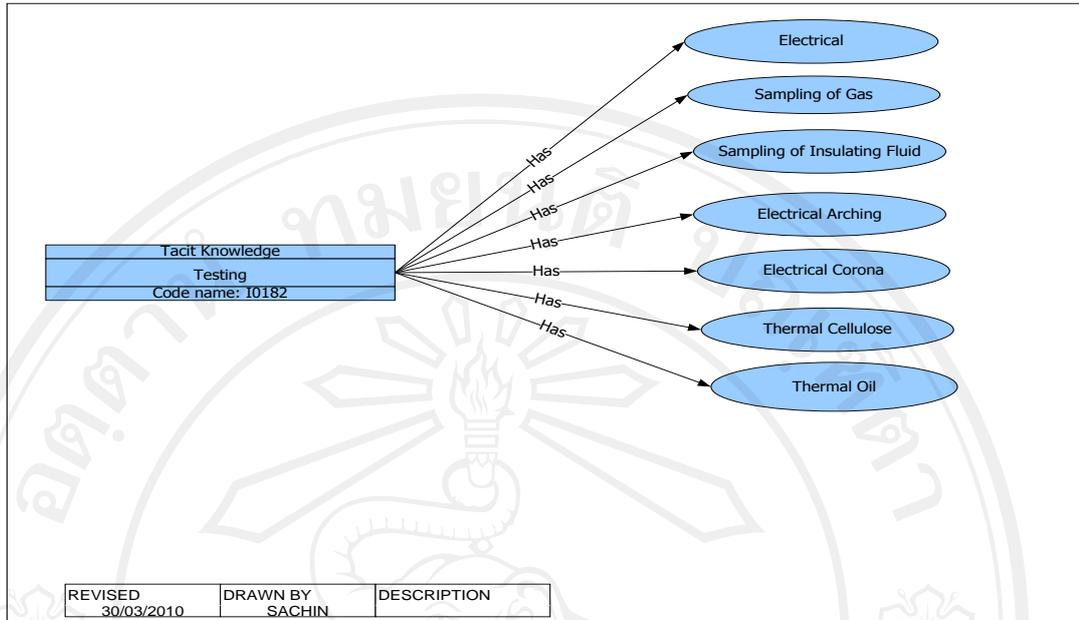


Figure B.18 Testing Knowledge of PT.

B.1.5 Preventive Maintenance

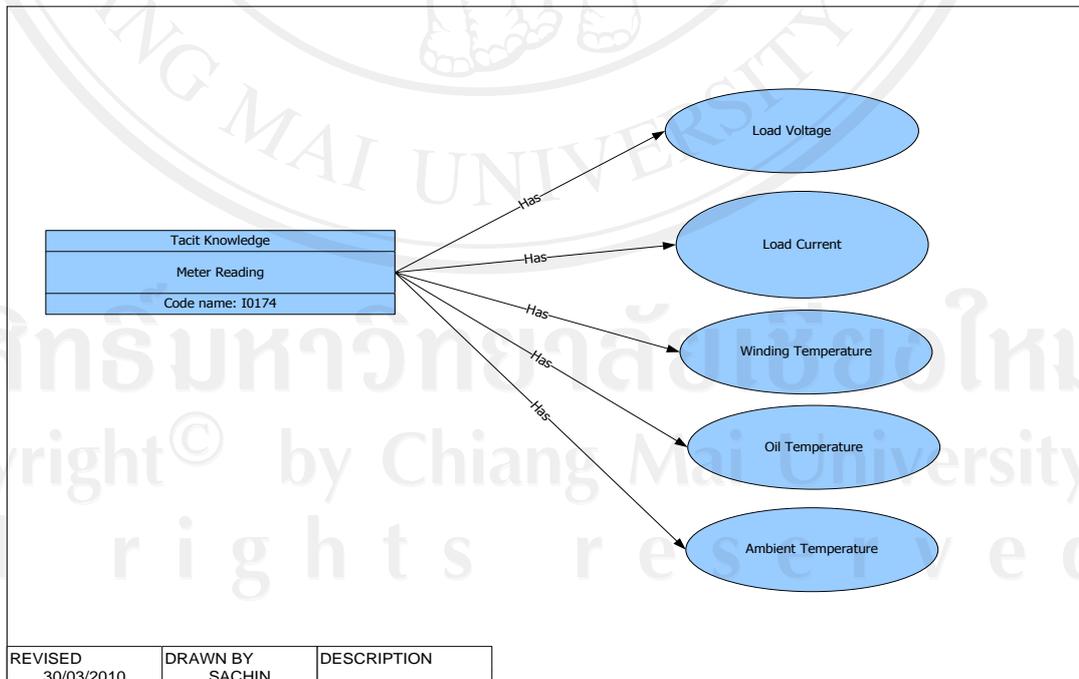


Figure B.19 Meter Reading Knowledge of PT.

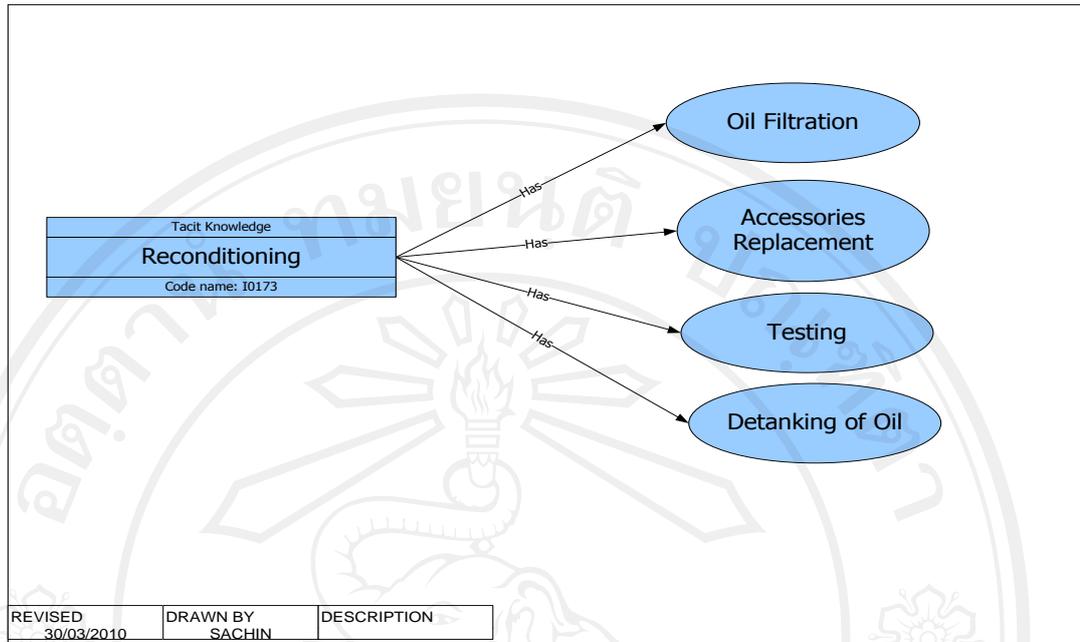


Figure B.20 Reconditioning Knowledge of PT.

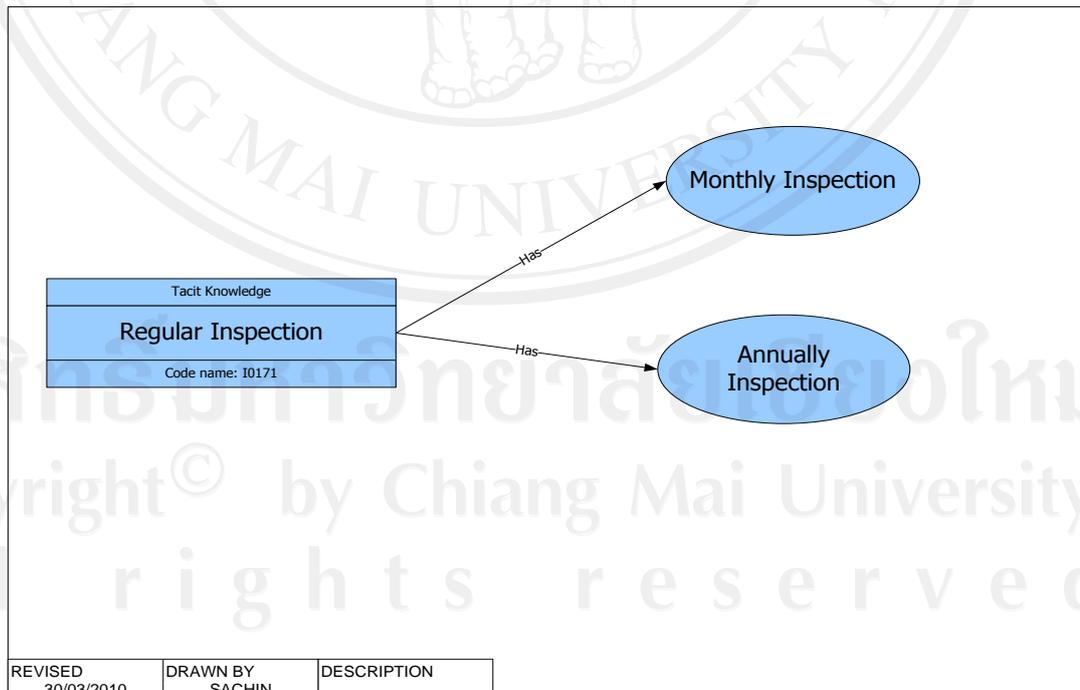


Figure B.21 Regular Inspection Knowledge of PT.

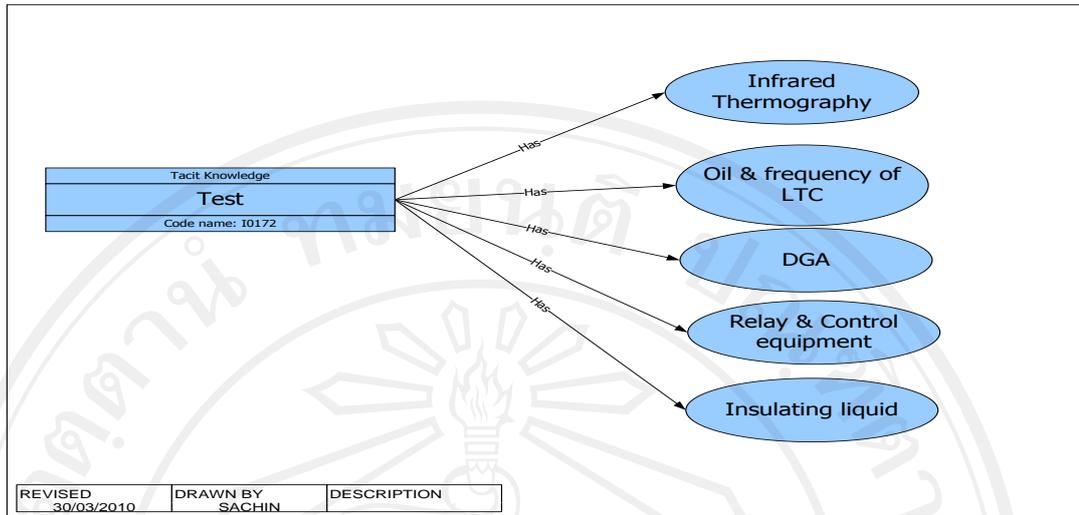


Figure B.22 Test Knowledge of PT.

B.1.6 Visual Inspection

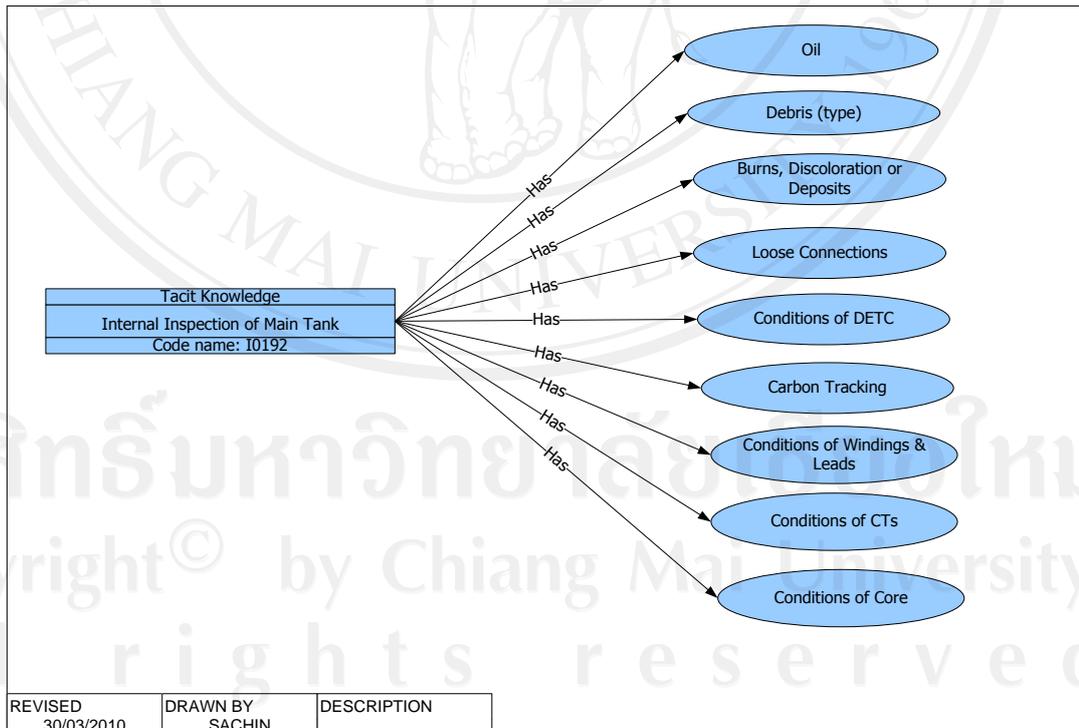


Figure B.23 Internal Inspection of Main Tank Knowledge of PT.

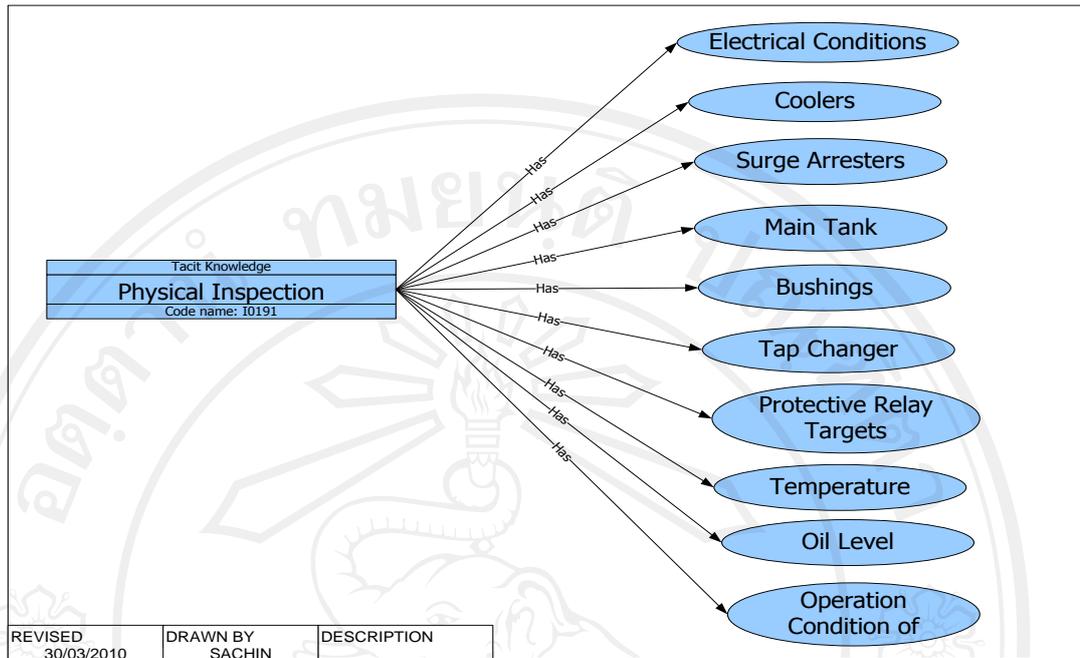


Figure B.24 Physical Inspection Knowledge of PT.

B.1.7 Training

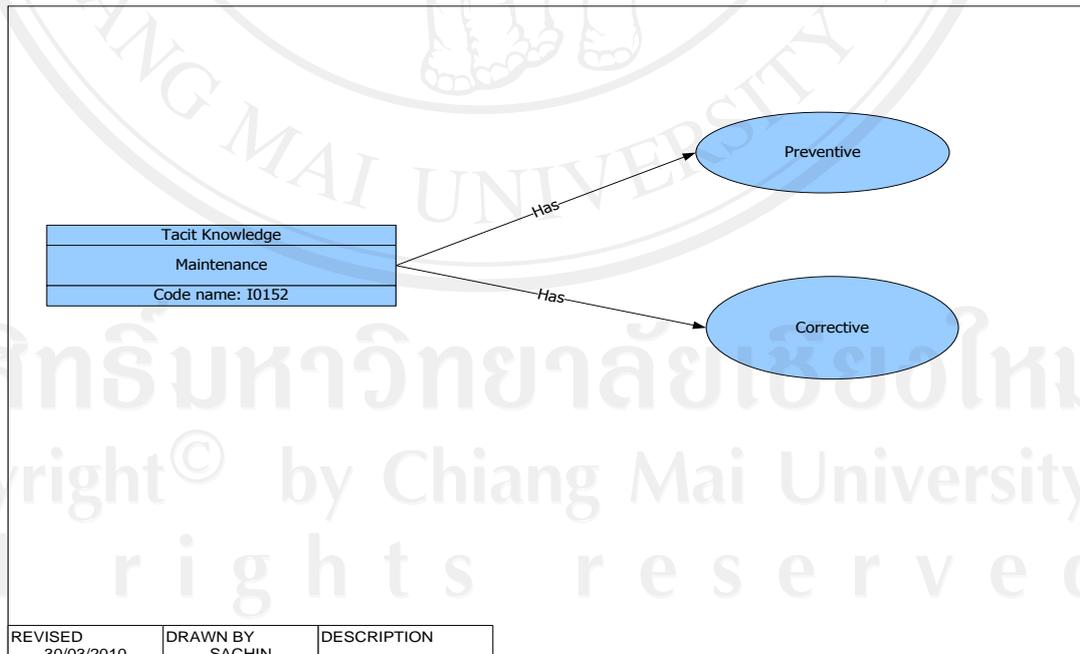


Figure B.25 Maintenance Knowledge of PT.

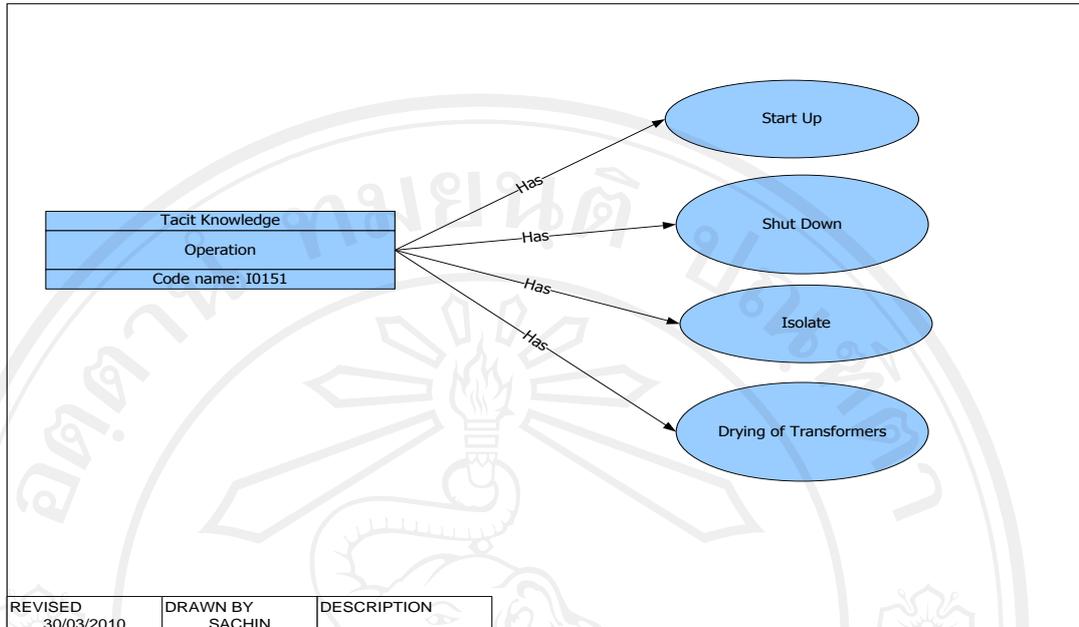


Figure B.26 Operation Knowledge of PT.

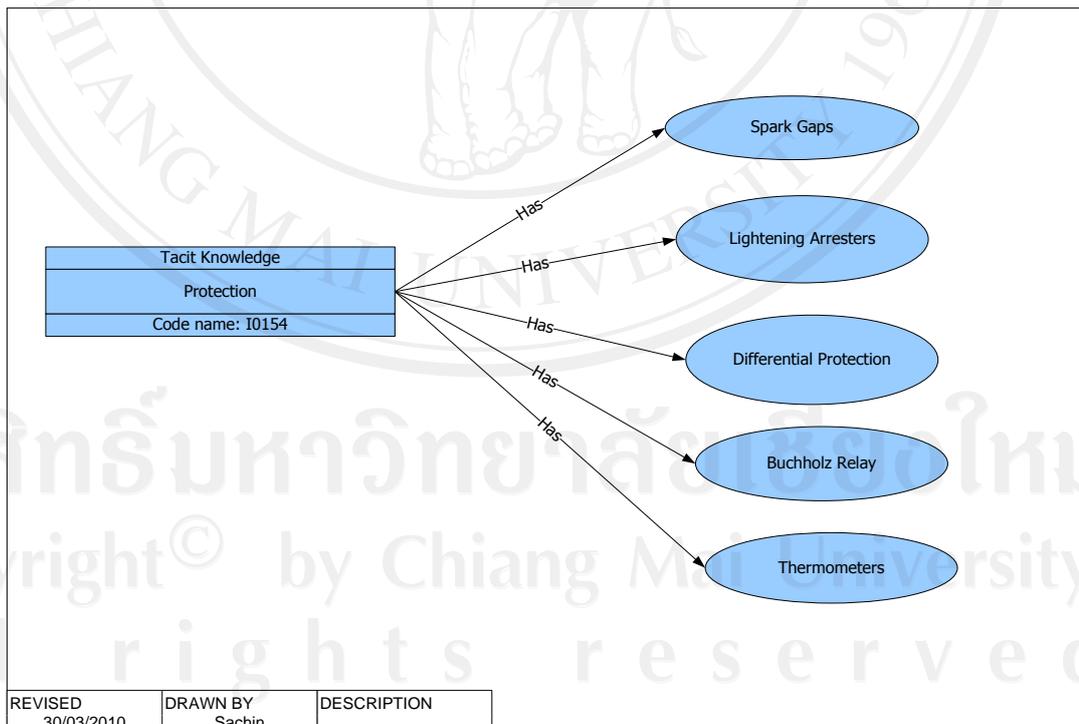


Figure B.27 Protection Knowledge of PT.

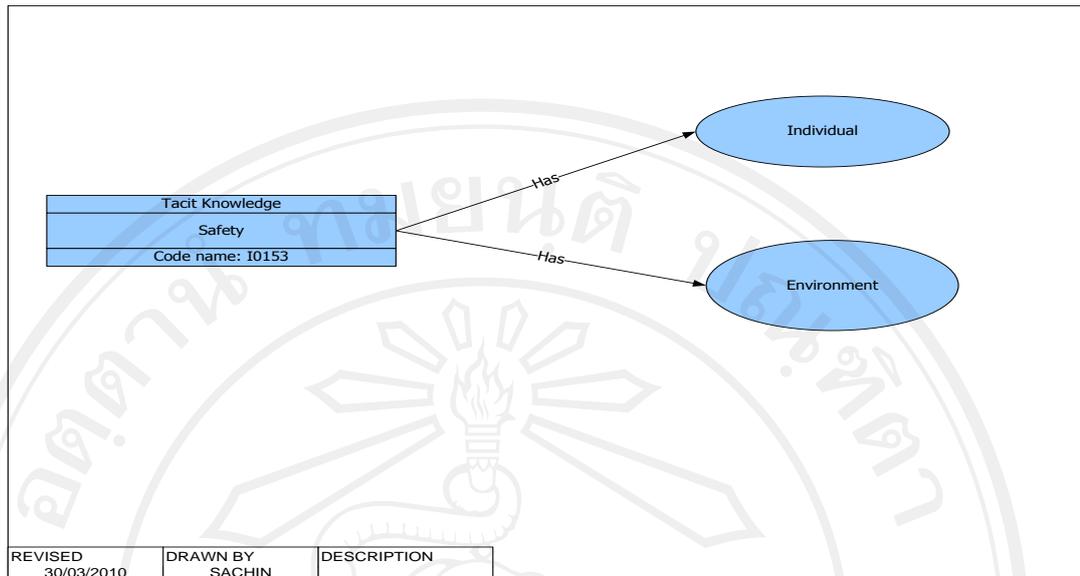


Figure B.28 Safety Knowledge of PT.

B.2 Inference Knowledge

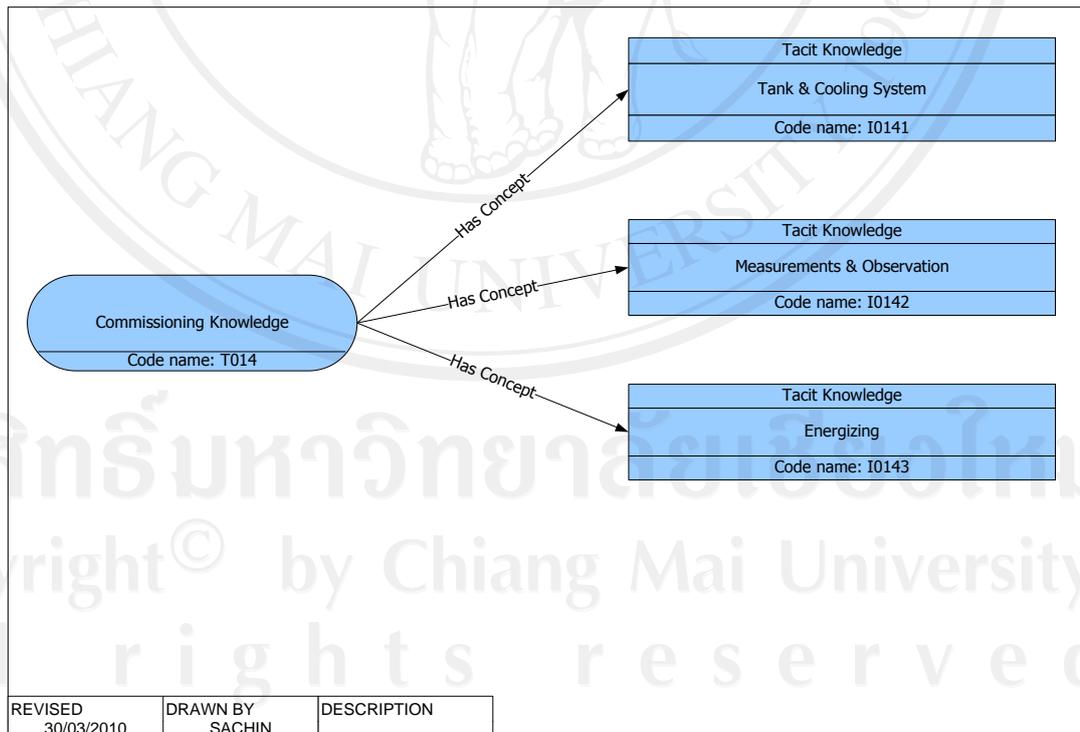


Figure B.29 Inference Knowledge of PT's Commissioning.

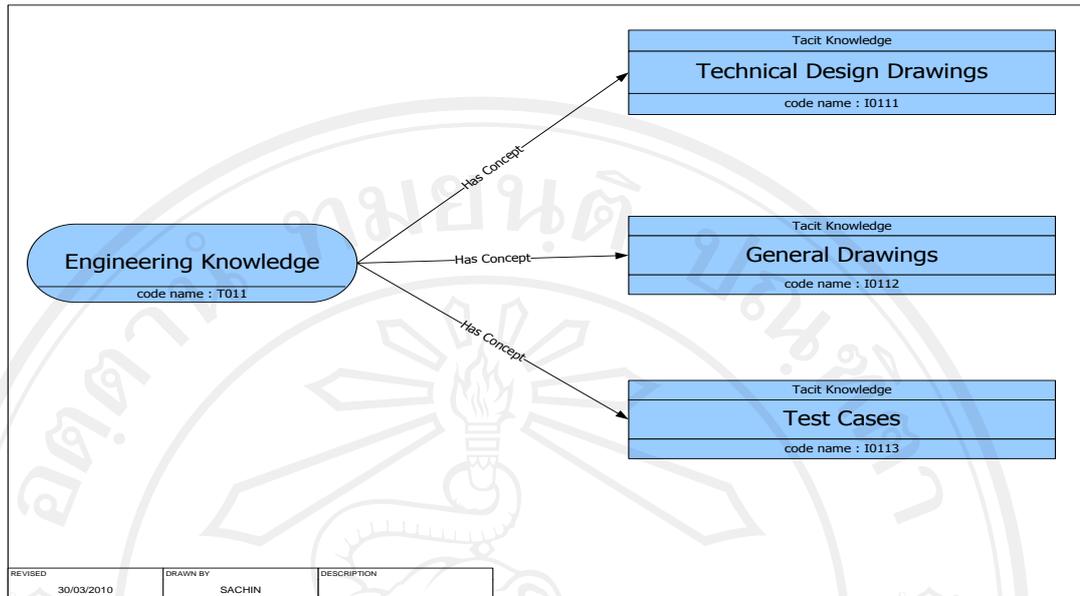


Figure B.30 Inference Knowledge of PT's Engineering.

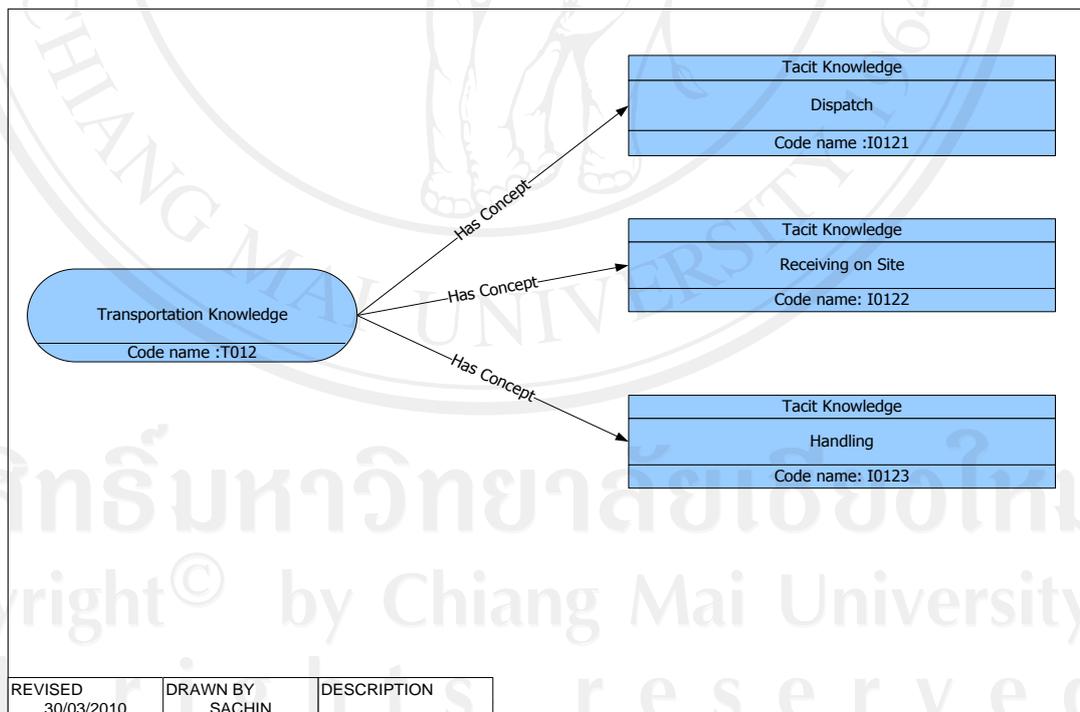


Figure B.31 Inference Knowledge of PT's Transportation.

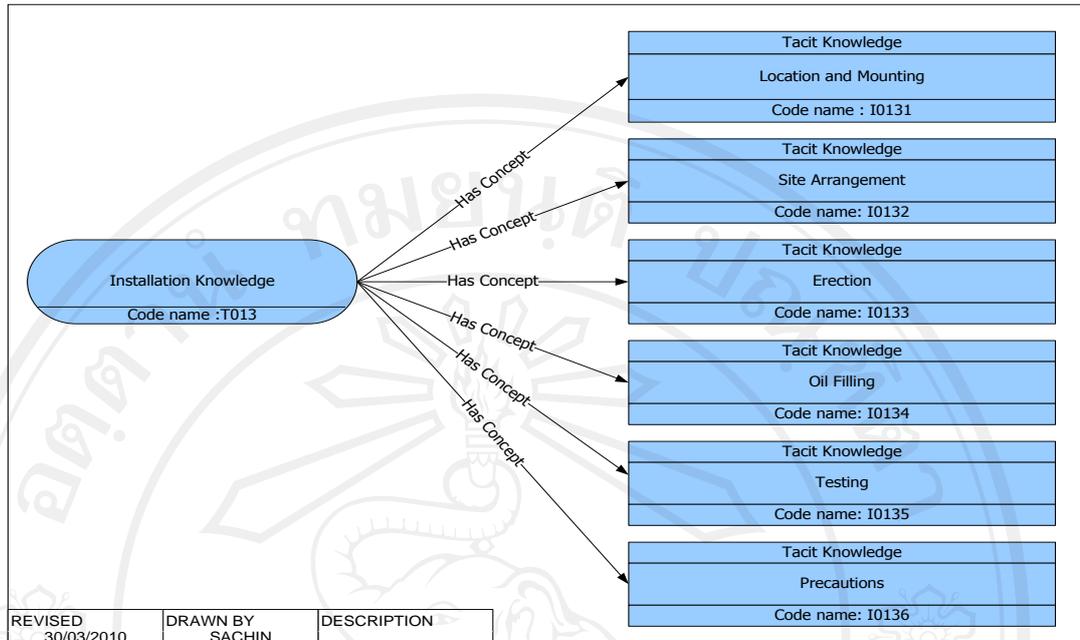


Figure B.32 Inference Knowledge of PT's Installation.

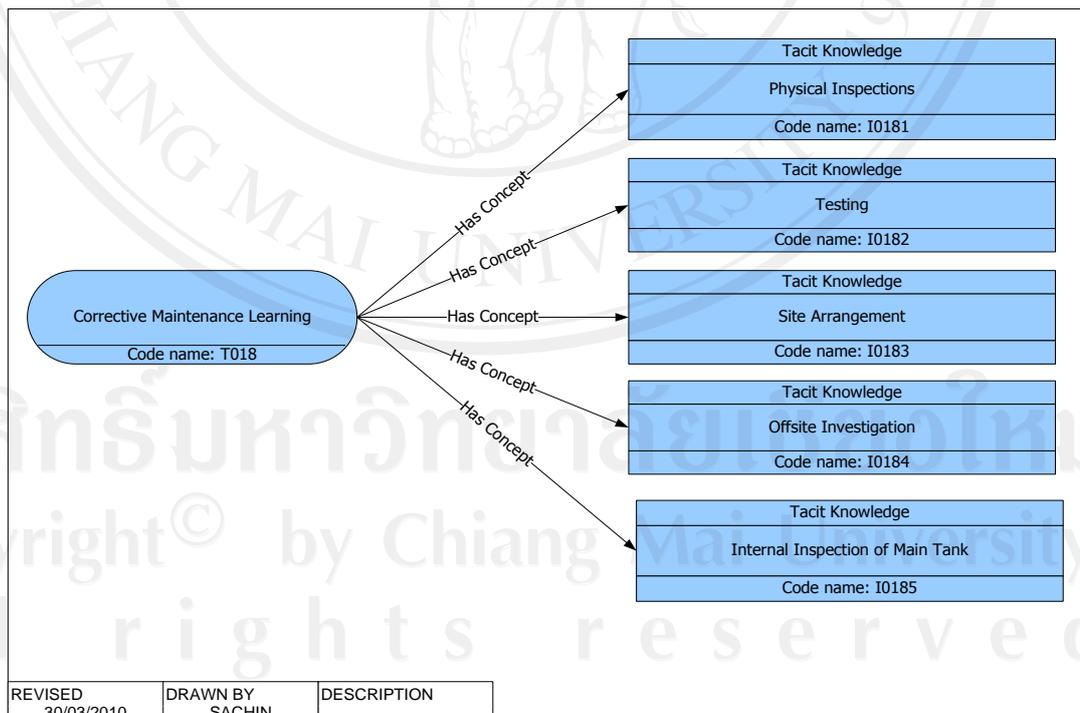


Figure B.33 Inference Knowledge of PT's Corrective Maintenance Learning.

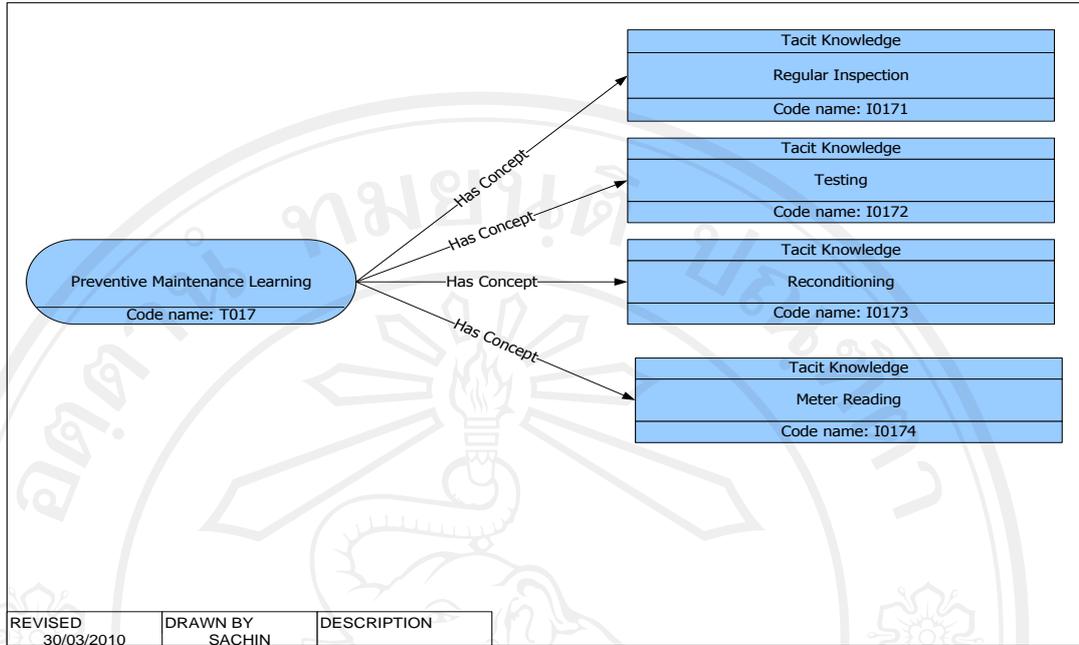


Figure B.33 Inference Knowledge of PT’s Preventive Maintenance Learning.

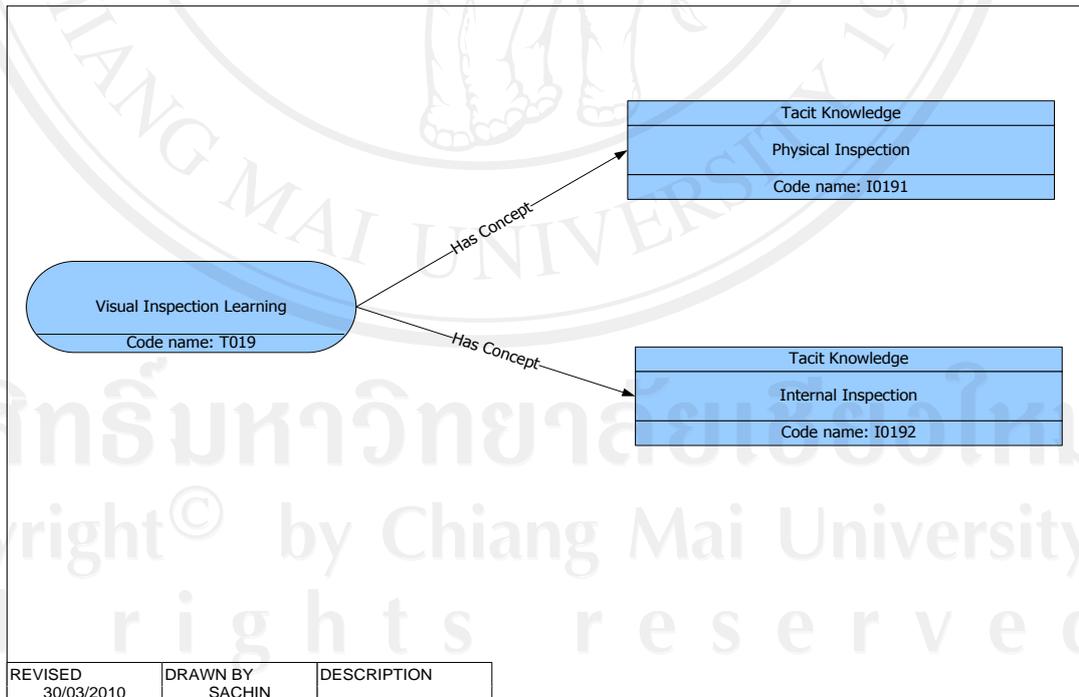


Figure B.34 Inference Knowledge of PT’s Visual Inspection Learning.

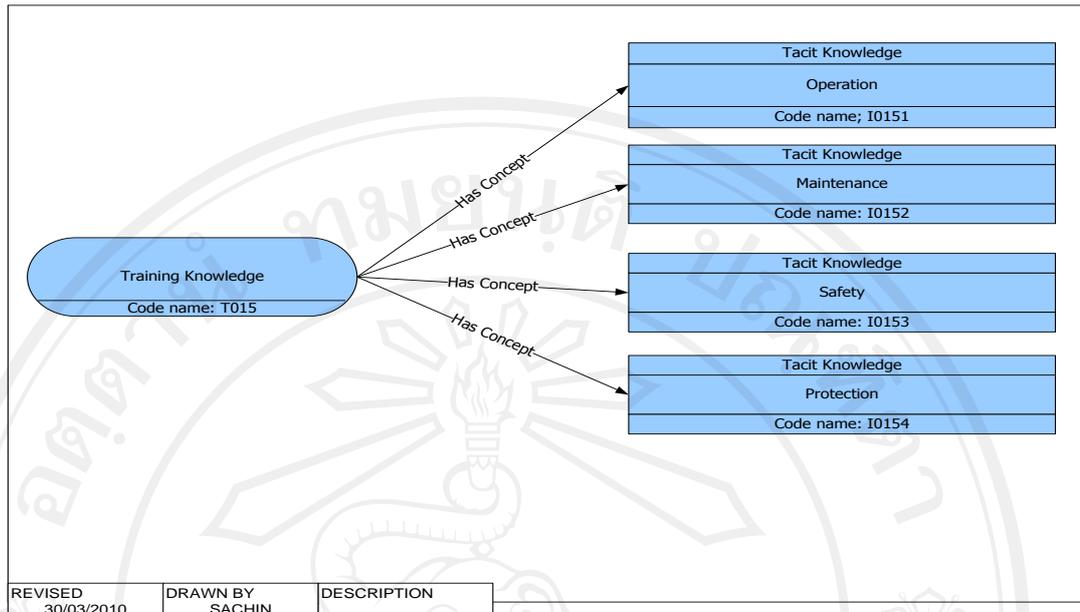


Figure B.35 Inference Knowledge of PT's Training.

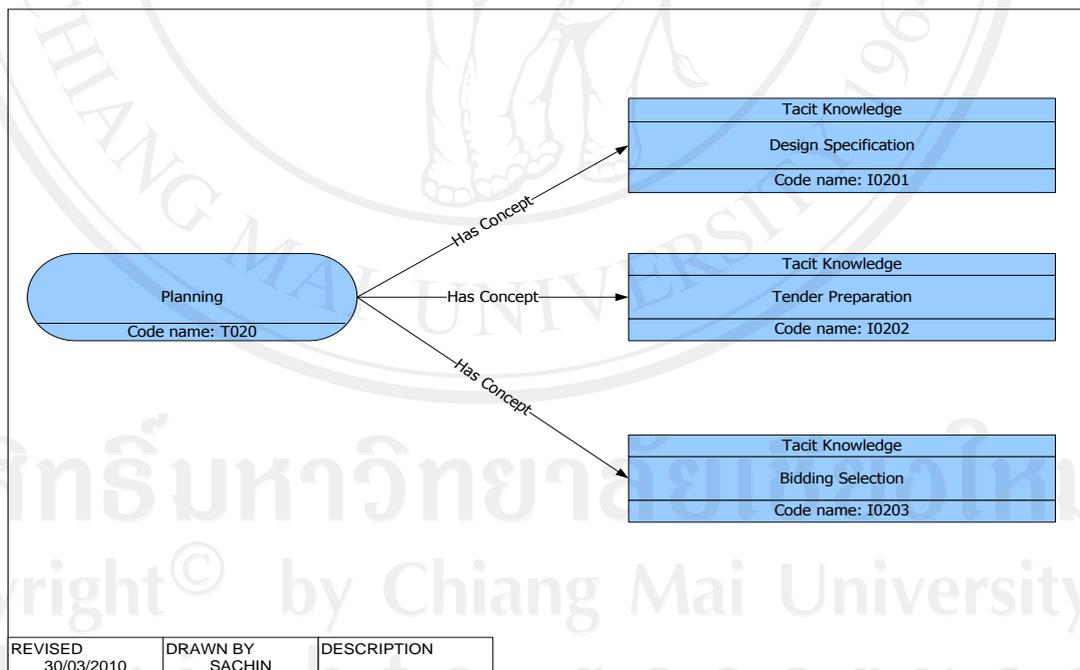


Figure B.36 Inference Knowledge of PT's Planning.

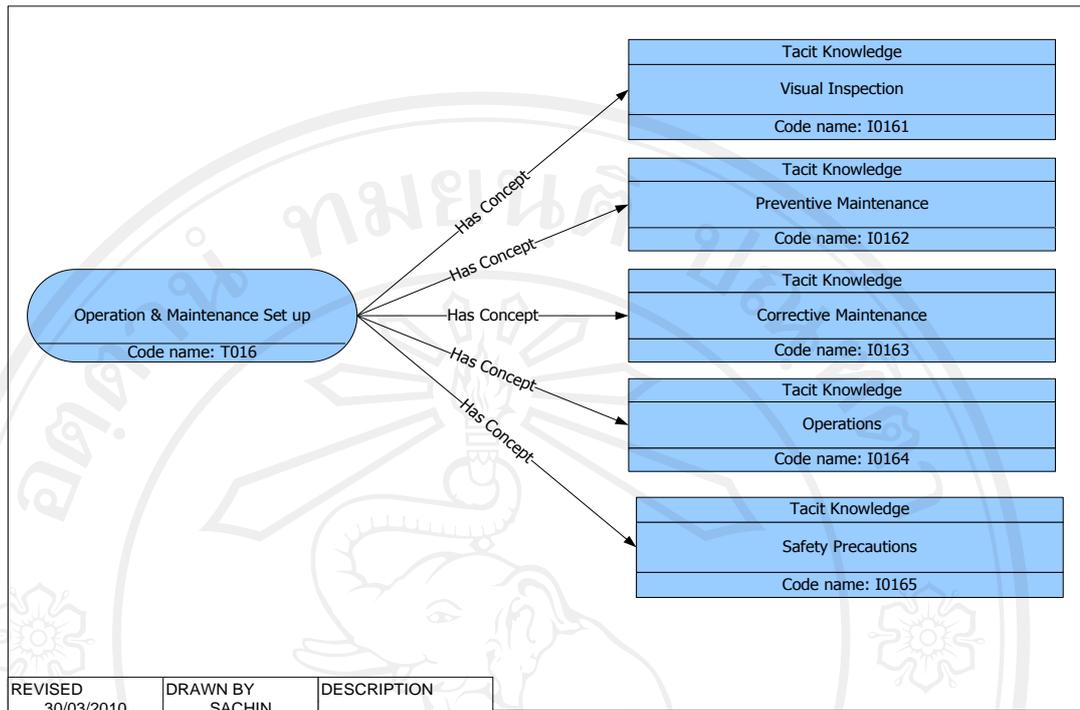


Figure B.37 Inference Knowledge of PT's Operation and Maintenance Set Up.

APPENDIX C

SIMULATION SOFTWARE

With the use of simulation software, the obtained results from the four case studies are presented through snapshots in section C.2 and the database of power transformer consists of multiple tables shown in section C.1.

C.1 Snapshots of Database of Power Transformer

Server: localhost Database: powertransformer Table: ptparameter

Field	Type	Collation	Attributes	Null	Default	Extra	Action
ldlife	int(11)			No			
loadfactor	float			No			
pf	varchar(3)	utf8_general_ci		No			
slinterest	varchar(4)	utf8_general_ci		No			
incometax	varchar(4)	utf8_general_ci		No			
salvage	int(11)			No			
admincost	float			No			
tariff	varchar(4)	utf8_general_ci		No			
om_expertcost	bigint(20)			No			
sup_cost	int(11)			No			
cm_exp	int(11)			No			
pm_learns	int(11)			No			
visinsp_learn	int(11)			No			
omsetup	int(11)			No			
dfactor	varchar(4)	utf8_general_ci		No			

Indexes: (0) Space usage: Type: Usage: Statements: Value: dynamic
 Index: 1,024 B Collation: utf8_general_ci
 Total: 1,104 B Rows: 1
 Row length: 80
 Row size: 1,104 B
 Creation: Dec 14, 2011 at 04:34 PM
 Last update: Dec 14, 2011 at 04:34 PM

Figure C.1 PT's Parameters Table.

Server: localhost Database: powertransformer Table: ptdetail

Field	Type	Collation	Attributes	Null	Default	Extra	Action
ptname	varchar(10)	utf8_general_ci		No			
capacity	float			No			
default	varchar(5)	utf8_general_ci		No			
year	varchar(8)	utf8_general_ci		No			
vratio	varchar(10)	utf8_general_ci		No			
location	varchar(15)	utf8_general_ci		No			
instyear	varchar(5)	utf8_general_ci		No			
vintage	varchar(8)	utf8_general_ci		No			
assetprice	double			No			
instdur	varchar(3)	utf8_general_ci		No			
trandur	varchar(3)	utf8_general_ci		No			
commdur	varchar(3)	utf8_general_ci		No			
mortgage	double			No			
st_kp_year	varchar(4)	utf8_general_ci		Yes	NULL		
war_period	varchar(12)	utf8_general_ci		No			
reinstatyear	varchar(5)	utf8_general_ci		Yes	NULL		
select	varchar(12)	utf8_general_ci		No			
check	varchar(7)	utf8_general_ci		No			
value	varchar(12)	utf8_general_ci		No			
temp	varchar(12)	utf8_general_ci		No			
pres_status	varchar(10)	utf8_general_ci		No			

Indexes: (0) Space usage: Type: Usage: Statements: Value: dynamic
 PRIMARY PRIMARY 1 Action: Field: Type: Usage: Statements: Value: dynamic
 Index: 2,048 B Collation: utf8_general_ci
 Total: 2,148 B Rows: 1
 Row length: 100
 Row size: 2,148 B
 Creation: Dec 14, 2011 at 04:34 PM
 Last update: Dec 14, 2011 at 04:34 PM

Figure C.2 Data Table of Network PT.

Server: localhost | Database: powertransformer | Table: load_profile_ptdetail

Field	Type	Collation	Attributes	Null	Default	Extra	Action
<input type="checkbox"/> ptname	varchar(15)	utf8_general_ci		No			
<input type="checkbox"/> year	varchar(8)	utf8_general_ci		No			
<input type="checkbox"/> des_id	varchar(4)	utf8_general_ci		No			
<input type="checkbox"/> act_id	varchar(4)	utf8_general_ci		Yes	NULL		

Check All / Uncheck All With selected:

Print view | Propose table structure

Add 1 field(s) | At End of Table | At Beginning of Table | After ptname | Go

Indexes: 0				Space usage		Row Statistics		
Keyname	Type	Cardinality	Action	Field	Type	Usage	Statements	Value
PRIMARY	PRIMARY	20		ptname	Data	480 B	Format	dynamic
				year	Index	2,048 B	Collation	utf8_general_ci
Create an index on 1 columns Go					Total	2,528 B	Rows	20
					Row length		Row size	126 B
					Creation		Last update	Dec 14, 2011 at 04:34 PM
								Dec 14, 2011 at 04:34 PM

Open new phpMyAdmin window

Figure C.3 Load Profile Table of Network PTs.

Server: localhost | Database: powertransformer | Table: new_transformer

Field	Type	Collation	Attributes	Null	Default	Extra	Action
<input type="checkbox"/> ptname	varchar(15)	utf8_general_ci		No			
<input type="checkbox"/> capacity	double			No			
<input type="checkbox"/> vratio	varchar(15)	utf8_general_ci		No			
<input type="checkbox"/> assetprice	double			No			
<input type="checkbox"/> instdur	varchar(10)	utf8_general_ci		No			
<input type="checkbox"/> traidur	varchar(10)	utf8_general_ci		No			
<input type="checkbox"/> commdur	varchar(10)	utf8_general_ci		No			
<input type="checkbox"/> mortgage	double			No			

Check All / Uncheck All With selected:

Print view | Propose table structure

Add 1 field(s) | At End of Table | At Beginning of Table | After ptname | Go

Indexes: 0				Space usage		Row Statistics		
Keyname	Type	Cardinality	Action	Field	Type	Usage	Statements	Value
PRIMARY	PRIMARY	3		ptname	Data	156 B	Format	dynamic
Create an index on 1 columns Go					Index	2,048 B	Collation	utf8_general_ci
					Total	2,204 B	Rows	3
					Row length		Row size	735 B
					Creation		Last update	Dec 14, 2011 at 04:34 PM
								Dec 14, 2011 at 04:34 PM

Open new phpMyAdmin window

Figure C.4 Data Table of New PT.

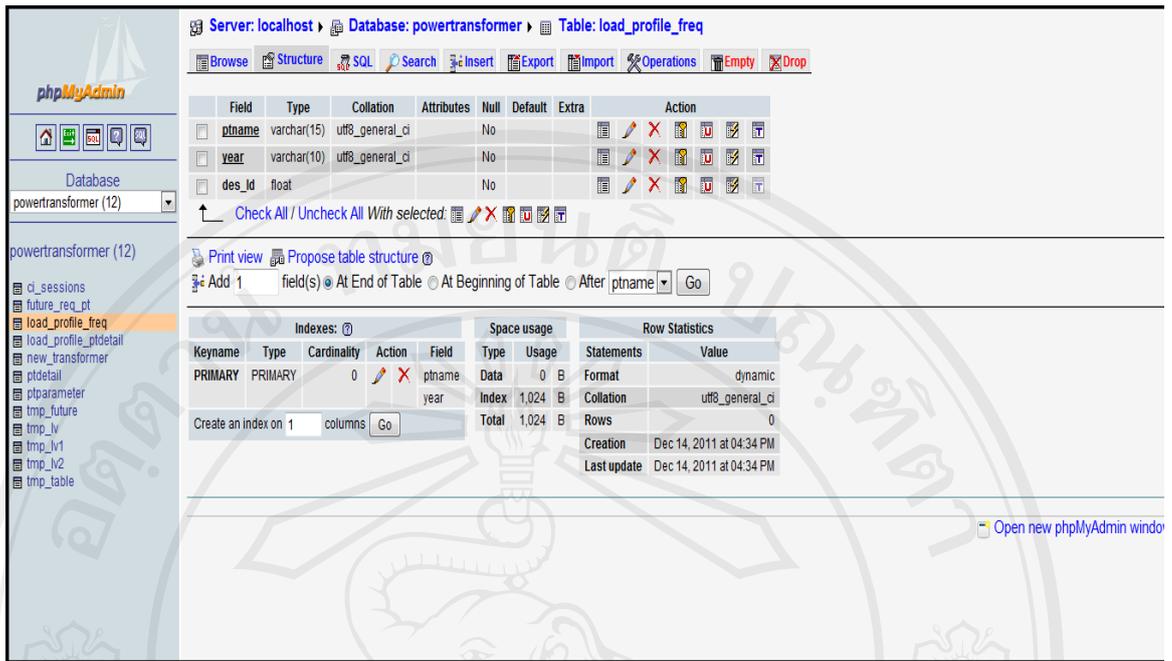


Figure C.5 Load Profile Table of Future Requirement PT.

C.2 Snapshots of Results

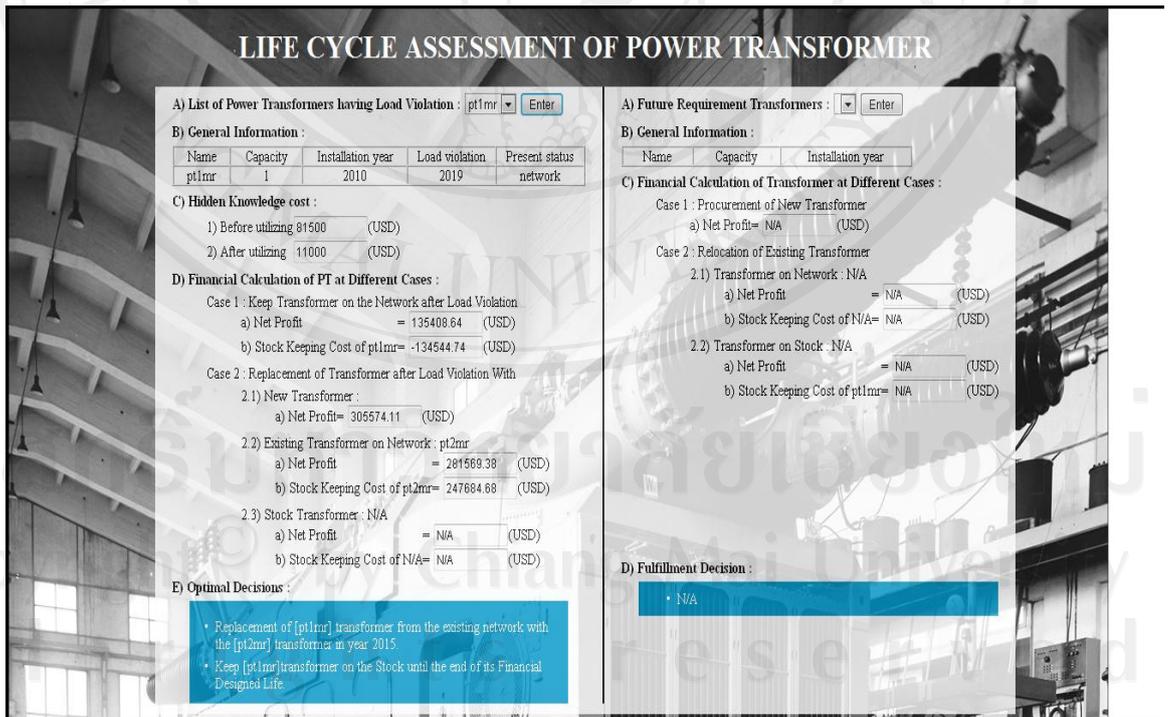


Figure C.6 Decision on Pt1mr in case II.

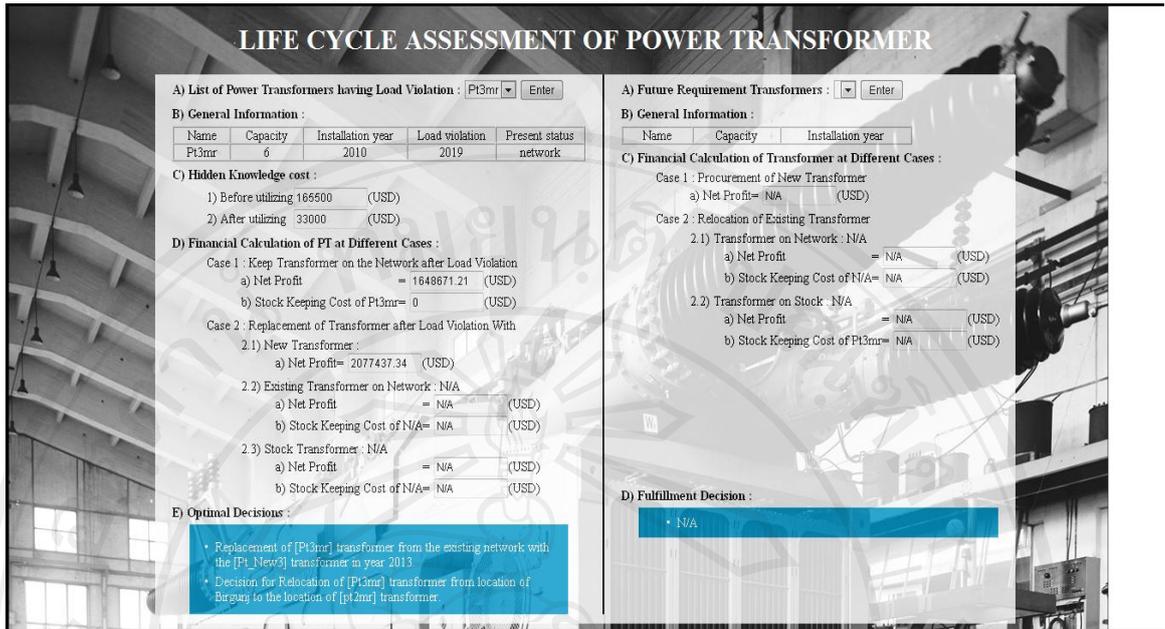


Figure C.7 Decision on Pt3mr in case II.

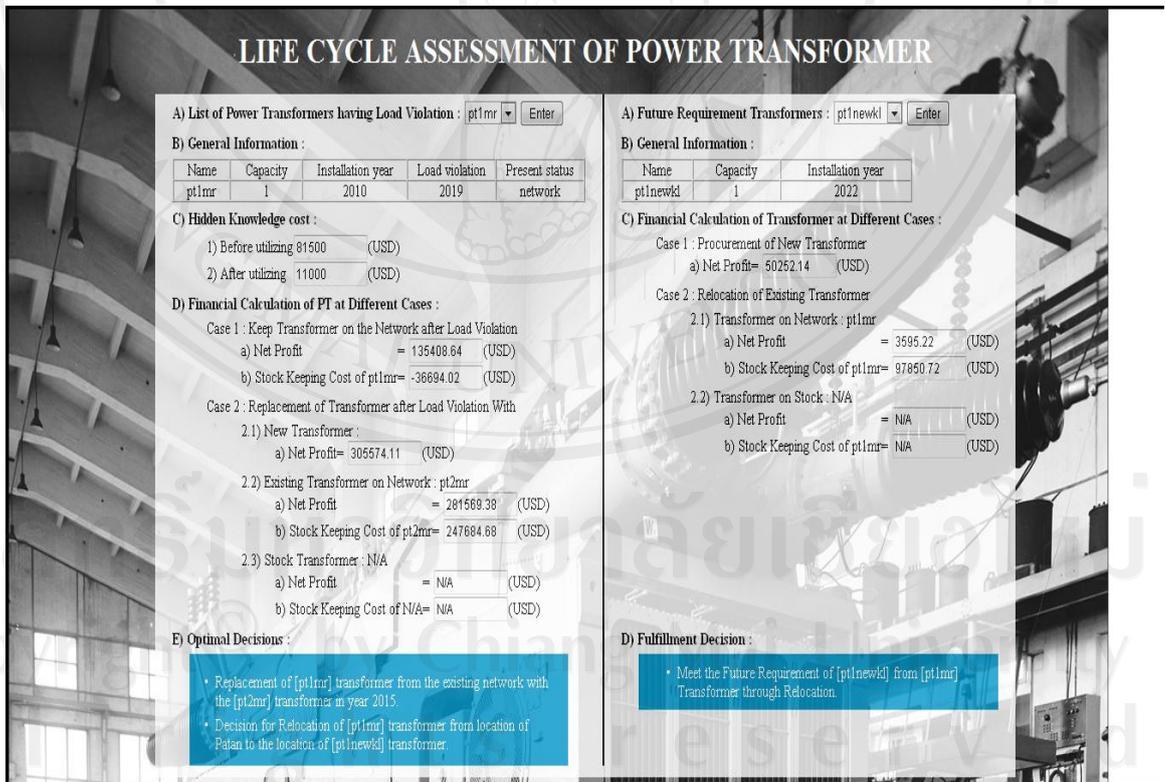


Figure C.8 Decision on Pt1mr and Pt1newkl in case III.

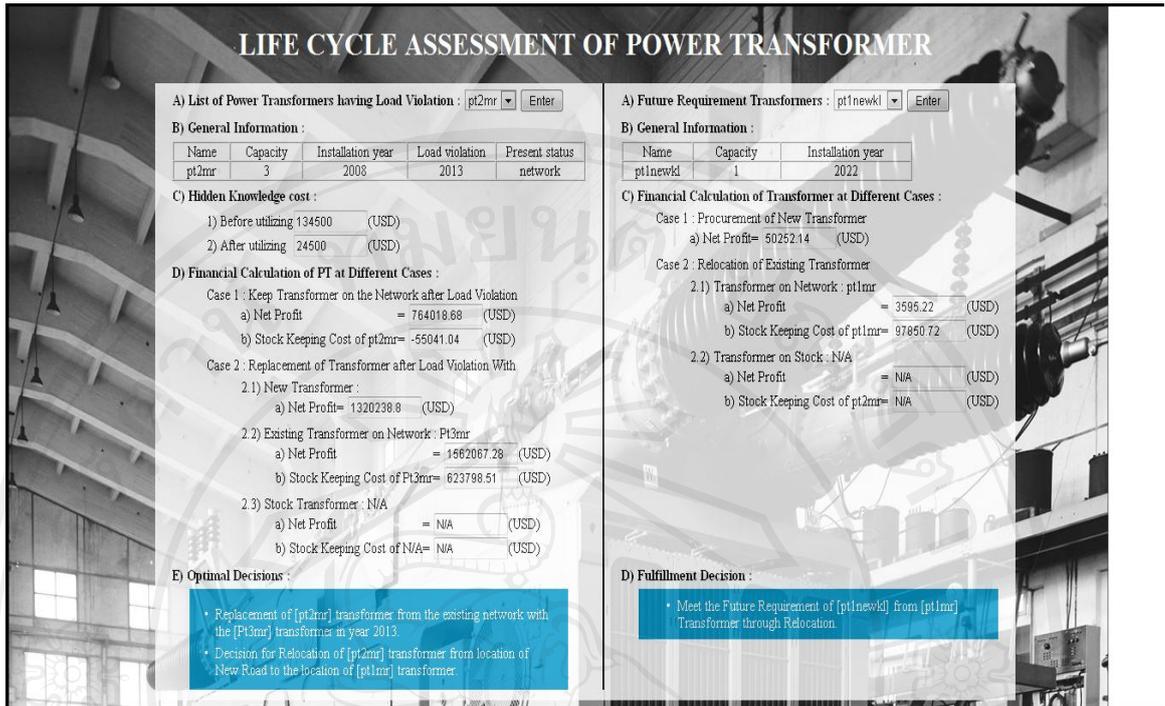


Figure C.9 Decision on Pt2mr and Pt1newkl in case III.

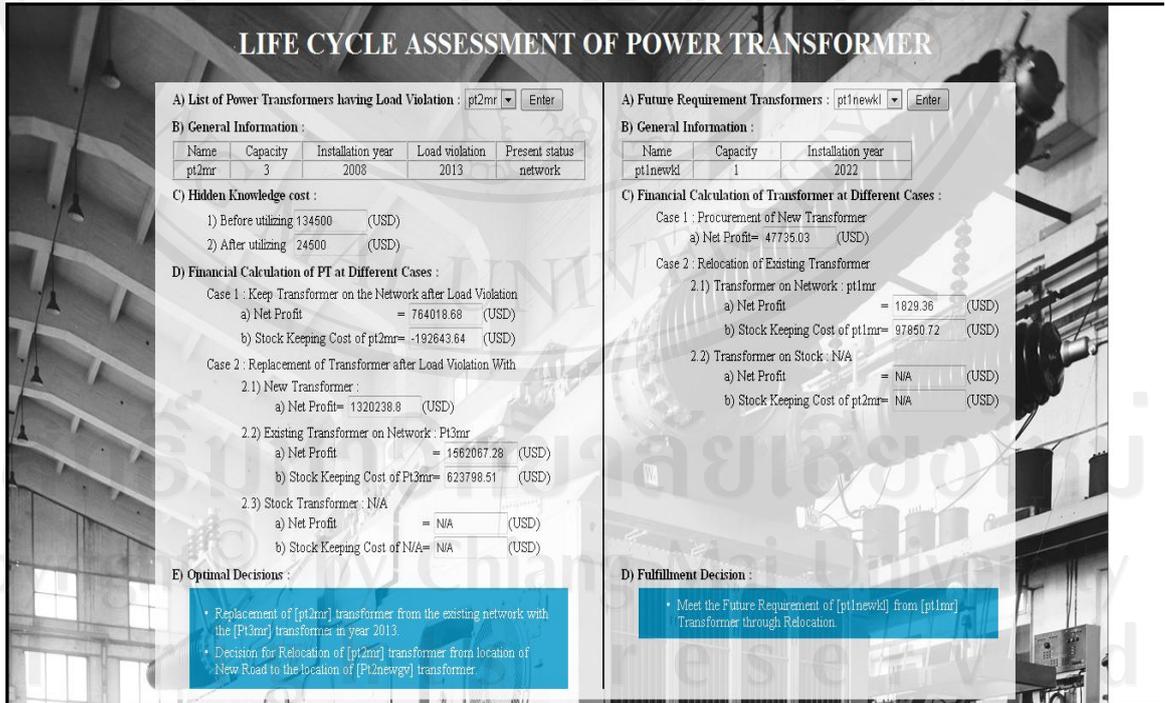


Figure C.10 Decision on Pt2mr and Pt1newkl in case IV.

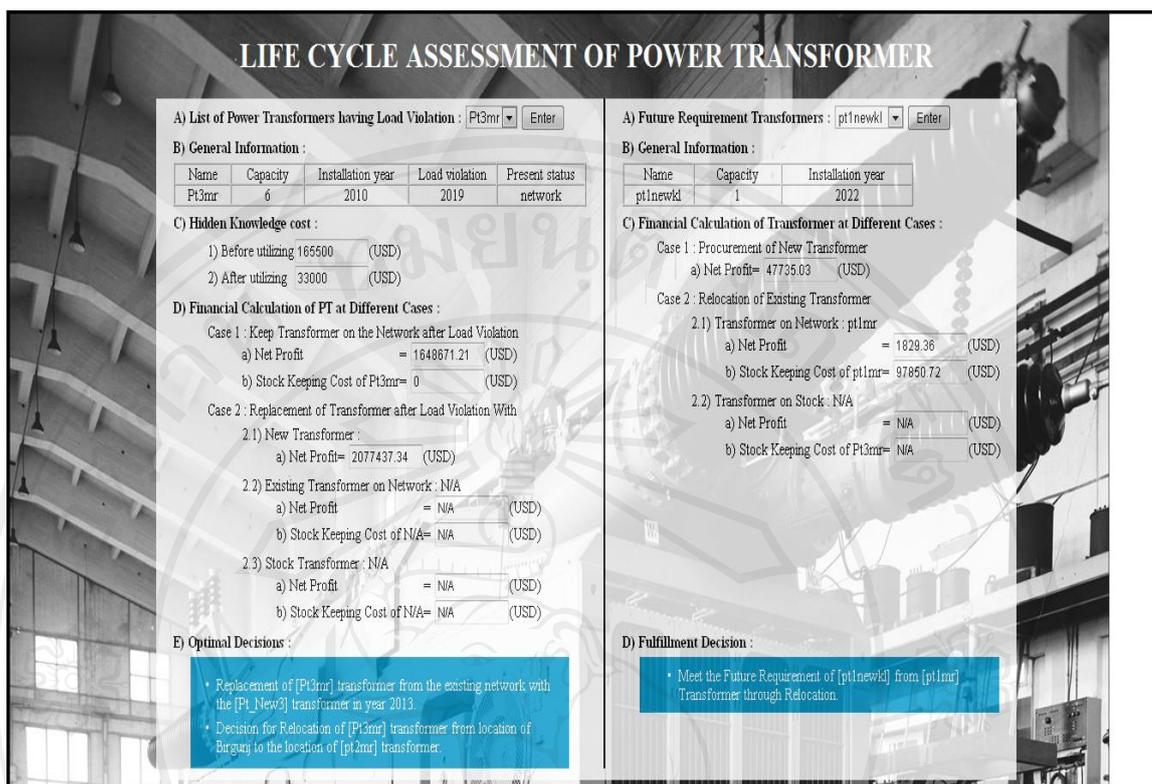


Figure C.11 Decision on Pt3mr and Pt1newkl in case IV.

CURRICULUM VITAE

Name Mr. Sachin Sharma Bhandari

Date of Birth 6th May, 1977

Educational Background

- 2000 Bachelor Degree in Electrical and Electronics Engineering, Kathmandu University, Kathmandu, Nepal
- 2005 Master Degree in Information Technology, Kathmandu University, Kathmandu, Nepal

Working Experience

- 2000-Present: Kantipur Engineering College, Kathmandu, Nepal
Position: Faculty Member