

3. RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

In this chapter, the research design and methodologies used are discussed with basic application models; which can be used to analyze the transfer process and its influencing factors in USL. Based on the literature survey, the researcher developed a model which can be used to analyze the technology transfer experience at USL. This will guide the company on how to do a proper analysis before acquiring new technology to USL in future.

3.2 Seven factor model Analysis

In order to conduct this research in a methodical way, the model containing the conceptual framework for effective technology transfer, known as “seven factor model” has been considered as the main model. This model is selected because it comprehensively covers all the factors and variables within the framework where the technology transfer has taken place. Although the particular model is very simple, it identifies technology components, capabilities and linking mechanisms that are appropriate elements in the seven factor model, where each element in the model could be analyzed in detail.

This research aims to examine the technology transfer process based on the following seven major elements.

1. Transferor (Seller)
2. Transferee (Buyer)
3. Technology
4. Transfer mechanism
5. Transferor environment
6. Transferee environment
7. Greater environment

The focus of the technology transfer can be different from transferor and transferee, individual to individual, organization to organization, and nation to nation and all the other

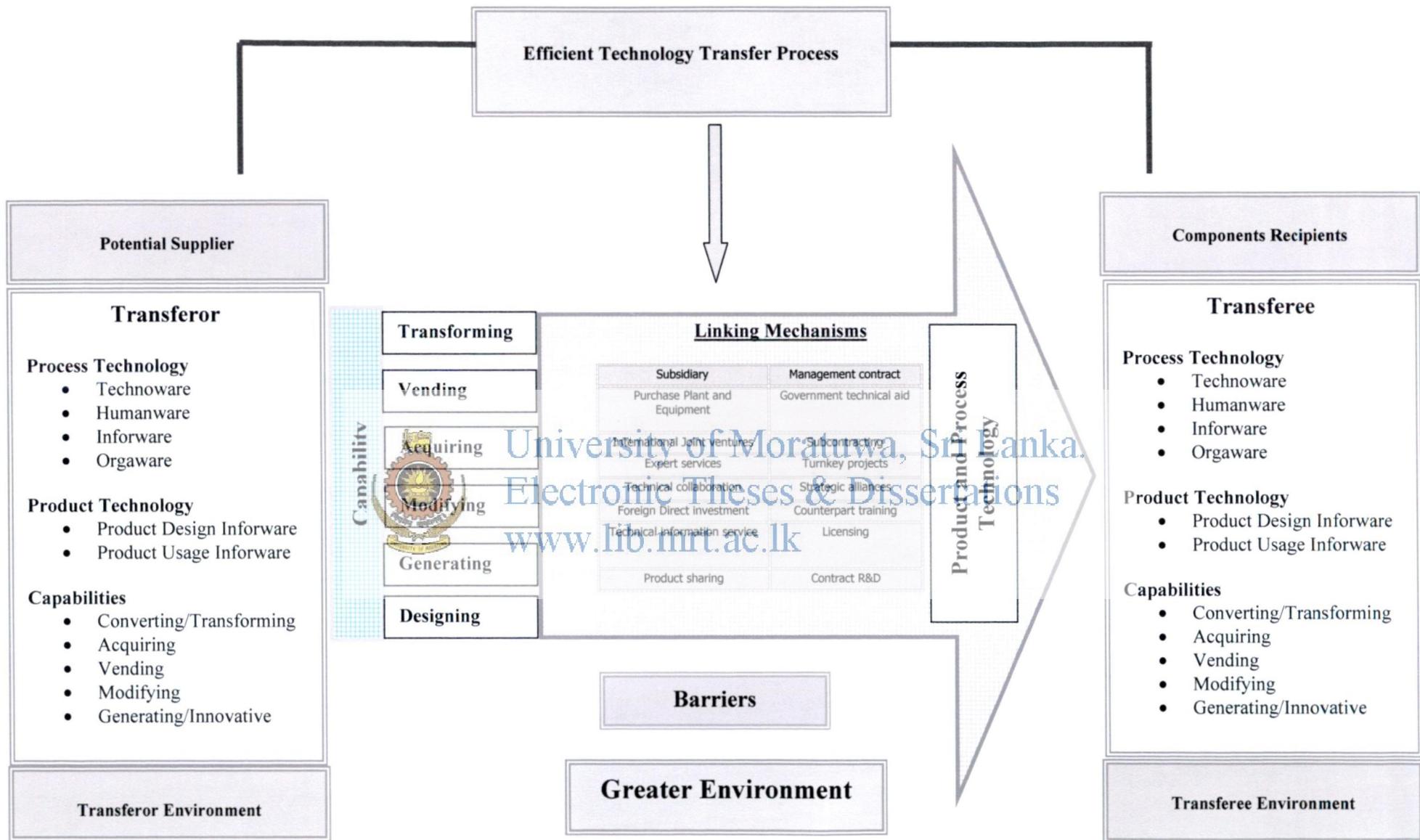


Figure 3.1: Combined Conceptual Model

possible ways. Therefore this model can easily be used to understand and identify the factors in each stage and also to analyse case by case at each level.

Finally both technology capabilities and seven factor model are merged together and made a common model, which satisfy the entire requirement which is planned for discussion in this research. The entire seven factors are analyzed with relevant applications to study the transfer.

3.3 Combined Conceptual Model

Figure 3.1 shows the combined model which is used to analyze this study. It was developed based on the findings from the literature survey and the work of Hussain (2005). This new simplified model provides an overall picture within the framework of technology transfer, key elements and sub elements. This model is also used to carry out analysis of technology transfer at USL. In the first level before the transfer process, the technological needs to be transferred are assessed at the technology component level. Transferring mechanism is chosen based on several factors mentioned previously, like greater environment, technological capabilities etc. As the final step, capabilities of the recipient will be studied in detail to obtain good feedback on this technology. All the three core processes will be linked to all three environments during the transfer process.

Suitable linking mechanisms will be dependent on the type of technology being transferred plus both the technological capabilities and the level of the technology components possessed by the transferee.

Finally report provides an integrated approach for the choice of appropriate technology based on the concept developed by Ramanathan. USL has faced many problems related to choice of technology. Here this concept has been discussed by using one national award winning project. This is an example which USL can use to gain an understanding on how to make a good technological choice by combining salient and valuable features of both techno-economic and contingency approaches. Here the three categories of criteria for screening: techno- economic, organizational and operating domain compatibility have been demonstrated with this example.

3.4 Data Collection Method

A comprehensive questionnaire attached in Appendix - 2 was prepared to gather data and evaluate the key elements and sub elements in the model considered in this study. It is also developed to assess the technological capability of transferee, which would give an idea about the success and failure factors of technology transfer. Further, it could be possible to observe where the technological gaps exist and what areas are in need of strengthening. The questionnaire in **Section-1** is intended to measure the technological capabilities of Unilever i.e transferee (buyer). The **Section- 2** of Questionnaire is intended to identify the technological components involved for this particular case. **Section- 3** was specifically designed to identify the enabling environment for technology transfer at USL. This section basically aims to assess the Transferee Environment, Transferor Environment, Greater Environment and barriers to technology transfer.

3.5 Data Analysis Method

3.5.1 Evaluating Technological Capabilities



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First page of questionnaire, Part - A is titled “Profile of the Respondent”; the data of the participants are collected to verify the information validity and reliability. Part B (Section – 1) is intended to measure the technological capabilities of Unilever. Each capability includes a number of questions. Scale has been given to each question, as indicated in Table 3.1, in which the respondents were asked to write down their score by considering their overall experiences in Unilever. The summary of the grouped questions and the related capabilities is given below in Table 3.2.

Table 3.1: Likert scale assigned for Technological Capabilities

Criteria	Very poor	Poor	Good	Very good	Excellent
Scale	1	2	3	4	5

Table 3.2: Grouped Questions and Related Capabilities

Question Numbers	Capability to be Assessed	Scale
Section 1 Q1- Q5	Converting/Transferring capability	1- 5
Section 1 Q6- Q10	Acquiring capability	1- 5
Section 1 Q11- Q15	Vending capability	1- 5
Section 1 Q16- Q20	Modifying capability	1- 5
Section 1 Q21- Q25	Generating/Innovating capability	1- 5

3.5.2 Evaluating Technological Components

Part - B (Section – 2) is intended to measure both the technological components and the elements in the seven factor model such as transferor, transferee, transferor environment, transferee environment, greater environment, transfer mechanisms and technology. Part - B (Section – 2) has been introduced with a scale which varies from 1- 5, in order to measure the Technological components of the technology that can be transferred to Unilever and the respondents were asked to mark their rank based on their experiences in the organization. The scaling method and summary of the grouped questions and the related elements are given in Table 3.3 and Table 3.4 respectively.

Table 3.3: Likert scale assigned for Technology Components

Criteria	Very Low	Low	Medium	High	Very High
Scale	1	2	3	4	5

Table 3.4: Grouped Questions and Related Elements

Question Numbers	Assessing Category	Remarks
Section 2 Q26 – Q30	Technoware	Considered Technoware, equipments & accessories transformation and processing
Section 2 Q31 – Q35	Humanware	Considered contact and support Humanware
Section 2 Q36 – Q40	Orgaware	Considered all work conventions, organization, facilitation and evaluation
Section 2 Q41 – Q55	Inforware	Considered TSI, HIS and OSI

3.5.3 Evaluating Enabling Environment

Part - B (Section – 3) is intended to measure the enabling environment for technology transfer at USL. Part - B (Section – 3) has been introduced with a scale which varies from 1-5, in order to measure Enabling Environment for Technology Transfer to Unilever and the respondents were asked to mark their rank based on their experiences in the organization. The scaling method and summary of the grouped questions and the related elements are given in Table 3.5 and Table 3.6 respectively.

Table 3.5: Likert scale assigned for measure the Enabling Environment

Criteria	Very poor	Poor	Good	Very good	Excellent
Scale	1	2	3	4	5

Table 3.6: Grouped Questions and Related Elements

Section 2 Q56 – Q65	Transferee Environment	Consider organizational capacities and capabilities
Section 2 Q66 – Q75	Transferor Environment	Limited information
Section 2 Q76 – Q80	Greater Environment	Limited information
Section 2 Q81 – Q90	Barriers	Considered internal and external environment status

This questionnaire helped to gather information on the Transferee environment, Greater environment, Technology selection, Transfer experiences, leading supplier status, barriers & other problems. Here the researcher was unable to find the Transfer Mechanism due to lack of understanding.

3.5.4 Analysis Method

The survey was carried out within the supply chain – make team. The participants were asked to rank on a 5 point Likert scale: the relative importance of each of the property which effect the TT as perceived by them. The significance of each property was then assessed using the Relative Importance Index (RII). This method was used by Bello, M.O. et al, (2007) in their study of “The influence of Consumer Behavior on Variables Determining the Property Value in Lagos, Nigeria”. Similarly, Emsley, M. et al, (2004) in their study on “Critical Factors Influencing Construction Productivity in Thailand” also used this RII method.

Assessment of Effectiveness of Technology Transfer Process

In order to analyse the research results, Relative Importance Index method was used. It is a weighted average method where the average rank for each question assigned for satisfaction level is calculated.

The following formula was used to calculate the **Relative Importance Index (RII)** for satisfaction level assessment.

$$RII = \frac{\sum (W_n) \times 100 \%}{A \times N}$$

Where,

- W = Constant expressing the weighting given to each response.
- A = Highest weighting
- n = Frequency of responses
- N = Total number in the responses

3.5.5 Sample Selection

To administer the questionnaire sample from Supply Chain was taken. For this survey all the employees, who are in the ranks of engineers, managers and senior levels, holding different responsibilities in the Supply Chain – Make have participated. Further, the 7 most senior and top ranking managers in USL were selected from the supply chain, for the interviews and to set the targets.

Questions were grouped together to evaluate the effectiveness of technology transfer with respect to each element within the seven factor model.

3.5.6 Discussion with Experts

After the completion of the questionnaire survey, formal discussions were arranged with the 7 most senior and top ranking managers in the USL organization in order to set the required targets for the considered areas of study. This enabled the setting of the expected targets for Technology Capability, Technology Component and Environment for Technology Transfer. In this regard, components of Technology Capability i.e. Converting, Acquiring, Vending, Modifying and Generating capabilities were analyzed against the set targets for USL.

Similarly components of Technology Components i.e. Technoware, Humanware, Orgaware and Infoware were analyzed against the set targets. Finally, components of Environment for Technology Transfer i.e. Transferee Environment, Transferor Environment, Greater Environment and Barriers to Transfer were analyzed and compared with the targets.

The following senior ranked officials were interviewed to set the above targets.

1. Ishraq Thameen
Supply Chain Director
2. Madhawa Abeyrathna
Factory Manager
3. Janaka Gammanpila
Manufacturing Manager
4. Welipitage Ariyathilake
Chief Engineer
5. Sanjeeva Jayasundara
Factory Engineer
6. Amitabh Singh
Project Manager
7. Priyankara Geekiyanage
Project Engineer

The meetings were done after the 4 day workshop on value engineering organized in December 2009. This workshop was facilitated by Raman Gopalan from Paramount Resources – India, in which USL’s regional technology team and regional engineering teams participated as well.