

Conceptual Model for Transfer of Technology in a Shipyard

M. R. Firmansyah¹, W. Djafar.²

^{1,2}Department of Naval Architecture, Faculty of Engineering, Hasanuddin University, Makassar
90245, Indonesia,

Corresponding author¹: mr.firmansyah@gmail.com

ABSTRACT

Transfer of technology is an important program to be done by a shipyard if the respective shipyard is to maintain and increase its competitiveness. But sometimes, some aspects that need to be considered in a transfer of technology program are ignored. Before any transfer of technology program is to be conducted in any shipyard, identification of the required technology to be transferred and why the changes in shipyard technology are needed must be done. These identifications will lead to the identification of the current shipyard competitiveness and the identification of the shipyard hardware and software technology components performances. Decision will be made which is based on these identifications. If the software technology components show good performances, then maximum advantages will be obtained from the current facilities and any investment in hardware technology components will tend to reduce the cost per unit of output. On the contrary, if the software technology components show bad performances, then any investment in hardware technology components will tend to increase the cost per unit of output. In this paper, a conceptual model of transfer of technology in a shipyard is developed. The proposed model is expected to be a reference model for a shipyard practitioners when a transfer of technology program is about to be conducted and hence prevent losses of investment mistake and obtain maximum advantages from the transfer of technology process.

Keywords: transfer of technology, hardware technology, software technology, shipyard competitiveness

1. INTRODUCTION

Transfer of technology is very important to be done by any shipyard since the fast development of new technology has made the reduction of technology life cycle. An effective and efficient transfer of technology must always be considered by any shipyard to maintain shipyard competitiveness in this current global business [1].

The word technology in the transfer of technology phrase has been

defined by some researchers. In general, the technology adopted by any company including shipyard is defined as anything in that company which refer to the equipments and physical hardware and software (non physical). The latter refers to company management, organization, method and procedure which being used to maximized the use of facilities and human resources, process and system for planning, quality, cost and material control [1], [2] and [3].

Based on the above definition of technology, then transfer of technology can be conducted in the form of flow of ideas, techniques and theories from one place to another and from one industry to another industry. Hence, transfer of technology can be defined as the successfulness to change receiver basic technology through acquisition and fusion of “something” such as skills, knowledge and worker capability, tools and management method, formal and informal controlling and planning system, as well as coordination system. [1] and [4].

The aim of any transfer of technology project is different in different company. It depends on the respective company interest. Various aims and interests from various companies in conducting transfer of technology can be described as follows;

- To reduce the production cost or to cover the technology gaps in the company which impose the addition of cost for facilities and equipments [3].
- To be more competitive in a market [5].
- To enter domestic or overseas market [6]
- To increase capacity and technical performance, variety and flexibility improvement, performance

improvement, personal skills development, cost and time reduction in performing any task [2].

- To increase the system capability and hence increase production, management and innovation capability of a system [1].

2. TECHNOLOGY STRATEGY

Identification of the required technology to be transferred and why the changes in a shipyard technology are needed must be done before any of the transfer of technology program to be conducted.

Analysis for the transfer of technology need in a shipyard can be put into a shipyard technology strategy. The strategy is very important for a shipyard since without such strategy, there is no technology policies guidance in the future [1]. In this shipyard technology strategy, some important aspects of technology are being described such as:

- Guidance for the future technology policies.
- Needed development (direction and purpose) in the shipyard technology.
- Implication from any adopted technology to the current shipyard technology and to the efficiency and effectivity of the production process.

- Direction for the shipyard technology development is directed to the market need and shipyard competitiveness.

Adoption of the right technology strategy is very important to prevent any loss on the investment cost. Hardware technology and software technology must be balanced in order to achieve competitive cost per unit of output. Birmingham [1] said that the level of adopted technology in any time is depending on the availability of the needed technology, technology which agreed to be applied and shipyard cost structure.

Some aspects that must be considered in the formulation of shipyard technology strategy are the level of the current shipyard competitiveness as well as the performance of the shipyard hardware and software technology components (Figure 1). If the performance of the shipyard software technology is good, the maximum advantages will be obtained from the current shipyard facilities and the investment on hardware technology will tend to reduce the cost per unit of output. On the contrary, if the performance of the software technology is bad, then any investment on the hardware technology will tend to increase the cost per unit output.

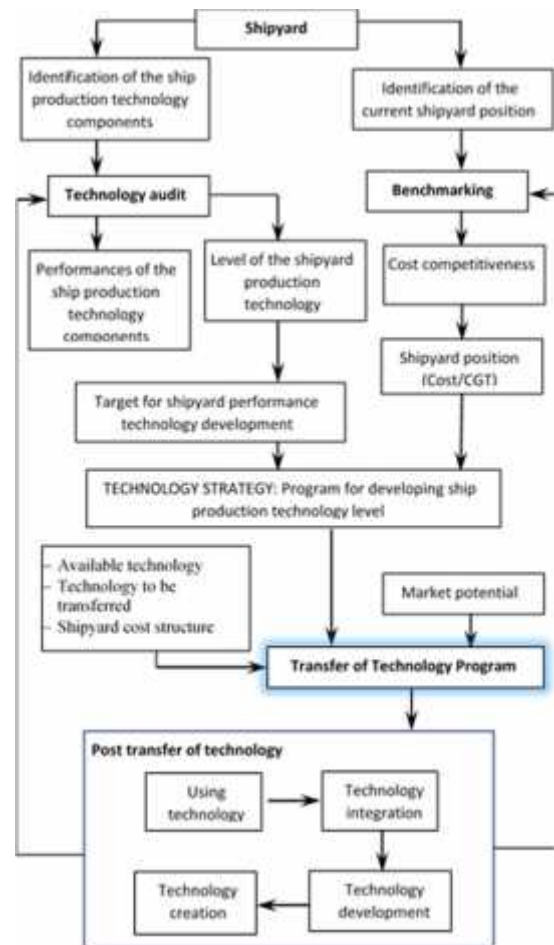


Fig. 1 Conceptual model for transfer of technology in a shipyard

A. Identification of the current shipyard position

The lack of experiences of the shipyard staffs as well as the lack of the knowledge transfer will cause the shipyard to operate with their current basic technology.

This condition will cause the lack of attention of the staffs to the high level of performance standard. To solve the shipyard staff lack of knowledges of the high level of performance standards, benchmarking need to be done in order to

show the comparative performance working standard of another shipyard. This information will be expected to push any changes in the shipyard as well as to encourage any innovative training and education. Benchmarking can be used to identify as well the relative position of a shipyard against another shipyard which have been recognized as the best in the world or at least against any known better performance shipyard.

B. Benchmarking

Benchmarking requires an agreed and acknowledged measurement tool which enables any shipyard to compare their working process effectivity or their shipyard performance against other shipyard which have been acknowledged to be the best shipyard performance in the world. One common general approach which being used by industries including shipyards to compare their company performance is competitiveness which is based on the cost (cost competitiveness). This is based on the cost per unit of output measurement.

This standard measurement will enable any shipyard to compare their competitiveness against any competitor and then determine target for improvement as part of the respective shipyard business strategy.

In a commercially shipyard competitiveness ability, the cost per unit of output measurement shows the effectivity of a shipyard [7]. By using this simple but effective measurement of cost and output, the performance comparison of different shipyards can be made in a cost per unit of output. At least three years of data measurements are suggested to be made so that the result of the improvement can be averaged [3]. The cost per unit of output of any shipyard must be done in the same currency.

On the cost measurement, the cost to be measured is the cost which part of the company operational total cost while on the output measurement, CGT (Compensated Gross Ton) as the unit of output must be used [8]. For any type of ship, this measurement of output is conducted by multiply GT with a coefficient which reflect the number of work needed to build any ship dimension and type. The result of the identification using this cost and output measurement will determine a shipyard position against a shipyard which is acknowledged as the best in terms of Cost/CGT.

C. Identification of the ship production technology components performance

The second identification that must be done before any of the transfer of technology program to be made is to

identify the performances of the ship production technology components which being used in the respective shipyard.

This identification is needed in order to know the performance of the current shipyard technology components. Based on this performance information of the shipyard technology components, an improvement action can be made to increase the performance of the technology components. The first target of improvement is to leveling the performance of all technology components so that the effectivity and efficiency of the production process can be achieved. The correction action or an improvement program to be made is directed and adjusted with the main aim of the shipyard development program. The identification process of shipyard technology components can be done using Audit of technology tool [3].

D. Technology Audit

Technology audit is a procedure which has been developed to measure the performance of the ship production technology in a shipyard [3]. This technology audit consist of a complete questionnaires which being used as basis to collect information regarding ship production technology in a shipyard. The questionnaire is divided into 7 parts which each shows the technological

components used in a shipyard. The first four parts is related with the shipyard software technology components which consist of strategy, marketing, purchasing and human resources while the last three is related with the shipyard hardware technology components which consist of design, planning and production. Survey is conducted by direct interviewing with some related authorize shipyard staffs. As an addition, some direct observation in the shipyard location is being conducted as well. The result of the interview and observation are being used to analyse certain elements in a shipbuilding procedures and then rank these elements in a technology scale 1 to 5.

E. Level of ship production technology

Technology audit will assess 70 of the technology basic elements in 7 audit moduls which includes hardware technology (engine and equipments) and software technology (management and operational system).

Based on the assessment result of the technology elements, the level of the shipyard technology as a whole can be determined. The level of each technology element can be determined as well which will be the description of the technology element performance.

F. Target for the performance improvement

Based on the performance assessment of each technology components, the level of each technology component can be determined. This technology component level of technology is then being compared with the whole shipyard technology level. Based on this comparison information, a comprehensive planning including the method to achieve the improvement in the level of the technology components to the target of shipyard technology level can be made.

Technology strategy is made in the form of program matrix which covers the whole shipyard technology development planning. In this matrix, it is described for each technology components functional strategy, policy as well as indicator the successful improvement for each technology component.

G. Transfer of technology

In a transferring process, commonly there are two basic things to be transferred which are knowledge transfer and technology transfer. Knowledge transfer is skills to use technology and new ideas while technology transfer is the implementation of the technology and the new idea. Every transfer of technology consists of

the technology itself and skill to use it while transfer of knowledge is the important factor for new technology and new ideas. Both type of transfer must be integrated for performance improvement.

In a transfer of technology process, it is significant to determine each party which involved in the planning stage, implementation and evaluation stage. Any involved party must be clear for its role and responsibility and it's stated in the technology transfer planning [9]. For example, technology supplier, must be clear of the types of technology that supplier can supply, transfer of technology plan and function and planning. The same thing applies for any party involved in this transfer of technology process [10].

H. Post transfer of technology

After the transfer of technology program is being conducted, the transferred technology then being used and applied in the shipyard, integrated into a new shipbuilding project, developed with some adjustment to the current shipyard technology, and then by continuous research and development, a new technology will be created [11].

3. CONCLUSION

Before any of the transfer of technology activity to be done, a shipyard

must be doing some preparations. The first is to identify the position of the current shipyard to determine the shipyard competitiveness in cost per unit of output. The second is to identify the performance of the shipyard technology components. This second identification can be done using audit of technology. The result of these identifications will be the base to make a shipyard technology strategy. This technology strategy will be the base for the shipyard to do a technology transfer program.

REFERENCES

- [1] Banerjee, S. K, (1999),” Theoretical Aspect of Transfer Technology: Concept and Models “, Proceeding of the Annual Reference of ICIMS – NOE, ASI ’99 Section, Lenven, Belgium.
- [2] Stock, G. N, Tatikonda, M. V, (2000), A Typology of Project-Level Technology Transfer Process, Journal of Operation Management, No. 18, pp. 719-737
- [3] Birmingham, R, Hall, S, Kattan, R, (1997), Shipyard Technology Development Strategies, Journal of Ship production, Vol. 13, No. 4, pp.290-300
- [4] Petroni, G, Verbano, C, (2000), The Development of a Technology Transfer Strategy in the Aerospace Industry : The Case of the Italian Space Agency, Technovation, No. 20, pp. 345-351
- [5] Didenko, N. I, Didenko, I. A, (1999), Experience in Realizing Technology of Dynamic Optimization at Power Station (Communication between Technology Supplier and Users), Proceeding ASI ’99, pp. 228-238, Leuven, Belgium
- [6] Chen, X, Sun, C, (2000), Technology Transfer to China: Alliances of China Enterprises with Western Technology Exporters, Technovation, No. 20, pp. 353-362.
- [7] Storch, R. L, Hammond, C. P, Bunch, H. M, Moore, R. C, (1995), *Ship Production*, Cornell Maritime Press, Maryland
- [8] Bruce, J, Gerrard, I, (1999), *The Business of Shipbuilding*, LLP Limited, London
- [9] Primo, M, A, M, DuBois, F, 2012, Technological Capabilities of Brazilian Shipbuilding Suppliers, Journal of Technology Management Innovation, Vol. 7, Issue 2
- [10] Clasen, G, Avila A, Alves, A, Zawislak, P, 2016, Technology Transfer and Capacity Building in the Brazilian Shipbuilding and Offshore Industry, International Association for Management of Technology, IAMOT 2016 Conference Proceedings.
- [11] Efstathiades, A, Tasson, S. A, Oxinos, G, Antonion, A, (2000), Advanced Manufacturing Technology Transfer and Implementation in Developing Countries : The Case of the Cyriot Manufacturing Industry, Technovation, No. 20, pp. 93-102

