

Process of Technology Transfer and Reverse Engineering

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Abstract

Market development and exportation are considered as the biggest matters of concern to senior executives in manufacturing and engineering organizations during the recent years. The question always arises as how to reduce a gap in our market with developed countries in the short run and possess a good share in the international trade. Evaluating such nations as Iran not gradually achieving technology and attempting to surround it over a period of time firstly presents with the widespread use of reverse engineering as a proper way to understand products basically as well as create and develop them in terms of its requirements. Further, disseminating and monitoring the good implementation of the systematic process of reverse engineering as well as employing engineering tools and techniques will make a profound impact on products technical knowledge in a short space of time and at a low cost. Still, the process is not now accomplished as a result of not its systematically employing.

Besides various technological strategy, the current paper aims to briefly present research and development position to achieve them, reverse engineering strategy choice as an appropriate way to progress developing countries and the methodology of the related system.

1- Introduction

Undoubtedly, the first prerequisite for improving quality and innovation is to recognize the product and understand the factors influence its characteristics. Reverse engineering is applied to retrieving and identifying the components of a product. In particular, if you do not have access to the basic design. Moreover, it is used for maintaining expanding and developing the existing facilities as well as re-engineering.

This method is accepted for developing countries first the lack of technical data is determined to support a product creation. Then, carrying out cohesive teamwork consisting of practitioners and the researchers in different disciplines of basic sciences

as well as managing and making good arrangements for R&D organizations documents and specific maps concerned with a product design are obtained. Prototypical pilot phases and if necessary manufacturing a product are done, considering its Features, objective and terms of the product design, common national standards and the unknown coverage.

In a general sense, R&D activities are always followed by two products: knowledge and technology. The role of R&D activities in developing technology is to such an extent that scholars recognize technology as a product of R&D factories.

Technology is the master key of development and the most influential factor for economic evolution in Societies.

Strategies to achieve technologies and products:

Basically, there are different ways to achieve technology as an industrial product. Every nation utilize them in each industrial area depending on its scientific, technical, economic and political capabilities. A variety of significant strategies to achieve a new product and target technology are as follows:

- 1- Innovation and design strategies to production.
- 2- Technology development strategy.
- 3- Copying and reverse engineering strategies.
- 4- Technological selection, transfer and localization strategies.
- 5- Effective use of existing facilities and technology
- 6- Purchase of plants.
- 7- Purchase of goods and desired technology.

Technology transfer concerning the emergence of their products passing the introduction phase is mainly more moderate to developing countries. In this case, it is uneconomical and unreasonable to

achieve the same product or technology in the developing countries via employing research to production strategy unless such goals as strengthening the country's scientific and technological bases are raised. Still, this strategy will not probably be desirable. The greater the degree of technology development is in prior to decline and obsolescence phase, the more affordable product and technology purchase will be.

The right strategy for developing countries like Iran is reverse engineering discussed now.

The overall process of reverse engineering and methodology:

1- Functional/Economic Analysis:

It consists of two parts:

a. Targeting and data collection. product development, product troubleshooting and self-sufficiency are introduced. Then, the aim of the project on each case will be explained. the phase aims at collecting all documentation and facilitating technical data and documentation production and employment reverse engineering.

Technical data package can be achieved using such methods as identifying similar cases, collecting data on procedures, examining embeded parts, a higher level of assembly sets highlighting the related information on input and output factors, adjacent parts as well as final consumption, a specifying and describing purchase of parts, a list of parts and schematics providing the initial data on checking the configuration of a part or a set. Naturally, this step is done more comprehensive and systematic to classify data level in the engineering processes. Thus, potential duplications will be avoided and the costs will be saved.

b. Assessment of data and planning: it aims to determine essential incomplete data level and estimate the cost of reverse engineering. Given the estimated level, implementing reverse engineering requires the preliminary estimates of expertise, testing, equipment, etc. After estimating the cost, the allocation of resources and reasonable estimated time are provided to produce such information. The project's Gantt chart will be presented to complete the technical data package. In fact, a map is drawn to demonstrate the procedure.

2- Function and case disassembling analysis:

Each case is composed mainly of some components undertaking a specific task. Its results in bringing about a desired task for each case. Here, reverse engineering team should be able to identify the significant parameters and characteristics of a component input and output. After defining the components as well as their inputs and outputs, the function of components should be audited with the available technical documents to a specify its contradictions. Then, the essential technical data on components will be extracted by experiment. If the breakdown and assembly of the components are decomposed into lower level components, this action is expected to continue reaching the parts level so that an assembly level will be specified. In the phase of break down, the functional task of lower-level parts should be recognized to perform the functional configuration audit and the physical configuration audit.

Ultimately, having been created and completed during the functional configuration audit and physical configuration audit, the technical Data Package will provide necessary information about the level-1 maps after validation.

3- Hardware and software on analysis:

This action, as the most significant part of reverse engineering, includes the following:

a. Material analysis: examining the structures and defects is done by chemical and metallurgical analysis, surface layers examination and mechanical properties measurement.

b. Review of manufacturing process: It includes the possible process for producing physical levels, the examination of surface tensions as well as microstructures and the measurement of some non-critical features like level smoothness helping detect the manufacturing process in directly based on the type of physical levels in the parts.

c. Dimensional analysis: It is comprised of such stages as dimensional measurement, tolerance and sensitivity analyses.

d. Electrical – electronic analysis if necessary: The result of this phase will be recorded and drawn on the level-2 maps with regard to the characteristics of circuit output, circuit path, materials, removal of coatings and essential connections for reproduction.

4- Product improvement and product analysis:

Some expensive areas such as design defects, additional design, excessive restriction on tolerances, excessive requirements for functions, etc. may be revealed and revised in prior to completing to process via obtaining new data and reviewing the value.

Engineering in the intended items for implementing reverse Engineering.

5- Plan for manufacturing process and provision for required quality assurance:

Here, all data packages completed so far are taken into consideration in terms of production capability and manufacturing process. In sum, this phase output leads to creating the level-3 maps including the essential requirements of design, engineering, manufacturing and quality control units to achieve or make the desired item.

In general, the level-3 maps consisting of all the essential documented parameters to manufacture and item are the result of reverse engineering. They intend to verify the accuracy of technical data packages to back up the parts production so that the adequate confidence in the accuracy as well as completeness of the maps and the characteristics created by reverse engineering process will be gained.

6- Preparation for final documentation:

Many engineering maps and testing procedures are revised several times as a product is being manufactured and tested in the phase of sample production. Moreover, all revised levels from level zero to the latest results should be situated in the technical data package. Then, a complete technical data packages is obtained through adding the information obtained by inspecting and making sure of the samples quality to the technical data package. Finally, a complete final technical data package associated with the product seen as the ultimate goal of reverse engineering is obtained after corresponding to the standards of technical data packages.

Benefits and achievements of reverse engineering:

1- Creating capacity and strengthening manufacturers technically and technologically by recognizing and full product understanding (obtaining the technical knowledge of products) and making self confidence among the engineers and Industry experts when they

are facing the domestic industries as well Technologies.

2- Designing an updated product in the global standard level and discovering the new way of product improvement and development of satisfy customer's needs such as better operation, adding Features and product troubleshooting as well as meet the market's requirements like technological change or its improvement and cost reduction.

3- Creating the potential to understand during advanced technologies transfer.

4- Training required experts in strategic industries.

5- Making systematic steps to help understand and documents the design and its process.

6- Enabling competitive benchmarks to understand competitors' products and develop better products.

7- Re-engineering using the technical knowledge obtained by reverse engineering.

Engineers and industry experts when they are facing the domestic industries as well as technologies.

2- Conclusion:

Reverse engineering is a method of access to the technical knowledge. It requires samples of products adopted at doing a research. The so-called 'discovery, technical knowledge' technical data is extracted by decomposing a product to achieve the technical knowledge. Experts take a product characteristics, objectives and design terms into consideration and attempt to manufacture the product based on their own common, national standards and cover the knowns using great test, expert studying and researching without involving themselves in the technical details and the product design, maybe as a conscious copy of a product, reverse engineering is a method actually adopted by some East Asian and European countries are now advanced, industrialized countries after the Second world war. Therefore, confirming reverse engineering as a productive and efficient strategy to meet Iran's requirements, good experience is gained by supporting the technical, technological aids scheme for industries operated, via providing cheap capital and the government support including appropriate tax policies on the country's various issues and products. Interestingly, the domestic experts gain confidence and technical courage necessary to encounter the foreign experts in the phase of technology transfer using such experience. Furthermore, it is obvious that there will

be certain circumstances to completely understand the technology transfer process, recognize the technical, scientific unknown of the domestic industries, make an effort to remove them, correctly direct the technology transfer, consult authorities about deciding and signing a contract for production, and cooperate the foreign companies, etc. As a matter of the greatest importance in computer hardware and software, reverse engineering is used in different hardware and software areas including domination of the defects, extension of the existing devices capabilities, purchase of spare parts, creation, of the repairing and maintaining centers for advanced devices, tools for learning, manufacturing compatible new products, cheaper than the available products in the market, competing and enhancing software efficiency.

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