Chapter 6

Conclusion and Recommendation

The purpose of this thesis is to develop product data management system to support the estimation of standard times for the chosen company. The company in this case study is a leading manufacturer of electronic components, mainly transformers and power supply units, produced according to specific customer need. The customers who buy from the company are well known brand manufacturers or otherwise known to be the original equipment manufacturer (OEM) of electronic products such as computer, television, microwave, printer, and mobile phone. The Engineering department of the company was facing with a data complexity, which consequent in the long lead-time in standard time estimation and the time estimated values are often subjective in the way that they are not consistent due to the manual handling by engineers. Author had discussed this over with the engineers and together performed a Cause and Effect analysis and the problem was traced to have initiated from the way work is presently done. Thousands and thousands of data were manually handled all the engineers, which introduced inconsistency and allegedly human error. Refer to Table 6.1 for the summary of problem.

Table 6.1: Results of Problem Analysis

Lack	Need	Solution
1. Lack of Manufacturing Knowledge	Description of the product (the technical system to be made)	Detailed Standard Process Plan (see Appendix 1)
2. Lack of experience therefore depend on detailed design description	Knowledge about the manufacturing systems and technologies available in the factory	Part Family and Guideline for Locating Parts to Standard Process (see Appendix 2)
3. Lack of structured mapping between design and production	Recognition of the markets regarding raw materials and semi-finished goods	Part Coding and Catalog (see Appendix 3)
4. Lack of contextual integrity	Standard application of standard time estimation method	Product Data Management System (see Appendix 4)

Having together thought this through with the engineers, efficiency and effectiveness of data handling would have been improved with the introduction of computerized product data management. However before anything author started this by searching the relevant information, theories and available literature in order to broaden vision, thus scope can be sharply focused. Author has learned during the search that guiding principle of this thesis is that data is a corporate resource, which must be protected carefully and use wisely to further the aims of business.

The rationale of the thesis comes from the fact that most PSU designs involve modifying upon the existing models instead of having to start from scratch. The manufacturing process is of similar manner. Accordingly, patterns of standard time estimation in existing products are applicable to a new design. Using the standard time data method for sub-contracting purposes, without clear defined of manufacturing standard time, manufacturing cost cannot be estimated and subsequently manufacturing standard time cannot be established prior the process plan is established, and process plan cannot be completed without product data. Therefore, the ability to establish standard time during the sub-contracting phrase, other factors must also be found before an actual production. The problem lies in that such complete product design information and process plan must be available before an estimate can be computed. This is where the historical production data, both in a tangible or intangible form, come into play. The assumption of this thesis is that large impact on standard time estimation can be made in the management of product data.

The author has investigated this assumption through a case study in which a predetermined time formula rather than an individual stop-watch motion-time study method is used in finding standard times. The formula consists of the following parameters:

1) **Constant time factor** – This involves the use of predetermined standard time related data, e.g., allowed time for a task based on historical production data of the case study.
2) **Variable time factor** – This involves the use of product related data, e.g., the effects of component characteristics such as complexity, size, and material, which varies according to individual customer's order.

6.1 Results of Implementation

Since product data varies according to the new models therefore the author has approached this thesis by utilizing historical production data for future reference in order to achieve faster lead-time and more consistent standard time estimation. To deal with the 4 problems listed in Table 6.1, the use of product data to facilitate standard time estimation in the case study is summarized and presented by the author in Appendix 1 to 4, respectively.

Table 6.2: Data Collection Based on Previous 30 PSU Models

1. A021TD	16. 11030016
2. A022TD	17. 11030026
3. A023TD	18. 11030036
4. A024TD	19. 11030046
5. A025TD	20. 11030056
6. QK1-0061	21. FC331TA
7. QK1-0062	22. FC332TA
8. QK1-0063	23. FC333TA
9. QK1-0064	24. FC334TA
10. QK1-0065	25. FC335TA
11. QK1-0281	26. A039WJ
12. QK1-0282	27. A371WRKZ
13. QK1-0283	28. AF3132198
14. QK1-0284	29. KJ38
15. QK1-0285	30. T2186XHZA

6.1.1 Detailed Standard Process Plan

This presents the work flow, which based on cost structure design of 30 PSU models shown above, for the development of Product Data Management System. The author has transferred manufacturing knowledge of the company in the case study onto a formal document and provided description of the technical system to produce a typical

PSU. The purposes are to standardize the process planning of individual engineer which will result in a more consistent standard time estimated value and to reduce assistance that would otherwise needed in standard time estimation process from the domain experts such as Cost Accountant and Shop-Floor Supervisor. The author extracted and documented the knowledge (necessary information) of that situated in the above mentioned departments based on the Activity Based Costing approach (ABC) into detailed standard process plan. (Refer to Section 4.2 and Appendix 1 for author's development of Formal Detailed Standard Process Plan)

6.1.2 Guideline for Locating Parts to Standard Process

This presents the algorithm for PDM system, which has been developed based on the use of product flow diagram and part family formation. This guideline reduces dependence on detailed design description every time a new PSU model comes in by providing a quick part routing guideline developed based on knowledge about the manufacturing systems and technologies. The purpose is to reduce dependency on detailed design description of complex electronic parts in the Material Specification Master List figuring out what technical system to be made every time the same part is used, the author organized part design data in PSU manufacturing more systematically based on the Grouping Technology (GT) using part coding and part family formation according to certain sets of design characteristics that suit the standard time estimation method in the case study. (Refer to Section 4.3 and Appendix 2 for author's development of Formal Guideline for Locating Parts to Standard Process)

6.1.3 Parts Catalog and Coding

This presents the database of the PDM system based on author research on historical part operation and part maker. The author creates structured mapping between component design and production by providing a key to supplier information to fasten recognition of the markets regarding raw materials and semi-finished goods. (Refer to Section 4.4 and Appendix 3 for author's development of Parts Catalog and Coding)

6.1.4 User's Manual of Product Data Management System

From Appendix 1, 2, and 3 as can be seen that the data flood occurred therefore it would be more convenient to manage using center computerized database system from the development of Microsoft Visual basic, Excel and Access. The necessity of those documentations in Appendix 1 to 3 is that product data of the case study shall be externalized and standardized before a simplifying method such as introducing a computer-based Product Data Management system in Appendix 4 shall later come to optimize confidentiality, integrity, and availability of product data. That is, standard time estimation requirement should drive the need for Information Technology, not that the market availability of Information Technology should drive the need for computer-based Product Data Management program.

6.2 Benefits of Implementation

During the implementation, author has been under observation with the head of engineers along with other engineers and found that the outcome has shown sign of improvement. On average there are 3 power supply unit models ordered per month, and as the result of one month implementation, the number of days used to estimate standard time for each models has been reduced approximately 30%. In total, the solution has helped the company to save 3 working days during the month of implementation. Moreover, the estimated standard time values are more consistent compared to the previous manual approach. Author also expected to see better result in the near future once more amount of product data is computerized and the PDM program is more utilized. Eventually, the ultimate business objective of increasing sales and profits can be improved.

Table 6.3: Result of Implementation

Testing Model	Manual Approach (hrs)	PDM Approach (hrs)
Model QK1-0107	23	16
Model FC124TA	31	22
Model AN2198-T	42	29
	96	**67**

N.B.

The number of hours improved can be worked out by 96 – 67 = 29 hrs of improvement

Which is equivalent to $^{29}/_{96}$ x 100% = 30.2% of improvement over the manual approach

Having introduced the product data management system to the engineering department, in which it was implemented for a month under constantly observation by the domain expert, it was found that the efficiency of the work that is actually in process has been reduced down to acceptable duration. The estimation of standard time can be established much more quickly than the previous working practice, as it cut away the longwinded methods such as searching through piles of documents, browsing through the internet looking for the exact part design, and the need to contact engineers at the headquarter in Japan. The proposed product data management system is steadier than man

thus enables engineers to estimate standard time more accurately and consistently. Hence the estimation in labor costs can be calculated more rapidly and accurately before the actual production is forwarded. The system also eliminates the unnecessary duplication of time studies on operations that are much alike. Lastly, the proposed system encourages less experienced users to participate in the estimation without any serious engineer training.

6.3 Recommendations

The coverage of PDM do not end at just the process planning stage, however, it can be further used in production planning, which is the next stage up from process planning. This thesis is only concerned at engineering support, whist PDM is also useful for Life Cycle product documentation often referred to as Change Management (in order to meet the requirement of ISO) and Access and Control Mechanism of product data vault in order to increase security level of protestation of the company's legacy document (refer back to Figure 5.2). These are the two other functions beyond the scope of this thesis but will definitely be useful for the company of this nature; therefore author suggests that further research is carried forward.