Current practice of engineering change management in Hong Kong manufacturing industries

G.Q. Huang*, W.Y. Yee, K.L. Mak

Department of Industrial and Manufacturing Systems Engineering, The University of Hong Kong, Pokfulam Road, Hong Kong, PR China

Abstract

This paper aims at investigating the current state of engineering change (EC) problem and examining the present industrial practice in managing ECs. The study draws the findings from the interviews that were conducted within four Hong Kong manufacturing companies in 1999. The current state of the EC problem has been examined in the aspects of volume, sources, and effects while the present industrial practice in managing ECs have been investigated in terms of documentation, organisation, and activities. The study has highlighted two general findings. One is that EC is a noticeable problem that cannot be underestimated in the competitive environment facing the manufacturing industries. This indicates that more effort is required to process ECs effectively and efficiently. Another finding is that the management of ECs is unsatisfactory in the companies surveyed. This indicates that a good engineering change management (ECM) system including guidelines, methodologies, and/or techniques is necessary for better dealing with ECs in the product development process.

Keywords: Engineering changes; Product development; Design changes

1. Introduction

Engineering changes (ECs) are the changes and/or modifications in dimensions, fits, forms, functions, materials, etc. of products or constituent components after the product design is released. An EC usually induces a series of downstream changes across a company where multi-disciplines work together dealing with these induced changes. Various functions across the manufacturing company have to adjust their activities in order to deal with ECs and their impacts.

Ye [1] carried out an extensive review of the ECM literature as listed in Refs. [2–19]. There were two main observations. The first observation is that EC is an inevitable problem that cannot be underestimated in the competitive environment of manufacturing industries. The second observation is that the management of ECs is costly and time consuming in most industrial companies. These two observations prompted the authors to conduct an interview survey to investigate the subject of ECM in the present manufacturing industries.

This paper reports on the findings of the interview survey conducted in Hong Kong manufacturing industries in 1999. Firstly, the methodology of the interview survey is presented in order to give an overall picture on how the entire survey was carried out from beginning to end. Then, the findings from this survey are discussed. Lastly, a summary concludes the implications that can be drawn from the findings of this survey.

2. Methodology of the survey

The aim of the survey is two-folded: the investigation into the present state of the EC problem and the examination of the current practice in managing ECs. Additionally, it was hoped to explore a number of potential areas for research, and more importantly, to gain valuable insight into developing a framework that is able to suit the needs of the manufacturing industries.

The design of this survey was mainly based on the ECM literature review and the preliminary investigation. The balance between the number of questions included in the interview and the time to answer the questions in the interview was considered with intense care. It was therefore attempted to design the questions so that they simple and quick to answer in order to obtain meaningful data that was able to achieve the aim of the survey. Most questions were of “multiple choice” type for the interviewees to select and several “open-ended” questions were for the interviewees to give their comments. After careful consideration, six questions were designed for the interview with the hope of their being answered within 30 min. The questions are shown in Appendix A for reference.
Regarding the scope of the EC problem, questions were
set to ask about the volume, sources, and effects of ECs. As
far as the ECM industrial practice is concerned, questions
were set on the aspects of documentation, organisational
structure, and activities.

The Directory of Hong Kong Industries (1998) was used
to search for relevant industrial companies. Three criteria
were set for the search. The first criterion was the size of
the companies. Due to the scope of this survey, large-sized
manufacturing companies, in the sense of the number of
staff, were selected. The second criterion was the industrial
sections. Some industrial sections, for example, electronics
toys, torches, machinery, and so on, were included. The last
criterion was industrial achievement. Only those companies
that have already achieved ISO 9001 and/or ISO 9002 were
chosen.

After the search, 11 companies were selected. Prelimi-
nary telephone contacts with the engineering managers or
someone who were involved in or familiar with the ECM
process or configuration management of these selected
companies were made. Through each phone contact, the
aim of this survey was explicitly introduced. As required
by some companies, the questions for the interview were
electronically mailed or faxed for their consideration. For
the companies that were interested in being interviewed,
further contacts were subsequently made to arrange the
time and venue for the interview.

As a result of the telephone contacts, several companies
showed interest in participating in the interviews the rest
did not respond to the invitation. Two companies were un-
able to have time for interview although they showed their
enthusiasm for the survey.

Eventually, four companies were interviewed. Deduc-
tions can be drawn from these four interviews. Two anal-
yses were carried out from the raw data derived from the
four companies included in the interview survey. The first
analysis was to explore the present state of the EC prob-
lem. The findings under this analysis are reported in terms
of the volume, sources, and effects. Another analysis was
about examining the current practice in managing ECs. The
findings are presented on the aspects of documentation, or-
ganisational structure, and activities. This chapter focuses
on these two analyses: the present state of EC problem and
the current practice of ECM.

3. Findings of the survey

This section presents the findings obtained from the in-
terview survey on the present state of EC problem and the
current practice of ECM within the manufacturing indus-
tries in Hong Kong. The state of EC problem is presented
in terms of volume, sources, and effects while the industrial
practice of ECM examines the aspects of documentation, or-
ganisational structure, and activities. Before proceeding any
further, it is necessary to give a word of caution about the
validity of data collected by the interviews. Many compa-
nies did not record the relevant data and as such were unable
to provide the data accurately and integrally, as required
during the interviews. In addition, the ECM process and
the associated system(s) used for recording and analysing
the data were different from one company to another. This
led to some distortions when the collected data were con-
verted and compared. Further, the names or terms used on
the aspects of documentation, organisational structure, and
activities of ECM varied from one company to another al-
though some of the names or terms might or do refer to the
same meanings. Therefore, for the purpose of consistence,
this paper unifies the names and terms when necessary.

3.1. Present state of EC problem

3.1.1. Volume of ECs

There are three measures that were selected to assess the
volume of ECs. The first one is the number of active ECs
processed at any time that ECs are recorded under consid-
eration or implementation, but excluding those that have
already been implemented or rejected for further consider-
ation or implementation. Another measure is the calendar
time that an EC is dealt with from its initiation to implemen-
tation, including the time spent for processing and imple-
mentation. The last one is the effort time in person-days that
employees expend in handling an EC from its initiation to
implementation, but excluding the time spend on processing
and implementation.

In this survey, the number of active ECs at any time ranged
from as few as 5 to as large as 60. One of the respondents
strongly stated that the number of ECs was so enormous to
the point that it was unable to be estimated. The calendar
time per EC was as short as 2 days to as long as the end
of the product. The effort time per EC varied from as few
as 2 to nearly 3 dozen person-days. To make a comparison
between the findings of the calendar time and the effort
time, it is discovered that a clear and wide time gap exists in
managing ECs. This appears to indicate that there is room
for improvement in reducing the time for the processing and
the implementation of ECs. Therefore, there is need of more
effort to improve the system used in managing ECs.

3.1.2. Sources of ECs

ECs may originate from numerous sources along the
product development process. Typically, an EC may have
originated internally from various disciplines within the
company. It may also have arisen externally from suppliers
and customers outside the company. For this reason, a num-
ber of typical origins was listed to ask in the interviews in
order to identify the major sources of ECs.

As anticipated, design office, shop floor workshop, and
customers were the three main sources of ECs. This shows
that communication problems may exist between the cus-
tomers, production engineers/shop floor staff, and design
engineers in discussing and handling the issues relevant to
the product design.
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