Title: The Human Subsection of Total Quality Management "A Paradigm Shift on Quality" Within An Engineering Organization

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Abstract: We attempt to identify to what extent Total Quality Management (TQM) concepts can be adopted, outside the manufacturing industry, into engineering service organizations. The principles of a leading quality management expert, Philip Crosby, are examined. Our research lead to a hypothesis that organizational implementation of TQM concepts would require a change in management approach and bring about a "paradigm shift" toward the human subsystem. In order to provide better quality in service organizations, the human subsystem obviously had to be improved. Survey results of ninety top engineering design service firms confirmed widespread management knowledge of quality improvement concepts of TQM, zero defects, "do it right the first time," etc., and the implementation of quality improvement programs in the work place. The implementation of quality improvement implies a paradigm shift in engineering management toward the human subsystem.

THE HUMAN SUBSECTION OF TOTAL QUALITY
MANAGEMENT "A PARADIGM SHIFT ON QUALITY"
WITHIN AN ENGINEERING ORGANIZATION

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EMP - P9025

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TOTAL QUALITY MANAGEMENT
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A paper submitted in partial fulfillment
for the requirements of EMGT 541

Comments:
1) Survey results should
be presented in a
readily identifiable
form, such as a table
or a succinct summary
where comparisons can be
made.

2) The argument for the
"paradigm shift" is not
strong enough. The survey
results ~~could~~ be used
more effectively to do that.

3) The survey should be in
the ~~Appendix~~

4) Fig. 3 ~~should~~ be integrated into the report

5) Fig. 1 should also be in the Appendix

6) Terminology should be corrected. (See pp. 3 & 5)

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ABSTRACT

The quality success of Japanese products on world markets has changed forever world competition. The American manufacturing products industry has made great strides in the last six years on quality improvement. Can product quality improvement in the manufacturing sector be applied to intangible service industries like engineering design firms? Can this intangible service industry achieve "quality" in the same context as manufacturing industries? Philip Crosby, one of the leading expert consultants on quality improvement (Total Quality Management {TQM}) says yes. Preliminary research for this project indicated a hypothesis that if engineering service organizations were to implement Crosby's principles, then there would be required a change in the approach by management and would bring about a "paradigm shift" towards the human subsystem. A literature search and survey questionnaire to the top design engineering firms were needed to verify this hypothesis. The literature search provided much information on the concept of quality improvement, quality improvement in the manufacturing sector and some information on quality improvement for combination service firms that provide both tangible products and intangible services. Literature information revealed a definite paradigm shift in combination service industries such as fast food, transportation and banking industries toward the human subsystem. To provide better quality in service organizations, the human subsystem had to be improved. Literature did confirm quality improvement implementation in some engineering service firms, but to what degree a paradigm shift was occurring was not conclusive. The survey questionnaire of ninety top engineering design service firms did confirm widespread management knowledge of quality improvement concepts of TQM, zero defects,"do it right the first time," etc., and the actual implementation of quality improvement programs in the engineering workplace. What success this type of program will have on engineering service organizations is too premature to measure. The implementation of quality improvement in the workplace according to Crosby, et.al., training methods, does imply a paradigm shift in engineering management toward the human subsystem.

INTRODUCTION

This project paper attempts to identify to what extent Total Quality Management (TQM) concepts been adopted outside the manufacturing industry arena into engineering service organizations.

TQM evolved out of work by Crosby and Deming [5,6,7,8] and describes "the management style and requirements necessary to provide a systemic way of guaranteeing that organized activities happen the way they are planned [5]." The emphasis is on preventing problems from occurring by creating attitudes and controls that make prevention possible.

Can a service industry such as engineering achieve "quality" in the same context as manufacturing industries? According to Philip Crosby, one of the leading proponents of "Total Quality Management", the answer is yes. In manufacturing industries "quality" is achieved through the planning and controlling of a process, to conform to product specifications.

Philip Crosby's concept of quality is "do it right the first time", "zero defects" and "conformance to requirements." In other words, development of a communication process.

These concepts focus more on human subsystems of projects and organizations that address institution of changes in behavioral attitudes as well as the more traditional aspects of management.

Preliminary research by the project team indicated a hypothesis that organizational implementation of TQM concepts would require a change in management approach and would bring about a "paradigm shift" [6] towards the human subsystem. This hypothesis then needed to be verified.

The project team was particularly interested in how these TQM concepts were being applied in non-manufacturing environments. The human subsystem accounts for a greater relative cost to service organizations than manufacturing organizations.

The project team focused specifically on engineering design firms as the subset of the non-manufacturing sector because: (1) primary interest was on management of technical professionals, and (2) the end product and its specifications are often less well defined than with manufacturing sector counterparts.

With project theme and focus in mind, it was decided that further research and a questionnaire survey was needed to prove or disprove the initial hypothesis that TQM would produce a paradigm shift or a fundamental change in the way in which organizational structure was managed.

In addition, it was felt that research and questionnaires might also show to what extent such concepts as TQM have been adopted by the engineering service industry and in what manner they have been implemented. In terms of implementation, the project team was interested in the degree of upper managerial commitment to these concepts as demonstrated by: (1) which staff personnel were brought into the TQM process, (2) was the TQM educational training portion conducted on company time, (3) were the companies clients informed of these programs and (4) was the training time spent by project people on TQM billed to clients.

To implement TQM in an engineering service organization all management must "buy-in" to the program. That is most important. To fully succeed total organizational buy-in is also required. This paper examines the admissibility of a paradigm shift within the engineering community. The objectives are to see how completely the term "Total Quality Management" has been adopted within the engineering service community, and to determine if it has resulted in a change in management philosophy.

QUALITY IN ENGINEERING SERVICE ORGANIZATIONS

Webster defines quality as "...a characteristic, property, or attribute...high grade, great excellence." In manufacturing organizations quality has always been the ability to measure and control a process or procedure resulting in a tangible product.

Over the years emphasis has been placed on the ability to control the process of manufactured items. William Deming in his use of Statistical Data Control (SDC) [8,9], provides manufacturing employees the responsibility for quality of their work by identifying, throughout the process, where and when defects will occur and to improve upon the process. The Ford Motor Company, with its corporate logo of "Quality Job #1" is an example of this in making employees responsible.

Recently, emphasis has been placed on the control of the process of measurable services such as banking, transportation and fast food, using similar methods of SDC on tangible products.

In engineering service organizations where products are such non-tangibles as ideas, concepts, judgement, design solutions, etc., ones ability to measure and control a process or procedure becomes difficult. Professionalism has always been a main focal point of measurement of performance (quality). Today, engineering organizations are turning to a "proactive sense" to quality instead of a "reactive sense." The conventional wisdom has been to address defects (human errors) after they occur. The new paradigm is to permeate the process to prevent defects from occurring, thus achieving "zero defects" and total quality.

Ideas, judgement, concepts, solutions, plans and specifications are the products of an engineering organization. The success of an engineering organization, however, depends on the "quality" of the its product.

LITERATURE RESEARCH

Background (?)

RESEARCH INFORMATION

The purpose of the literature research was to collect published information on TQM and evaluate for correlations with results from the questionnaire survey. Information was gathered from published books, technical journals and TQM course materials from Philip Crosby's Quality College [7]. The literature was

surveyed under the following subjects: quality, quality in management, quality principles and development of quality. The most recognized authors on total quality are Juran, Deming, and Crosby [5,6,8,9,17,18,19].

It was found that most articles (generally the oldest) were related to quality in production manufacturing and not to service organizations [28,14,24,1,27,11]. Even fewer articles described the concept of a paradigm shift of quality towards engineering design and service firms [13,16,4,21,25]. These few articles did, however, emphasize the factors, reasons and actions undertaken by some companies in order to implement successful TQM.

Camp Dresser And McKee,Inc.,[26] an environmental engineering consulting firm, has applied quality management principles through several initiatives based on: (1) the commitment of senior management to quality, (2) procedures established for technical quality assurance, (3) responsibility of project managers for establishing and meeting project-specific quality requirements, (4) importance of technical development for maintaining sound and diverse technical expertise, and (5) responsibility of each employee for quality on the job.

To summarize, the literature often contained the following important and critical TQM issues:

1. The reasons for company TQM involvement, the expectations that followed, the degree of development of the system, and factors affecting degree of TQM program development, e.g., size of the company, etc. [3,20].
2. Duties of quality teams or departments to carry the company to total success [20].
3. Principles of TQM (14 principles stated by Deming) [28].
4. Degree of participation of employees and top management [15,20,13,16,4].
5. Advantages of the quality concept for the companies (cost reduction, conformance to clients' standards) [26,13,22,12,10].

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The Literature

SUMMARY OF RESEARCH ~~INFORMATION~~

Most research material was related to implementation of the
quality concept into manufacturing organizations. Most
manufacturing companies are familiar with quality processes and
are at different stages of implementation [28].

The introduction of the quality improvement processes to
American companies took place after observing the success of the
Japanese. These American firms are applying Demings' principles
(Figure 1) and trying to produce and maintain the quality needed
and required by customers [12].

American companies decided to apply quality improvement
processes in order to better compete. This required providing
the best quality to satisfy increasing supply demands and
increased standards of goods and services that customers are
willing to purchase.

One frustration is that the concept of total quality is not
a quick and sudden solution for a company's problems. It is a
continuum process. It is long term in both time and payoff. A
company must maintain a high level of quality due to the extreme
competition in the marketplace. To initiate a total quality
process is difficult. It requires a change in a company's
culture in order to remove the defect generating process [13].
Corporate culture and values are very difficult to change.

The continuous innovation in products and development, the
changing market share and stiff competition, increases turnover
and shortens product life cycles. Therefore, it is imperative
companies introduce a concept of quality improvement which
eliminates defects. Defects are expensive, due to the extra time
required for inspection, sorting and repair [13,10].
Consequently, a firm with poor quality will start to fall behind
in the race for market share and competition.

Considering the development of products in a market, a
company must go through a continuous loop of quality improvement.
Non-continuous or intermittent quality improvement will not

DEMINGS' FOURTEEN POINTS FOR QUALITY MANAGEMENT

1.   Create consistence of purpose toward improvement of product and service with the aim to become competitive and to stay in business and to provide jobs.

2.   Adopt the new philosophy that we are in a new economic age, created by Japan. We can no longer live with the commonly accepted style of American management nor with commonly accepted levels of delays, mistakes and defective products.

3.   Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the produce in the first place.

4.   End the practice of awarding business on the basis of price tag. Instead, minimize total cost.

5.   Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.

6.   Institute training on the job.

7.   Institute supervision. The aim of supervision should be to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.

8.   Drive out fear, so that everyone may work effectively for the company.

9.   Breakdown barriers between departments. People in research, design, sales and production must work as a team, to foresee problems of production in use, that may be encountered with the product or service.

10.   Eliminate slogans, exhortations, and targets for the work forecasting for zero defects, and new levels of productivity. Such exhortations only create adversary relationships, as the bulk of the causes of low quality and low productivity.

11.   Eliminate work standards that prescribe numerical quotas for the day. Substitute (with) aids and helpful supervision.

12.   Remove the barriers that rob people in management and in engineering of their right to pride of workmanship. This means, inter alia (among other things), abolishment of the annual or merit rating and of management by objectives.

13.   Institute a rigorous program of education and training.

14.   Put everybody in the company to work to accomplish the transformation. the transformation is everybody's job.

FIGURE 1. (28) Shetty, Y.K.

suffice in a fast developing and changing environment. Most firms, therefore, try to include their suppliers in this process by encouraging them to improve their product quality and thus gain at the initial onset from the benefits of quality improvement [14,27].

One of the recent innovations companies have used to accomplish this strategy is by forming partnerships and alliances with suppliers [1,21]. Both companies, therefore, are responsible for quality improvement and will help each other conform to the requirements of customers.

All levels in the organization must be involved in this process. Top management involvement is critical because of it's decision making responsibilities and functions. In many situations it is more efficient to introduce the quality concept to all members of the organization simultaneously, to provide better harmony and coordination, thereby, reducing resistance to change [13].

Quality teams (quality circles) are used to increase performance and overcome difficulties encountered during implementation of a quality improvement process. Quality teams are either assigned throughout the entire organization to deal with all types of quality problems or separated into units for specific control problems [28]. The reasons for such decisions is dependent on the size and structure of the organization, i.e., relative difficulty of communication between departments.

The implementation of quality improvement can be either generated by external or internal training [4,16]. Companies may either send employees out to consultants for training or hire people to bring the concept into the organization. In both cases, top management must realize the necessity of having all employees participate. Management must continually emphasize and demonstrate the positive results of quality improvement. They must manage and control development of the process and share the benefits with employees even after the training process is complete.

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The last and most important premise is the application of "do it right the first time" for design and service organizations [10,21,25]. In manufacturing companies, the application is easier to apply. The quality improvement process is introduced to the production line to create defect free products and results. For design and service organizations a company needs continual feedback and information from the client [21]. The difficulty here is the lack of a continual or repeated production process which can repeat easily recognized defects. This is not the case with service organizations. Many times the clients are unique and each task or job is different. Therefore, predicting which techniques are necessary to eliminate defects in service organizations is more difficult due to the different standards and needs of clients.

The obvious shift of the quality improvement concept toward design and service organizations can be implemented successfully through expert knowledge when limits are known on the speed of technological development. Acceptance of a new process of technology by the users (every new concept must be scheduled for a specific length of time) happens when there is a need for it. A company's search, therefore, for new dimensions to increase competitiveness will result in the introduction of quality concepts to the service area (Paradigm shift). The best example of this is the service capability and quality of IBM.

QUESTIONNAIRE SURVEY

CONSTRUCTING THE QUESTIONNAIRE

In order to complete project objectives, it was necessary to develop a survey questionnaire. It was decided the best target for the questionnaire was engineering design firms as they consist almost exclusively of professionals. Their deliverables are also more subjective in nature.

It was determined that the best way to reach a cross-section

of engineering design firms was to send questionnaires to a major segment of the top 500 design firms listed (listed in order of billings) in Engineering News Record of April 5, 1990. Questionnaires were sent out to the top ninety firms on the list.

The next area of focus was the questionnaire itself. The project team's intent was to develop a questionnaire that would cover the entire spectrum of concepts and issues surrounding TQM but, at the same time, be brief and relatively easy to answer. The team did not want respondents to lose interest or incur any return mailing costs.

In order to improve the questionnaire return rate, it was decided to offer a sharing of information incentive to the respondents. We offered to share survey data results in addition to a general thank you note.

The first seven questions of the survey were general in nature and applicable to all firms whether or not they had participated in a quality improvement program. Questions asked included the respondent's: (1) familiarity with the general concepts of TQM, (2) involvement in any type of quality improvement program over the last three to five years, and (3) profitability and employee turnover.

The remainder of the survey questions attempted to determine how quality improvement programs were being introduced into organizations. Was it instituted in a high or low profile manner and what management commitment was involved? A sample of the questionnaire is shown of Figure 2.

Some potential problems that were discussed prior to sending out the questionnaire were the: (1) lack of having a specific personal contact in each firm, and (2) lack of knowledge about what divisions or subgroups within an organization would have the most knowledge on quality improvement programs. To address these issues, it was decided (upon advice from the Director, PSU Engineering Management Department) the questionnaires be sent: Attention: Vice President of Engineering, to each of the ninety firms on our survey list. The second issue did not seem to

Portland State University
Engineering Management Program
Total Quality Management Questionnaire

The concept of Total Quality Management has been developed
to describe the management style and requirements necessary
to provide a systematic way of guaranteeing that organized ac-
tivities happen the way they are planned. It is a management
discipline concerned with preventing problems from occuring
by creating the attitudes and controls that make prevention
possible.

We believe that this type of management will require a
shift in paradigm for managers as well as the professionals
they manage.

A project team within the Engineering Management Program
at Portland State University is attempting by means of this
questionnaire to find out what impact these concepts have had
on the leading design firms in the United States.

The concepts stated above have been for some time applied
to the manufacturing sector where the products are tangible
and the specifications are measurable,but recently these concepts
have been applied to the service sector and in particular to
engineering design firms.

We are interested in the different types of quality improve-
ment programs that have been tried,how these programs have been
introduced to the company,how managers in particular have
"bought in" to these ideas,and what measures of success have
been established.

We hope to find out what actual successes have been acheived
relative to whatever measures of success were established and
if there has been an enduring change in the way managers within
the organization approach the way they manage.

We can offer little incentive for filling out this ques-
tionnaire other than informing the participants that they will
share in the fruits of our research and the lessons lerned.
The identity of companies participating will be revealed to
no one.

The Project Group: Stephen Hawkins,Paul Huebschman,Gordon Lee
                   David Liesch,Bernice Lira,Mesut Pervizpour
                   Russ Wagner.

(1) Are you or anyone else in your company familiar with any
    of the following concepts?

    Total Quality Management   _____
    Zero Defects   _____
    Do It Right The First Time   _____
    Statistical Process Control   _____
    Quality Circles   _____
    Conformance To Requirements   _____
    Prevention As A System   _____

    Comments:_____
    _____
    _____

(2) Has your company or anyone in it participated in a
    quality improvement program in the last three to five
    years?

            Yes_____   No_____

    Comments:_____
    _____
    _____

(3) Is the portion of your organization that deals with quality
    improvement a seperate department or does it function with-
    in another department?

    Quality is a separate functional group   ____
    Quality functions within a department of another
                                              name ____
    No department has a quality improvement function ____
    All departments have a quality improvement function____

    Comments:_____
    _____
    _____

Figure 2. Survey Questionnaire

(4) Project managers and functional department managers wihin our organization view their job primarily as preventing problems from occuring by creating the attitdes and controls that make prevention possible.

All the time_____ Some of the time_____ Never_____

Comments:_____
_____
_____

(5) Our companies profitability over the last three to five years has been:

Declining:_____ About the same:_____ Improving____

Not applicable_____

Comments:_____
_____
_____

(6) The employee turnover at our organization over the last three to five years has been:

Very high____ High____ About same_____ Low____
Very low____ Not applicable____

Comments:_____
_____
_____

(7) If your organization has not participated in a quality improvement program in the last three to five years, what is the most appropriate reason?

Unfamiliar with any quality improvement programs ____
Familiar with some programs but don't feel they
                                    would benefit us ____

Comments:_____
_____
_____

* If your company has not participated in a quality improvement program in the last three to five years the following questions need not be answered...Thank you

(8) If your company has participated in a quality improvement program in the last three to five years, was it developed internally, externally by consultants, or a combination of both?

Developed internally   ____
Developed externally   ____
Combination of external and internal   ____

Comments:_____
_____
_____

(9) Why did your company pursue a quality improvement program?

To better compete with foreign competitors   ____
To better compete with domestic competitors   ____
To better compete against all competitors   ____
To reduce costs   ____
To use as a marketing tool   ____
To pursue continual improvement   ____
None of the above   ____

Figure 2. Survey Questionnaire

(10) What portion of your organization was involved in the quality
improvement program?

Only senior management   _____
All employees considered to be managers   _____
All salaried employees   _____
Virtually all the employees   _____
A random cross section of employees   _____
Only one or a select few   _____
None of the above   _____

Comments:_____
         _____
         _____

(11) Where was the quality improvement program conducted?

The program was conducted off the company's
                                    premises_____
The program was conducted completely on the
                            company's premises _____
The program was conducted somewhat off and somewhat
                    on the company's premises _____

Comments:_____
         _____
         _____

(12) When was the quality improvement program conducted?

The program was conducted after working hours   _____
The program was conducted during bussiness hours   _____
The program was conducted some during bussiness
                hours and some after bussiness hours_____
None of the above apply   _____

Comments:_____

(13) Which of the following would best describe the way in which
chargeable hours used to implement the quality improvement
program were handled by your organization?

Time spent on quality improvement by people who
        were assigned to project groups was billed
        diretly to the client   _____
Time spent on quality improvement by people who
        were assigned to project groups was billed to
        overhead/non-reimbrsible accounts   _____
Time spent on quality improvement by people who
        were assigned to projects was billed partially
        to the client and partially to overhead.   _____
None of the above   _____

Comments:_____
         _____
         _____

(14) Which of the following best describes your client companys'
attitudes towards the quality improvement program?

Client was unaware of our involvement   _____
Client was aware of our involvement but we stayed
                                        low key _____
Client was not encouraged to participate   _____
Client was formally told of our involvement and
        they were encouraged to participate in it also_____
Company's involvement in the program was used as a
        marketing tool and the client was encouraged
                                    to participate_____
None of the above   _____

Comments:_____
         _____
         _____

Figure 2.   Survey Questionnaire

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(15)   nat way was your project organization affected by your
        company's participation in quality improvement?

        No change____   Very little____   Minimal change____
        Major change____   Extreme change____   Not applicable____

        Comments:_____
        _____
        _____

(16) Were qualitative or quantitative measures put in place
     to measure any improvement as the concepts were implemented?

     Measures were established but not followed up on   ____
     No measurements were established but we'll know it
         if we see any improvement as a result   ____
     Some qualitative measures were established   ____
     Measures for tracking quality inprovement were
         implemented early on and used often   ____
     None of the above   ____

     Comments:_____
     _____
     _____

(17) How would you rate the impact of the program on your organ-
     ization? (especially as to the way people do their jobs.)

     Very large____   Some____   Minimal____   None____

     Comments:_____
     _____
     _____

(18) How would you honestly rate your top management's committ-
     ment to the concepts developed during the program?

     None____   Low____   Medium____   High____   Very high____

     Comments:_____
     _____
     _____

(19) How much follow up occured in your organization to reinforce
     what was learned in your quality improvement program?

     None____   Little____   Moderate____   Frequent____
     Very frequent____

     Comments:_____
     _____
     _____

*Your participation in answering this questionnaire is greatly
appreciated.

Figure 2. Survey Questionnaire

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create any problems. Apparently, sending questionnaires to the
Vice President, Engineering was a good idea. It was at a high
company level and at the appropriate office for good company
response to our survey questionnaire.

RESULTS OF THE SURVEY

From the ninety survey questionnaires sent out, seventeen
responses were returned. This was a response rate of 19%. Of
the seventeen firms responding, fifteen of these were familiar
with most, if not all the concepts of TQM, Zero Defects, Do It
Right The First Time, SDC, Quality Circles, Conformance To
Requirements, and Prevention As A System. All fifteen firms had
participated in some type of quality improvement program over the
last three to five years. Of the two firms not participating in
a quality improvement program, the reason given was they felt
such a program would not benefit their organization.

We need to make some assumptions about the questionnaire
survey in order to not over-emphasize the actual implementation
or importance of quality management programs to the engineering
service industry. Firms using or familiar with quality
improvement programs would more likely than not respond to the
questionnaire. It is also likely that 81% of the remaining firms
not responding, would be in that group which did not have a
familiarity or any type of quality improvement program in their
organization. The short time length of the survey should be also
considered. The population survey sample and questionnaire
response time (only about one month) were not really sufficient
for any statistical results or predictions. There was also no
second questionnaire follow up for non-response.

Most of the respondents (twelve out of seventeen) stated
that all their departments were responsible for implementing and
maintaining a quality improvement function in their
organizations. Most managers viewed their jobs as having some
responsibility in quality improvement programs. Of the responses

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to the question: "...viewed their jobs as primarily preventing problems from occurring by creating the attitudes and controls that makes prevention possible...", ten of seventeen respondents answered some of the time, while six of seventeen respondents answered: "all of the time." It is interesting most of these firms were experiencing profitability and therefore not distressed. Company profitability over the last three to five years for these firms was either about the same (nine of seventeen), or was improving (eight of seventeen). Employee turnover in most of these firms over the last three to five years was about the same (nine of seventeen).

Of the fifteen firms that implemented some type of quality improvement program, seven of fifteen developed it internal to the organization or through a combination of both external/consultant and internal method (seven of fifteen). The main reasons given by respondents for implementing a quality improvement program were: (1) to better compete against all competitors, (2) to reduce costs, (3) to use as a marketing tool, and (4) to pursue continual improvement.

Seven out of fifteen of these firms also indicated that virtually all their employees needed to be involved in quality improvement program training. The training should be conducted either completely on the company's premise (seven of twelve) or should be conducted somewhat off and somewhat on the company's premises (five of twelve). This program should be conducted either during business hours (seven of thirteen), or some training during business hours and some after business hours (six of thirteen).

The cost of quality improvement was charged partially to clients and partially to company overhead accounts (six of fourteen), or charged completely to overhead (five of fourteen). There was no clear and definitive answer to question #14, the client's attitude towards the quality improvement program. In hindsight, this information may not be readily available to firms. Since quality improvement programs are new to most

service organizations and may take years to return benefits, any
expectancy of client perception/feedback may have been premature.

Most of the firms indicated that a qualitative and
quantitative measurement system should be established to
determine quality improvement. It should be implemented early in
a quality improvement program and used often (nine of ten).
Responses for follow-up training to reinforce learning in a
quality improvement program ranged from moderate to very frequent
(nine of fifteen). Top management's commitment to the program
ranged from high to very high (nine of fifteen). Lastly, most
firms felt that quality improvement programs had some impact on
the organization (eight of twelve).

SUMMARY AND CONCLUSIONS

Total Quality Management emphasizes preventing cost related
problems from occurring in an organization by creating an
attitude among employees and management of "Do it right the first
time."

The concept of quality improvement and applications of
successful programs in the manufacturing products industry have
been well described in literature. There is evidence that a
quality improvement paradigm shift has already occurred in
combination industries such as fast food and banking. These
combination industries are those that market tangible products
along with intangible services. Descriptions of the documented
applications, modeling and testing successes in manufacturing and
more recently, newer applications in the combination service
industries does, indeed, indicates a "potential" or implies a
paradigm shift toward the human subsystem in the engineering
service industry.

Limited information from technical literature was available,
however, to fully substantiate a "paradigm shift" occurring
within intangible engineering service-type organizations. It is
reasoned that quality improvement programs and successes

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entrenched in the manufacturing products industry and now burgeoning in combination industries have not been sufficiently modified and fully formulated to have direct application to the human subsystem in engineering service organizations.

The questionnaire survey indicated that engineering service organizations are well aware of the philosophy of quality improvement. Many engineering service organizations are either considering, or have implemented improvement programs for their professionals in the workplace. The survey indicates, for the most part, that quality improvement programs for the human subsystem are, at best, very new to most engineering organizations. Any substantiation, at this time, of engineering service population (large scale) relative success is premature. The survey results, combined with the literature findings on quality improvement in the manufacturing and combination industries, indicate that the early stage is set for human subsystem quality improvement in engineering service organizations. The tentative survey results conveys the hypothesis that a paradigm shift is a natural occurrence in management toward the human subsystem in the engineering service industry (Figure 3).

PARADIGM SHIFT MODEL

START:
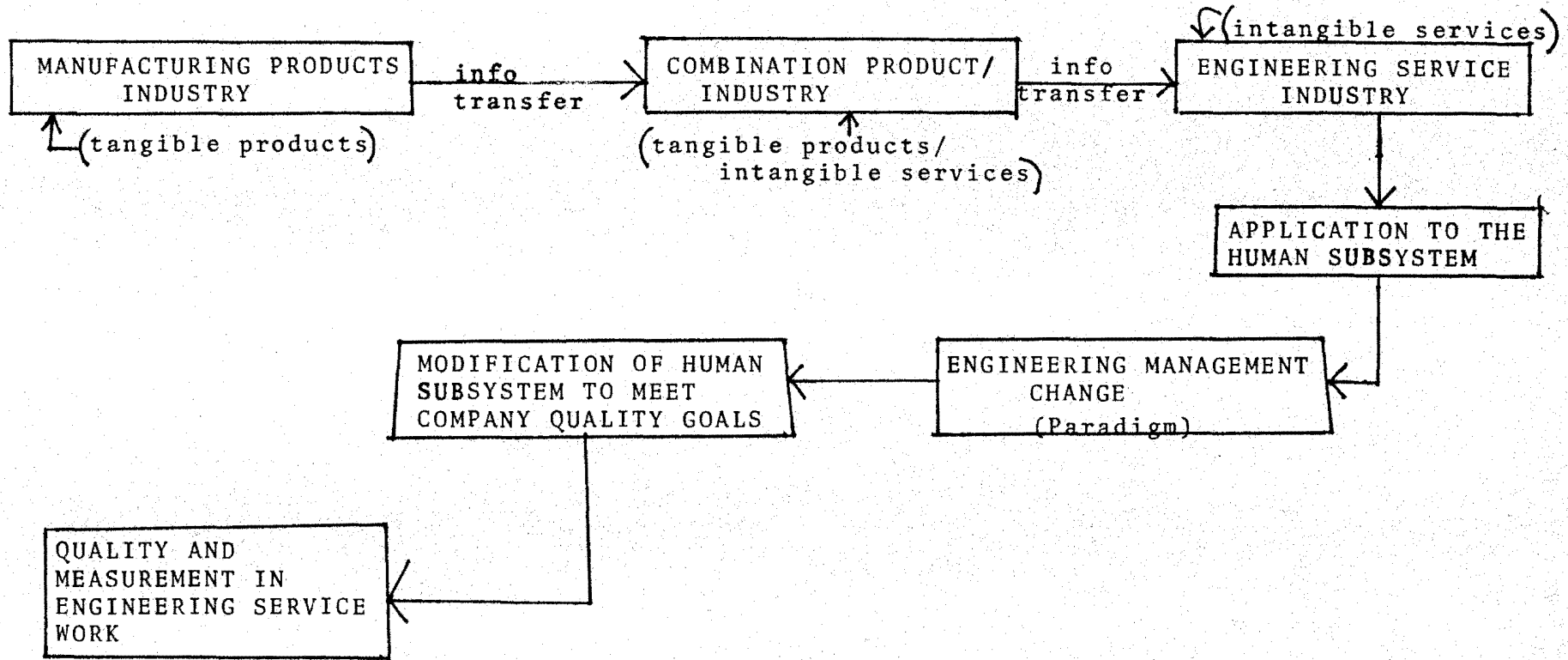
Figure 3.

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