The Impact of ISO 9000 Quality Assurance Series to Design Sectors in Corporate

Kuoh-Siang Chen Wei-Cheng Chen

Department of Industrial Design, National Cheng Kung University

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Abstract

As the global trade competition becomes more and more intense, certified ISO 9000 series is considered as key pass into European Community as well as competitive weapon for winning international orders for Taiwan's businesses. Meanwhile, as Taiwan tries to upgrade industries' competence, design and R&D will inevitably play a more and more important roll in a business. Therefore, how corporate design sectors get involved in carrying out ISO quality assurance series, and how ISO affects design and R&D are worth investigating. And hence, the purpose of this study is set to identify the appropriate rolls design sectors should play and to maximize the value they can contribute to the businesses during carrying out the ISO series.

The study comprises three phases. First, it analyzes current government strategies, business policies, interactions between design sector and other business sectors and the relationships between design and ISO series. Secondly, it investigates, via case studies, the breadth and depth of design sector's participating in carrying out ISO 9000 quality assurance series. Thirdly, it verifies the findings, via questionnaires, to further put together a list of guidelines for design sectors to follow.

The results summarized from this study exhibit below:

(1) The major problems design sectors facing in carrying out ISO 9000 series include: the official interpretation and authentication of documents, and personnel's coordination required;

(2) The benefits design sectors gained while carrying out ISO 9000 series include: standardization of design activity flow, reliable inheritance, ease of trace back, completeness of documents, thorough design thinking, and constant design quality;

(3) The pains and disadvantages design sectors experienced while carrying out ISO 9000 series include: design work delayed, bureaucracy accumulated, and cumbersome standards rejected by designers;

(4) The most significant contribution design sectors made in carrying out ISO 9000 series is the conclusion of design standards and process flow, which conforms to ISO spirits.

Keywords: ISO 9000, R&D, Design Sector

I.Introduction

As the global trade competition becomes more and more intense, certified ISO 9000 quality assurance series is considered as key pass into European Community as well as competitive weapon for winning international orders for Taiwan's businesses. Meanwhile, as Taiwan tries to upgrade industries' competence, design and R&D will inevitably play a more and more important roll in a business. Therefore, how corporate design sectors get involved in carrying out ISO quality assurance series, and how ISO affects design and R&D are worth investigating.

Quality serves to satisfying customers' needs. According to Dr. Deming (1986), quality is the key to both success and sustainability for a business while facing intense competition. Dean (1994) also pointed out that increasing the quality of products and services to create corporate competence is the only way to guarantee the marketing leading advantage. Furthermore, the forming of European Community and its new EN-29000 quality assurance series converted from ISO 9000 series, inevitably puts pressures on those countries who want to enter European Community markets. And hence, ISO 9000 series rapidly gained its popularity all over the world, and became the industrial standard admitted among major trade bodies and countries.

Meanwhile, in trying to upgrade industries' competence, the government introduced ISO 9000 quality assurance series to the industries in March 1990 via Commerce Inspection Bureau. Up to May 1999, there were 174 passed ISO 9001 and 1,468 certified ISO 9002 in Taiwan. As for the motivations behind it, two major types could be identified: one is active and the other passive. The former type include: enhancing company's constitution, improving products' quality, promoting corporate image, opening up export opportunities, and strengthening competitiveness internationally; while the latter covering: required by customers, following marketing trends, pressure from competitors, required by governmental policy, and required by stock holding company (Cheng, 1997).

Michael Porter in an interview (1997) indicated that unique product design is one way to keep competitive advantage for Taiwan's companies. Which once again stressed the importance of product design and development in a business environment. According to ISO 9001, there are eight items under category Design Control concerning design procedure: design and development planning, organizational and technical interfaces, design input, design output, design review, design verification, design validation and design changes. In summary, as ISO 9000 series not only can ensure the quality of design and development processes, but also can satisfy clients' needs for tracing back any design project; more in-depth research into it will surely be necessary.

The most important job for design sectors in implementing ISO 9000 is to bring ISO's standards and spirits into the product development and design procedures as well as design strategy planning processes. But, as design is just one of many functional sectors in a corporate environment, it must communicate thoroughly among various departments in order to make it happen. Chen, in his study (1995), indicated that the most difficult job in promoting ISO in business was the integration among various departments. Therefore, the purpose of this study can be summarized as

below:

1. Clarifying how design sector participates in and gets involved with implementing ISO 9000;
2. Finding how design sector interacts with other departments during implementing ISO 9000;
3. Understanding the impact to design sector in implementing ISO 9000;
4. Pinpointing what design sector can contribute during implementing ISO 9000; and
5. Constructing a list of guidelines for design sector to follow in implementing ISO 9000.

This paper consists of five parts. Following the introduction is literature reviews; then comes case studies with in-depth interviews on six companies; followed by the generalization of case study findings via questionnaire survey; and finally, conclusions and suggestions are included.

Although there is little study concerning design sector's contribution to promoting ISO in business, some other related research regarding the preparation phases and the benefit ISO can bring to a corporate can be found. Hockman et al. (1994) proposed a nine-step preparation procedure for ISO 9000 registration. Johannsen (1995), on the other hand, suggested a quality management model for applying ISO 9000 in professional services. Wu (1995) applied the concept of PDCA (Plan, Do, Check, and Act) in the processes of ISO 9000 assessment.

Among others, Shieh's (1993) compilation of steps for ISO 9000 certification was relatively more detailed, as below: 1) identifying the reason(s) for it; 2) choosing certification authorizing institution and certification mode; 3) training carry out personnel; 4) drafting carry out plan; 5) establishing committee; 6) announcing quality policy; 7) corporate diagnosis; 8) training personnel for every phase; 9) compiling documents; 10) training internal inspection personnel; 11) implementing regulations by documents; 12) implementing quality inspection; 13) correcting the plan and implementation; and 14) applying for certification. Chen, (1994) on the other hand, pointed out that the benefit form carrying out ISO 9000 series includes: 1) developing unique quality culture; 2) enhancing corporate brand image; and 3) increasing products' competitiveness. He also recognized the difficulty of effective integration of various departments.

II. Methods

Structured interview, case study and questionnaire were employed in this study for gathering necessary data. In structured interview, all the questions, sequence and wording were all set, as an interview schedule, before any interview to be proceeded. Ground theory was used in case studies, while questionnaire was for verifying purposes.

The subjects chosen for this study must be included in the 1000 biggest manufacturers compiled by Commonwealth Magazine (Taiwan, 1998). Besides, information, consumer electronics and transportation were considered as the ideal target industries as industrial designers can play more active rolls in them. Other than that, the final conditions set for a manufacturer to be selected as subjects are listed below: 1) ISO 9001 certified company; 2) including industrial design sector; and 3) willing to be interviewed heavily.

The basic data of the study subjects for scheduled interview are summarized in Table 1.

Table 1. Scheduled interview for the six study subjects

Corporate Name	Name & Position of the Interviewed	Date of Interview
Acer Corporation	Mr. Cheng/Design Manager Mr. Ong/Product Manager Mr. Lin/Director	1998.1.18
TECO Electric & Machinery Corporation	Mr. Chen/R&D Manager Mr. Chang/Director	1998.1.19
Sampo Corporation	Mr. Lee/Design Manager Mr. Lu/Director	1998.1.21
Compal Electronic Inc.	Mr. Chou/R&D Manager	1998.1.25
First International Computer Inc.	Mr. Cheng/Design Manager Mr. Liaow/Designer	1998.2.1
Giant Manufacturing Co.	Mr. Liaow/Designer	1998.2.2

Questions to be answered in the interview are listed below:

1)How did design sector participate the preparation of ISO 9000 registration?

2)How did design sector interact with other sectors in implementing ISO 9000?

3)How has ISO 9000 been impacting design sector?

4)How much did design sector contribute to the whole ISO 9000 assessment processes?

5)Other ISO related issues that design sector could be help?

The interview data gathered from the six companies was organized into five parts as questions been grouped: participation of design sectors in preparation stage, practicing in implementing stage, impact to design sectors, contributions made by design sectors, and other issues related.

2.1 Participation in preparation stage

The major tasks design sectors had to cope with in preparing ISO 9000 assessment are shown in Table 2. Design sectors played a supporting roll in corporate in preparing ISO 9000 assessment. They usually adjusted the already fluently operated product development procedure to further match ISO's spirits. Items included in Table 2 also show that the types of documentation processes involved and the most difficulty design sectors faced in preparing ISO 9000 assessment.

2.2 Practicing in implementing stage

The most problematic issues regarding design sectors' practicing ISO 9001 standards and the means adopted by design sectors interviewed to resolve the problems are shown in Table 3.

2.3 Impact to design sectors

Table 4 include: the impact to design sectors in implementing ISO 9001, the advantages design sectors benefit from being implementing ISO 9001 and the disadvantages affecting design sectors while implementing ISO 9001.

Table 2. Tasks and processes in preparing ISO 9000 assessment

major tasks design sectors had to cope with in preparing ISO 9000 assessment	1.compiling design documents; 2.following the specifications of design documents; 3.design sector's internal quality inspection; 4.proposing and implementing correcting plan for deficiency.
types of documentation processes involved	1.compilation of document that involved co-development; 2.amendment of deficient data records; 3.definition of management specifications for product development; 4.integration of data records of product development.
the most difficulty design sectors faced in preparing ISO 9000 assessment	1.difficult to manage human's working habits; 2.difficult to set standards; 3.poor cooperation from other functional sectors; 4.workloads not evenly distributed; 5.conflicts between design work and administrative ones; 6.bureaucratic attitudes being exercised.

Table3. Practicing in implementing stage

problematic issues regarding design sectors' practicing ISO 9001 standards	1.authentication of documents didn't conform to regulation; 2.forgot to update documents; 3.transmission of documents didn't conform to regulation; 4.executant enforced in document was not clear; 5.deviation between planning and implementation was large; 6.definition of standards was not unified; 7.personnel cooperation was poor; 8.frequent organizational changes; 9.bureaucratic attitudes from all functional sectors.
means adopted by design sectors interviewed to resolve the problems	1.problems resolved privately by the persons involved; 2.coordinated by involved sectors' heads; 3.by redefining the procedure of product development; 4.by seeking advice from consulting firms or experts; and 5.coordinated by ISO implementing group or special team within company.

Table4. Impact to design sectors

the impact to design sectors in implementing ISO 9001	1.the product development procedure became clearer and more definite; 2.stable design quality could be ensured; 3.complete records of design processes could be ensured; 4.design staff could have guidelines to follow in work; 5.documents could be shared among different functional sectors; 6.good design habits could be cultivated through daily operations; 7.design thinking could be further systematically complete; 8.workloads of design staff were increased; 9.too much time consumed in compiling documents.

the advantages design sectors benefit from being implementing ISO 9001	1.can ensure stable design quality; 2.can identify exactly where goes wrong if any; 3.can facilitate better on-job training for design staff; 4.can secure complete documents of design processes; 5.can verify responsibilities between functional sectors; 6.can formalize the production of design documents and design drawings; 7.can integrate thoroughly design functionality and marketing needs; 8.can cultivate more thorough product design thinking.
the disadvantages affecting design sectors while implementing ISO 9001	1.design creativity was restricted; 2.the control of ISO 9001 was rejected by designers; 3.documenting was tedious and complicated for designers; 4.time for design was occupied by paperwork.

The influences on design performances while implementing ISO 9001 summarized from the case studies and the indicators used for evaluating the influence on design performances by the six companies are shown in Table 5.

Table5. Influences on design performances and the indicators used for evaluation

the influences on design performances while implementing ISO 9001 summarized from the case studies	1.there was clearer specifications to follow for design operations; 2.it was smoother for data transmission crossing functional sectors; 3.it strengthened the training programs for design staff; 4.it helped maintaining stable design quality; 5.it helped marketing products successfully; 6.it controlled design progress better and further shorten the schedule; 7.it reduced design cost; 8.it improved design efficiency; 9.training programs for new staff became ever complete and convenient; 10.it facilitated more precise manipulation of data records.
the indicators used for evaluating the influence on design performances by the six companies	1.the number of times tooling molds were modified; 2.the amounts of data records were mended; 3.the fineness of models of all sorts; 4.the control of design schedule; 5.the control of design cost; 6.the completeness of documents and drawings; 7.the continuity of documents; 8.the searchability of documents.

2.4 Contributions made by design sectors

The contributions design sectors made to the corporations during implementing ISO 9001 standards and some suggestions for better involvement mentioned during the interviews are summarized in Table 6.

Table6. The contributions design sectors made and suggestions for better involvement

the contributions design sectors made to the corporations during implementing ISO 9001 standards	1.carry out design related ISO standards; 2.define spec. for development procedure conforming ISO spirits; 3.compile product development related documents; 4.improve design processes via implementing ISO 9001; 5.adjust current product development procedure and criteria rationally; 6.make design output (documents and drawings) correctly executable; 7.keep development procedure stable and not affected by different personnel and time; 8.help other sectors gain development experience via design documents; 9.help establish ISO 9001 related policy at the corporate level; 10.help trace back where deficiencies occurred in the product cycles; 11.link documents generated during development into a working unit; 12.clarify relationships among functional sectors during development.
some suggestions for better involvement mentioned during the interviews	1.design sectors should understand all the related corporate policies before proceeding product development; 2.design sectors should put more efforts on the coordination between products' competence and ISO's spirits; 3.design sectors should consolidate the communication and coordination between upstream and downstream sectors; 4.design sectors should solidify common consensus among design staff first; 5.design sectors should integrate all the efforts from other functional sectors; 6.design sectors should evaluate design staff's performance via public presentations.

2.5 Other issues

Concerning about all sorts of regulations and the emerging of ISO 14000 and 18000 series, the interviewed companies had also developed their own strategies. Their suggestions can be summarized in Table 7.

Table7. The strategies developed at the emerging of ISO 14000 and 18000 series

some strategies developed at the emerging of ISO 14000 and 18000 series by the interviewed companies	1.establish a special group responsible for watching and predicting ISO's movements; 2.the special group can periodically release news on ISO's movements to design sector; 3.combine ISO's spirits with design staff's on job training courses; 4.familiarize design staff with ISO's related information regularly; 5.establish close cooperation on information sharing among governmental institutions, industries, and academic bodies.

III. Results

The criteria for subjects to be qualified for questionnaires are quite the same as those set for case studies except for the corporate scale. They are:
1)ISO 9001 certified; and
2)Must have industrial design related sector.

3.1 Questionnaire survey

76 companies were asked to fill the questionnaire via postal mail, and 45 did and sent back. Among them, 41 copies were good (about 54%). The contents of the questionnaire were divided into five parts echoing the questions asked during the previous interviews with the six companies. Due to limited space, it will not be shown here. The types of questions included: multiple choice and subjective assessment (7 ranks, 1-7, 7 is the highest score). Multiple choices were calculated as frequency distributions while subjective assessments were averaged among evaluators.

3.2 Analysis of survey results

Table 8 shows the industry distributions of the 41 answered companies. Tables 9 through 13 summarize the statistical figures covering all the questions presented in the questionnaire.

Table 8. Distributions of industry of the 41 answered companies

Industry category	Transportation	Electronics	Information
No. of companies	4 (9.7%)	15 (36.6%)	22 (53.7%)

Table 9. Summaries of design sectors' preparing ISO 9001 certification

Issue Category	Questions	Results
ISO related requirements	Managerial responsibility	51 %
	Document and data control	76 %
	Internal quality audit	49 %
	Quality system	49 %
	Design control	98 %
	Training	49 %
Administrative works	Identify motivation for implementing ISO 9001	4.6
	Train personnel who implement ISO 9001	4.4
	Draft implementing plan	4.8
	Establish carry out group	4.7
	Announce quality policy	4.7
	Train personnel involved in each phase	5
	Compile documents	5.7
	Train internal audit personnel	4.7
	Follow regulations set in documents	6
	Carry out internal quality audit	5.3
	Implement correction plan	5.3
	Apply ISO certification	4.1

Works participated supportively	Establish new documents	83 %
	Mend document records	71 %
	Integrate development documents	88 %
	Set standards for product development procedure	85 %
	Personnel Training programs	63 %
	Implement quality audit	54 %
	Establish and participate ISO implementing group	51 %
Sectors with regular interactions	Planning sector	73 %
	Production technique sector	49 %
	Quality control sector	83 %
	ISO implementing group	63 %
Implementing strategy	Adopt current development processes to fit ISO spirits	88 %

Table 10. Summaries of design sectors' implementing ISO 9001 standards

Issue Category	Questions	Results
Internal implementing problems	Don't like ISO's requirements and restriction	
Sectors with regular interactions	Planning sector	54 %
	Production technique sector	51 %
	Quality control sector	66 %
Interaction problems while implementing	Organizational changes	3.4
	Forget to update documents	3.2
Means to solve the problems	Coordination among sectors' heads	78 %
	Adjust operational processes reasonably	63 %

Table 11. Summaries of the impact to design sectors from ISO 9001 standards

Issue Category	Questions	Results
Impact to design sectors during preparation phase	Product development procedure became clearer	5.5
	Stable design quality could be ensured	5.1
	Complete records of design processes could be ensured	6
	Design staff had guidelines to follow	5.4
	Documents could be shared among different sectors	5
	Good design habits could be cultivated	5
	Design thinking could be further complete	4.7
	Workloads of design staff were increased	5.4
	Spent too much time on compiling documents	5

Advantages to design sectors in implementing phase	Can ensure stable design quality	66 %
	Can identify exactly where goes wrong if any	68 %
	Can facilitate better on-job training for design staff	51 %
	Can ensure complete documents of design processes	49 %
	Can verify responsibilities between sectors	66 %
	Can formalize design documents and drawing	85 %
Disadvantages to design sectors in implementing phase	Tedious and complicated paperwork	78 %
	Time used on paperwork instead of design work	59 %
Impact to design performance in implementing phase	Clearer rules for routine design	68 %
	Smoother transmission of documents between sectors	83 %
	Design quality can be maintained at a certain level	59 %
	Facilitate more precise manipulation of data records	66 %
Evaluation indicators for implementing ISO 9001	Completeness of documents and drawings	78 %
	Continuity of documents	68 %
	Searchability of documents	49%

Table 12. Summaries of the contributions made by design sectors

Issue Category	Questions	Results
How to be helpful	Implement ISO 9001 basic requirements	68 %
	Understand related corporate policies	68 %
	Seek both product competence and ISO standards	66 %
	Strengthen communication between sectors	78 %
	Consolidate common consensus of design staff	56 %
	Integrate efforts among various design sectors	63 %
Contributions made by design sectors	Implement ISO 9001 basic requirements	5.6
	Define design procedure specs. conforms ISO	5.5
	Compile product development related documents	5.7
	Improve design processes	4.8
	Adjust current design development procedure	5.4
	Design output can be executed correctly	5.4
	Keep product development procedure continuous	5.6
	Help other functional sectors gain experiences	5.5
	Help trace back where deficiencies occurred	5.1
	Link documents among different functional sectors	5.6
	Clarify relationships among functional sectors	5.6
	Help establish ISO related policies at corporate level	5.2

Table 13. Summaries of the contributions made by design sectors

Issue Category	Questions	Results
Environmental concern	Recognize the trends of environmental concerns	85 %
Responding to ISO 14000	Use recycled materials	49 %
	Ask cooperation from suppliers & manufacturers	49 %
	Save energy	66 %
	Computerized design processes	61 %
	Networking administrative operations	49 %
	Reuse packaging materials	80 %
	Recycle discarded models	71 %
ISO related information	Special group taking care of	83 %
Other regulations to obey	Governmental laws and regulations	49 %
	Safety regulations of exporting nations	73 %
	National standards of exporting nations	59 %

3.3 Proposal for a better model

Figures 1 and 2 summarize the findings described in section two. The heavy weight boxes represent major areas in which design sectors involved the most, while the gray shades highlight the proposed extra interactions between design sector and both of its upstream and downstream sectors.

IV. Discussion and Suggestions

As this whole study was aimed at design sectors, much detailed activities involved in the preparation, establishment and implementation of ISO 9001 standards in design sectors were collected thoroughly as expected. However, the thoughts from the higher levels with so called "corporate strategic policies" were not clearly understood in the study. Furthermore, the final design quality, other than the quality of design and development processes, was not easy to be evaluated within the time frame.

It can be expected that ISO will continue to play a leading roll in both quality and ecological issues. The emerging series of 14000 and 18000 just tells its own tale. And hence, in order to respond to such circumstances corporate have to pay very close attention to the trends of ISO certification development. Being the brain of a corporate, design sectors can not to give no thought to such serious situation. Besides the findings described above in this study, a couple of aspects need to be further explored:

1)A macro view from the top level of a corporate would be a good supplement to this study;

2)How design sectors can avoid all the negative effects in implementing ISO series standards.

V. Acknowledgments

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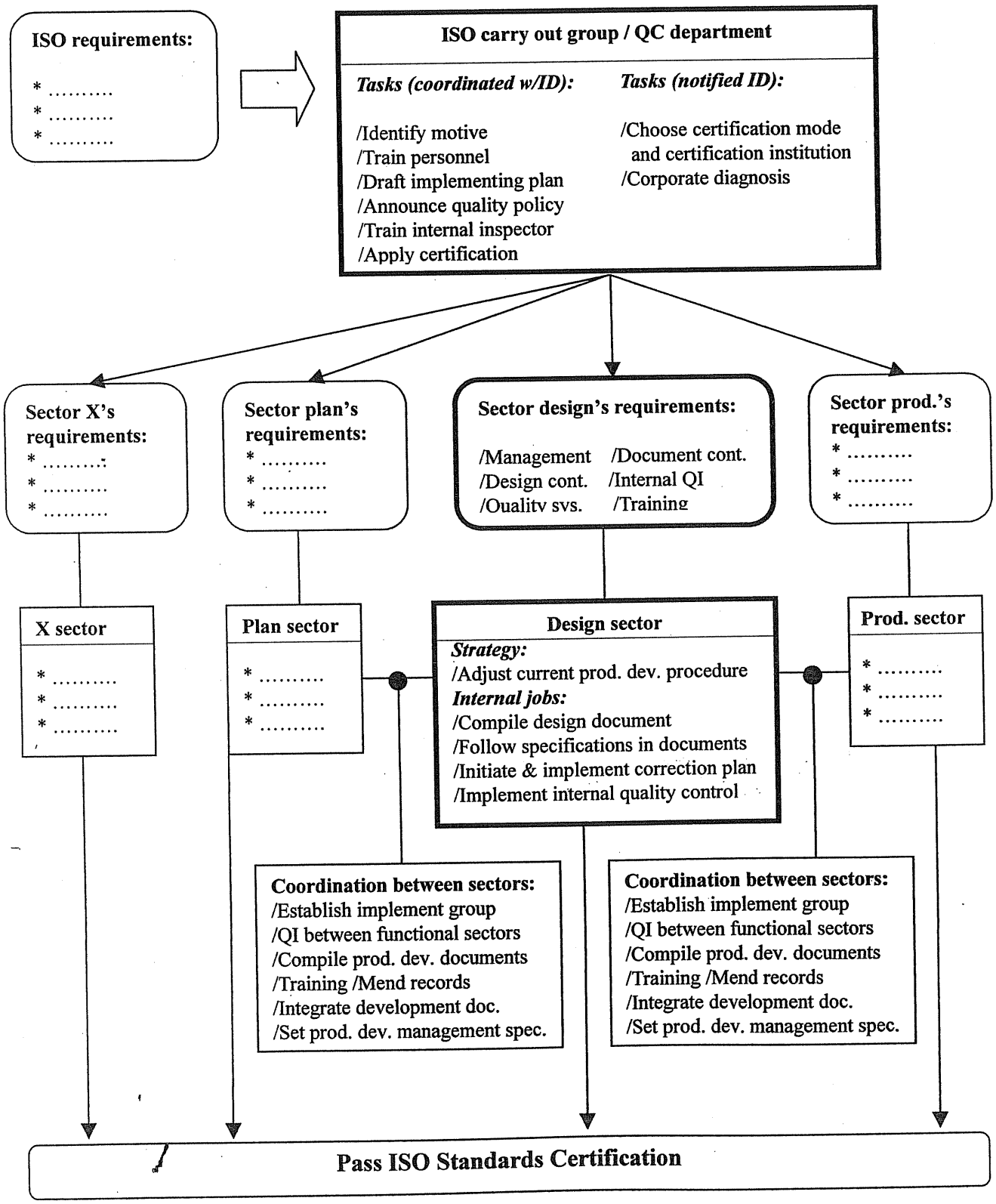

Figure 1. Model for design sectors' preparing ISO 9001 certification

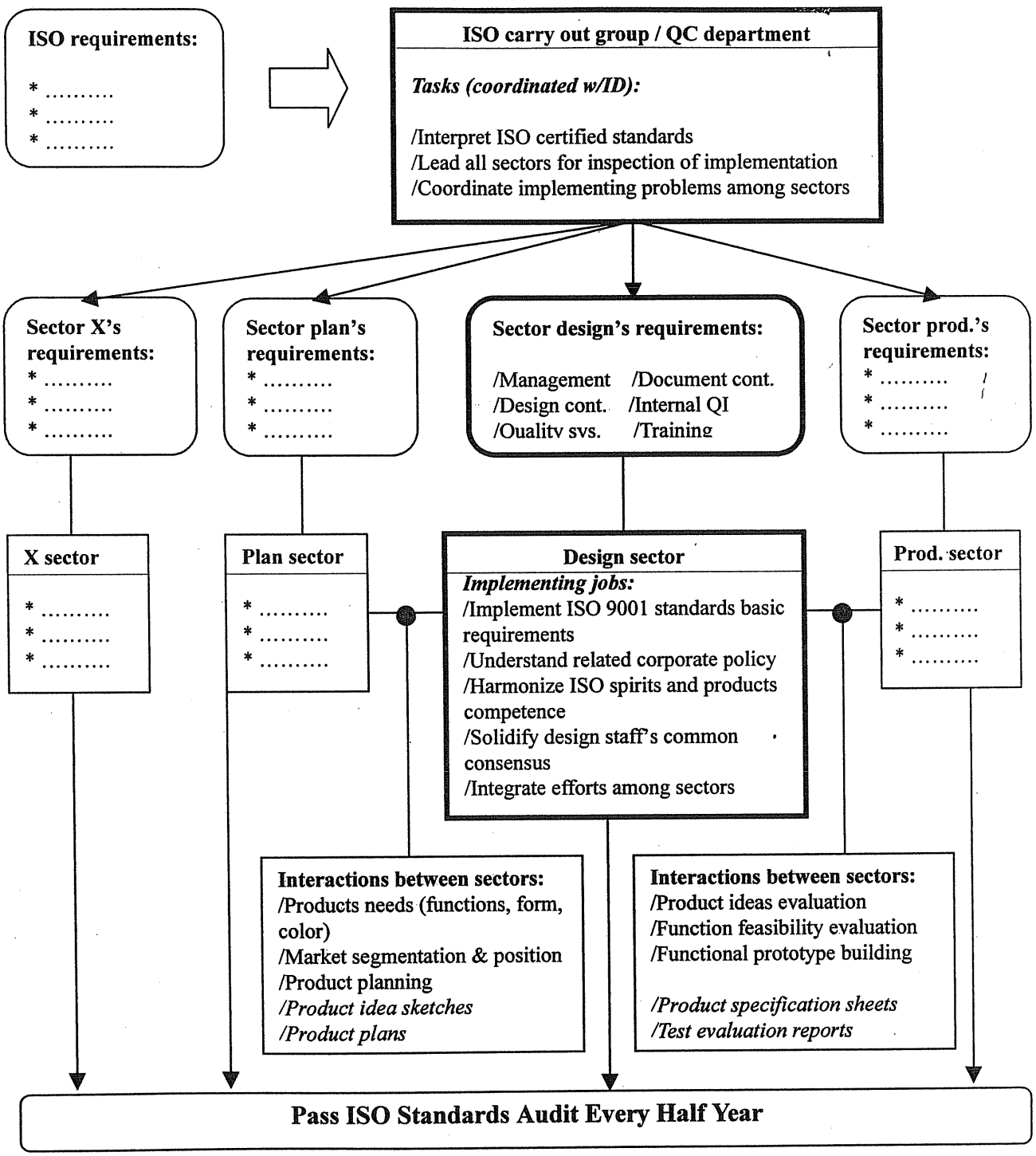

Figure 2. Model for design sectors' implementing ISO 9001 standards

Figure 2. Model for design sectors' implementing ISO 9001 standards

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ISO 9000 系列品保制度對設計部門之影響

陳國祥　陳偉誠

國立成功大學工業設計研究所

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摘要

對以外銷爲命脈的台灣企業而言，通過 ISO 9000 系列品保制度認證已被業者視同取得進入歐洲共同體與爭取國際訂單的必要通行證。基於此，台灣已於 1990 年 3 月由商檢局引進 ISO 9000；再加上台灣正逢產業升級之際，產品的設計與研發在台灣產業中勢必日益扮演重要的角色。綜上所述，ISO 對設計研發的可能影響，以及肩負設計研發任務的企業設計單位應如何因應 ISO 之發展趨勢並參與推行，正是本研究的重點所在。

本研究以三階段漸次地歸納出企業設計部門參與 ISO 9000 系列品保制度之推行模式：(一)分析現行政府因應策略、企業的推動措施、ISO 9001 的設計管制，以及 ISO 與設計之關係；(二)經由個案研究之實地訪談，萃取出設計部門在企業推動 ISO 9000 時的參與廣度與深度。(三)透過問卷調查之驗證，建構出企業設計部門參與推行 ISO 9000 系列的模式。本研究以通過 ISO 9001 之企業設計單位爲研究對象。

研究發現歸納如下：

(1)設計部門在推行 ISO 9000 系列時所面臨的主要問題包括：文件的官方解讀及其僞之鑑定與其他單位的配合；

(2)落實 ISO 9000 系列對設計部門的主要益處包括：設計活動流程之標準化，文件資料可靠之繼承性、可追溯性、及完整性，周全之設計思考，及穩定之設計品質；

(3)設計部門參與推行 ISO 9000 系列所經歷的負面經驗包括：設計工作受到延誤，行政官僚充斥，繁瑣的文件編制工作被設計師排斥；

(4)設計部門參與推行 ISO 9000 系列的最大貢獻在於協助企業制訂與編製設計之標準流程，而這正符合 ISO 的一貫精神：標準化一切。

關鍵詞：ISO 9000、設計與研發、設計部門