Successful Organisational and Human Practices in the UK Construction Industry: Proposing the CONSTRUCT© Framework of Good Practice

by

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Abstract

Previous research recognised a lack of team culture and collaboration in construction projects and failure of the fragmented UK construction industry to recognise people as an asset, generate profits or deliver high customer service. The Construction Task Force commissioned by the Government in 1998 confirmed these findings and suggested that industry and clients collaborate to reverse them by applying best practice. The Task Force identified key drivers for change and specified improvement areas. However, lessons from construction and other projects were not widely or adequately disseminated amongst construction professionals and the emerging information on good practice was not fully utilised. This research set out to identify and share with practitioners, human and organisational factors and good practices that would help to improve UK construction. Qualitative methodologies of case study and evaluation were employed within a phenomenological research framework. An in-depth investigation of the Heathrow Express (HEX) railway construction project revealed human and organisational factors that led to success. Literature suggests that appreciation of complex situations and informed decision-making rarely occur through application of prescriptive or best practice models. Rather, organisations develop by applying practices contingent to their particular situation. Using the HEX findings and further study of the literature, a descriptive framework of good practice, entitled CONSTRUCT©, was created, focusing on four domains of knowledge: building a single team, establishing trust, managing procurement and contractual relations, and involving the supply chain. An innovative approach, using the mindmapping technique, led away from a prescriptive model towards an interactive, CD-ROM based framework that enables practitioners to delve into knowledge on good practice as implemented by industrialists and advocated by academics. Therefore, CONSTRUCT© is proposed as a contribution to the sought improvement of UK construction industry through the application of good practice. It will help develop construction professionals' awareness of proven interventions thereby informing their project decisions. The content and context of CONSTRUCT© were evaluated by 20 construction and other sector practitioners selected for their expert opinion. Most of these experts found CONSTRUCT© to be useful, interesting and well-structured and all of them agreed on its applicability to project organisations. Recommendations for future work comprise the updating of good practices presented by the framework and its further dissemination to the construction industry.

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Declaration

The author declares that this work and the work described herein is solely her own, except where duly referenced. This original work is being submitted for the degree of Engineering Doctorate and has not been submitted for the award of any other degree at this or any other university.

Athina Nicolaides Bastien

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My thanks extend to my parents, family and friends for having believed in me. I express my gratitude and appreciation to Christophe Bastien, to whom this work is dedicated, for having wholeheartedly and unconditionally supported me "for better, for worse, for richer, for poorer, in sickness and in health", throughout the course of this doctorate.

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Abbreviations

ASCE	American Society of Civil Engineering
BAA	British Airports Authority
BPF	British Property Federation
BPRC	Business Processes Resource Centre
CBPP	Construction Best Practice Programme
CD-ROM	Compact Disk - Read-Only Memory
CIB	Construction Industry Board
CMP	Construction as a Manufacturing Process
CRISP	Construction Research and Innovation Strategy Panel
CSFs	Critical Success Factors
DETR	Department of the Environment, Transport and the Regions
DTI	Department of Trade and Industry
E-mail	Electronic mail
EngD	Engineering Doctorate
EPSRC	Engineering and Physical Sciences Research Council
ESRC	Economic and Social Sciences Research Council
GDP	Gross Domestic Product
GPS	Group Project Services
HEX	Heathrow Express
HRM	Human Resources Management
HSE	Health and Safety Executive
HTTP	Hyper Text Transfer Protocol
IMI	Innovative Manufacturing Initiative
JIT	Just in Time
KPIs	Key Performance Indicators
M4I	Movement for Innovation
NEC	New Engineering Contract
NCE	New Civil Engineer
NEDO	National Economic Development Office
ONS	Office of National Statistics
OST	Office of Science and Technology
PMA	Post Module Assignment
QFD	Quality Function Deployment
RIBA	Royal Institute of British Architects
TQM	Total Quality Management
UK	United Kingdom
WMG	Warwick Manufacturing Group
WWW	World Wide Web

Glossary

Affinity or KJ method	The KJ (name registered by the Kawayoshida Research Center) or affinity method is an organisational technique used to clarify problems through the collection of verbal data and their analysis 'by mutual affinity' (Mizuno, 1988).
Construction Best Practice Programme (CBPP)	An initiative, funded by the government (through the Department of Trade and Industry), part of 'Rethinking Construction', aimed at promoting awareness of best practice benefits and offering advice to organisations on skills required to implement change. (http://www.cbpp.org.uk/)
"Egan Report" (or "Rethinking Construction")	"Rethinking Construction" is the name of the report commissioned in 1997 by John Prescott, the Deputy Prime Minister and produced by the Construction Task Force, chaired by Sir John Egan, in July 1998. It outlines 5 key drivers for change (committed leadership; focus on the customer; product team integration; quality driven agenda; commitment to people); 4 project process improvements (product development; partnering and the supply chain; project implementation; production of components); and 7 targets for improvement (reducing capital cost, construction time, defects and site accidents; improving increasing productivity, turnover and profitability and predictability). These proposals became known as "5-4-7". The 'four strands' of Rethinking Construction are: the Movement for Innovation (M4I); the Housing Forum; the Local Government Task Force (LGTF); and the Central Government Task Force (CGTF). They work in partnership with: the Construction Best Practice Programme (CBPP); the Government Construction Clients Panel (GCCP); and the Construction Industry Board (CIB). (http://www.dti.gov.uk/construction/rethink/index.htm)
Demonstration Projects	Construction flagship projects, promoted by the Movement for Innovation (M4I), "seeking to innovate or employ best practice in working relationships, construction techniques/processes, or development of components" (http://www.m4i.org.uk/news.news00061.html, retrieved June 20, 2001). There are currently approximately 170 M4I Demonstration Project that demonstrate at least one of the following improvements in at least one of the 4 specified areas: product development; project implementation; partnering the supply chain; production of components.
Java frames	"Java is an object-oriented programming language developed by Sun Microsystems, Inc. to create executable content (i.e. self-running applications) that can be easily distributed through networks like the Web. ... Java enables developers to create content that can be delivered to and run by users on their computers. This software can support anything ... from spreadsheets to tutorials to interactive games and animation"

	(http://www.learnthenet.com/italian.glosscom/glossary/java.htm, retrieved March 4, 2002).
Learning managers	Individuals "who continuously seek to develop and improve themselves by being resourceful, self-directed, inquisitive and creative in their approach to learning ...[and are] emotionally competent in understanding and addressing the 'internal' conflict" between their psychological needs for self-actualisation and their social needs for belonging and acceptability (Antonacopoulou, 1999:223-224).
Movement For Innovation (M4I)	One of the 'fours strands' of "Rethinking Construction", promoting the implementation of its proposals in non-housing in the private sector, primarily through the dissemination of innovations and best practice through the Demonstration Projects. (http://www.m4i.org.uk/)
Partnering	"Partnering is a management approach used by two or more organisations to achieve specific business objectives by maximising the effectiveness of each participant's resources. The approach is based on mutual objectives, an agreed method of problem resolution and an active search for continuous measurable improvements" (Bennett & Jayes, 1995:2).
Phenomenology	Research paradigm, otherwise known as humanistic or interpretivist, concerned with "understanding human behaviour from the participant's own frame of reference" (Hussey & Hussey, 1997:52). Derives from the Greek words *phaino*, show, and *phainomai*, appear.
Philomathia & Mathophobia	Phenomena reflecting respectively the positive and negative attitudes of individuals towards learning, in relation to a complex set of interactions between personal and organisational factors (Antonacopoulou, 1995).
Philomathic managers	"Philomathic managers are the individuals who are appreciative of the need to learn and engage in a conscious and active learning process to improve themselves, beyond the boundaries of the context in which they operate" (Antonacopoulou, 1999:223).
"Rethinking Construction" (or "Egan Report")	"Rethinking Construction" is the name of the report commissioned in 1997 by John Prescott, the Deputy Prime Minister and produced by the Construction Task Force, chaired by Sir John Egan, in July 1998. It outlines 5 key drivers for change (committed leadership; focus on the customer; product team integration; quality driven agenda; commitment to people); 4 project process improvements (product development; partnering and the supply chain; project implementation; production of components); and 7 targets for improvement (reducing capital cost, construction time, defects and site accidents; improving increasing productivity, turnover and profitability and predictability). These proposals became known as "5-4-7". The 'four strands'

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PART I INTRODUCTION

Chapter 1 Thematic Framework & Scope

This document summarises a doctoral research Portfolio that encompasses a collection of investigations pertaining to human and organisational aspects of the UK construction industry. These investigations follow previous research findings showing that the UK construction industry is fragmented, underachieving and fails to recognise people as an asset (Barlow, Cohen, Jashapara & Simpson, 1997; Egan, 1998; Hillebrandt, 1984; Hillebrandt & Cannon, 1994a, 1994b; Langford, Hancock, Fellows & Gale, 1995; Latham, 1994; Office of Science & Technology [OST], 1995; Saad & Jones, 1998). This doctoral investigation acknowledges the Construction Task Force (Egan, 1998) recommendations for implementation of best practice by the construction industry and its clients. However, it identifies a lack of shared knowledge on proven practices. This shared knowledge would lead to better informed decision-making that would help practitioners act to achieve the sought improvements and changes.

Therefore, this new research represents a bridge between previous research and practice and aims to identify, review and present organisational and human practices that have led to success. The objective is to make proposals and recommendations stemming from the proven good practices that would help improve UK construction. It is concerned with findings that are relevant for both theory and practice (Lawler III, Mohrman Jr, Mohrman, Ledford Jr & Cummings, 1985), hence, 'usable' by practitioners (Argyris, 1982, 1983, 1985).

The industrial audience of this research is encouraged to once again 'Rethink Construction' (Egan, 1998) and then, with the help of the emergent findings and

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proposals, develop ideas that will help to identify actions and make decisions on achieving change and improvement.

This investigation focuses on one-off major or civil engineering projects, where the unit of analysis is the project. Primary, but not exclusive, concentration lies on the stages of the project life cycle that follow the award of a contract to a main works or management contractor. Nevertheless, given the holistic outlook of this research, the pre-award stage, with a focus on contractual arrangements, has also been addressed.

The implications of this work extend to contractor, client and industry levels. In addition, as confirmed by expert opinion employed in this research, advantages, implications and knowledge from this inquiry spin off to other sectors, industries and companies interested in continuous improvement.

1.1 Executive Summary Structure

This Executive Summary presents the main components of the research and discusses their role in this context and their significance for future research and application.

This document comprises nine chapters within three main parts:

- Introduction
- Realisation
- Conclusion

Firstly, Part I, as depicted in figure 1.1, introduces the thematic framework and scope of this doctoral Portfolio, presenting a background of the literature and appreciation of the key issues in UK construction (chapter 1). Then, it presents an account of the conception of the research scheme, in relation to its theoretical foundations and research purpose (chapter 2). Finally, Part I introduces the methodological framework within which the research took place (chapter 3).

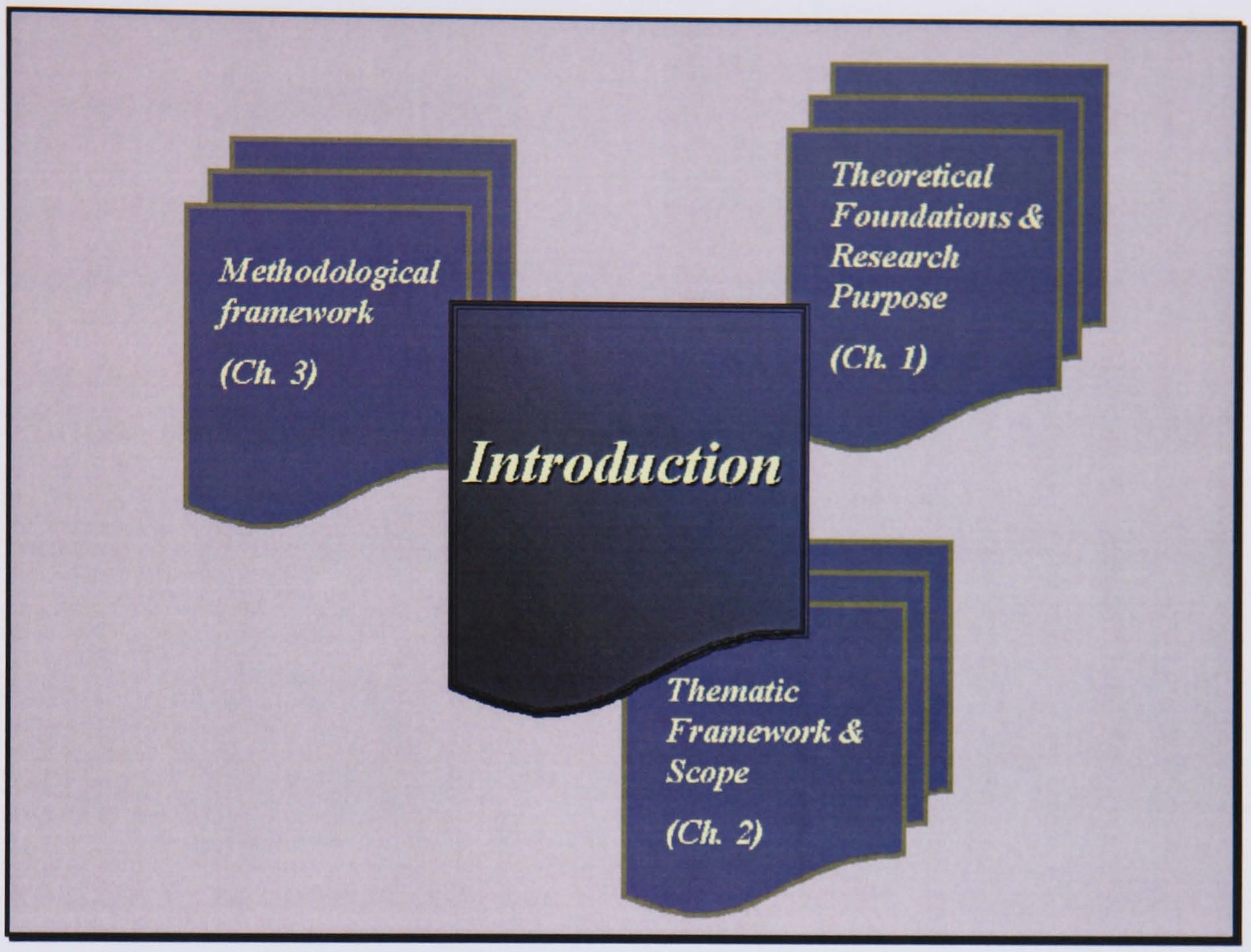

Figure 1.1 Executive Summary Part I: Introduction

Secondly, Part II (represented by figure 1.2) presents the realisation of the research programme, spanning across four phases on a continuum from development and exploration to conceptualisation and evaluation (chapters 4, 5, 6, 7). The four chapters that constitute Part II, present a route map of the research and its main achievements.

Thirdly, Part III, as shown in figure 1.3, presents further recommendations and proposals to extend this work (chapter 8). Finally, this last part refers to the types of research adopted by this investigation in order to serve its particular purposes. In reference to these research purposes, it discusses the innovation and contribution made by the research (chapter 9).

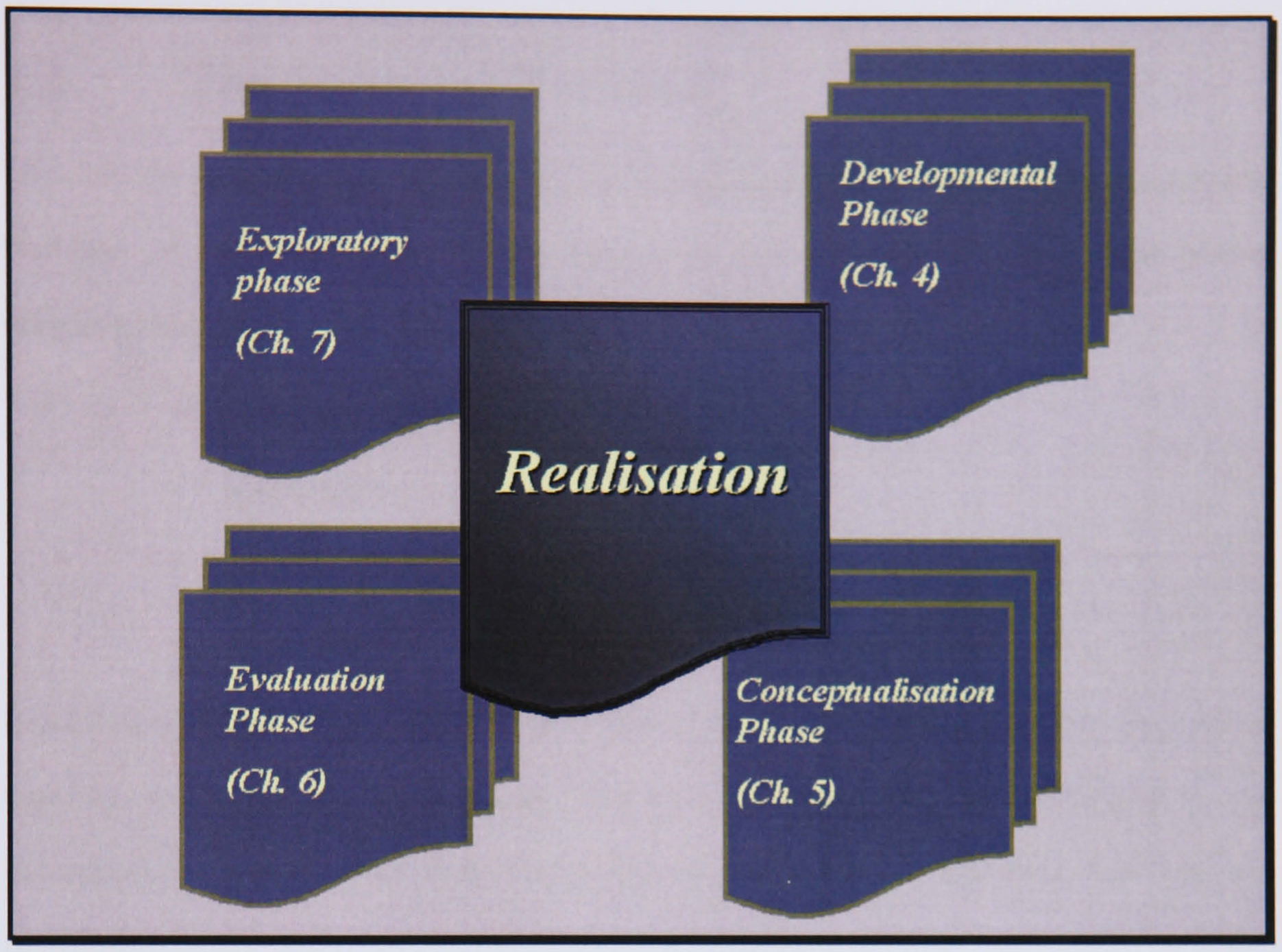

Figure 1.2 Executive Summary Part II: Realisation

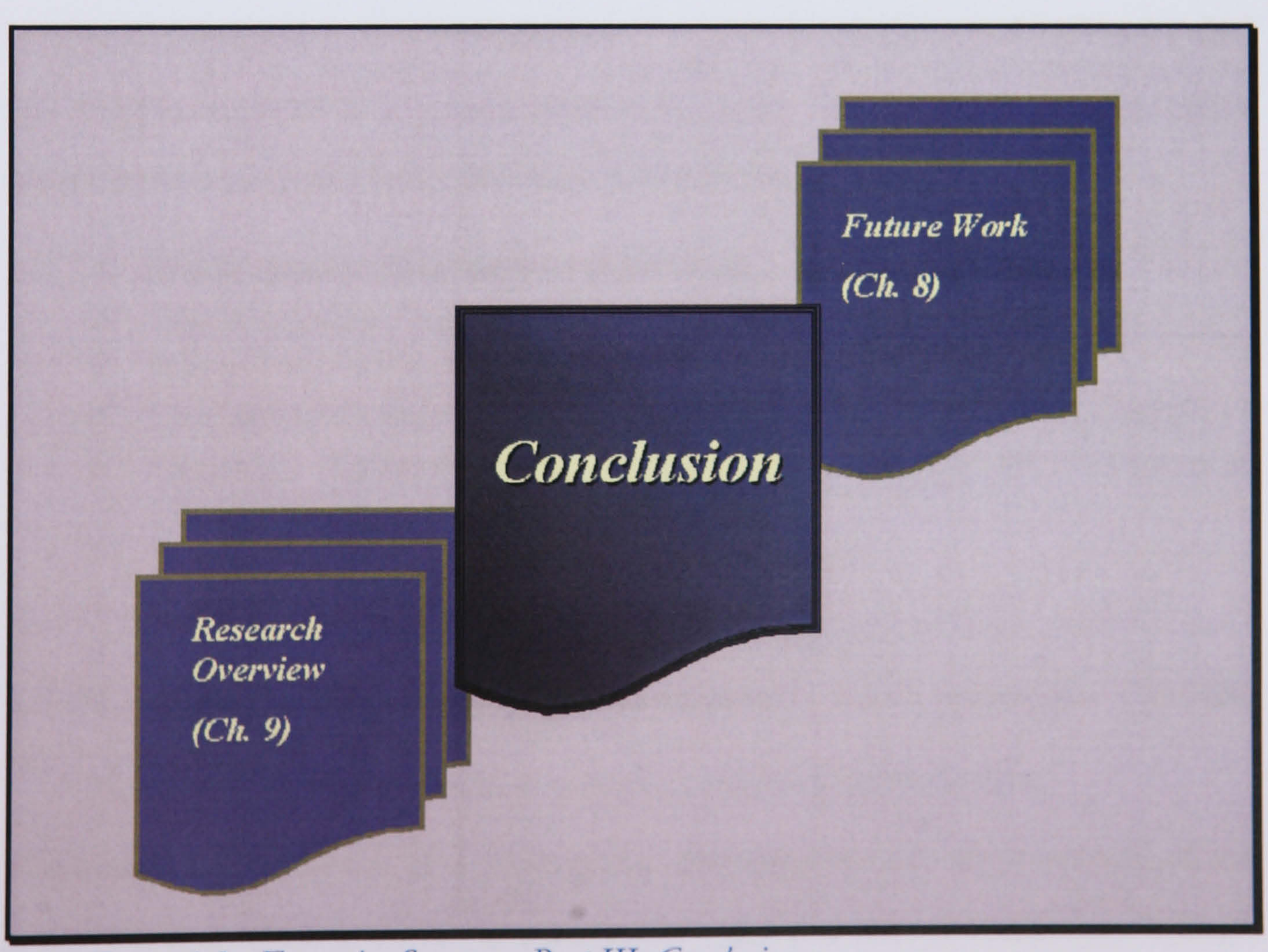

Figure 1.3 Executive Summary Part III: Conclusion

1.2 The Doctoral Portfolio

This section presents an overview of the reports submitted to the doctoral research Portfolio. All submissions have been categorised into the four distinct phases of this research. Namely:

- Developmental
- Exploratory
- Conceptualisation
- Evaluation

Individual submissions are referred to in this section and a brief explanation is given of their key attributes and contribution. The order in which they are presented is the chronological order in which they were written and in which it is advisable that they are referred to.

In total, 10 submissions have been made to the Portfolio, with specified reports bundled into 'collections' comprising multiple documents. These 10 submissions are listed below while the research phase with which they correspond is indicated:

1. Eng.D. research proposal (developmental)
2. Report collection "Establishing links with BAA" (developmental)
3. Human Factors in Industry PMA: "Teamworking" (developmental)
4. Collaboration & Contract Management PMA: "Partnering" (developmental)
5. Appendix: Partnering focus group correspondence and proceedings (developmental)
6. Presentation to BAA top management (exploratory)
7. Heathrow Express (HEX) case study (exploratory)
8. Innovation Strategy PMA: "Innovation" (exploratory)
9. CONSTRUCT© framework: development and interactive CD-ROM (conceptualisation)
10. CONSTRUCT© framework: evaluation and findings (evaluation)

In addition, the academic and professional development and achievements of the researcher have been presented in a dedicated document, entitled **"Personal Profile"**.

submitted with the research Portfolio. This is a summary of the way in which the specified competences for the award of the Eng.D. have been accomplished.

1.2.1 Developmental Phase

This was the initial phase of this research, of a formative role for the overall research and the specific areas it would select to concentrate on. During this developmental phase, as presented in chapter 4 of this Executive Summary, a brief research proposal was written. Furthermore, initial literature reviews took place and the main areas of significance were identified. Links were established with industrialists to identify areas to be rigorously and meaningfully investigated through this research. The work components submitted during that phase, as described here, consist of examples of the scene-setting work that took place during that initial research stage.

Firstly, a **research proposal** (1), followed by a **collection of reports and proposals, entitled "Establishing links with BAA"** (2), feature in the Portfolio and comprise documents proposing BAA as an industrial contributor. This collection also includes a BAA-related report on the topic of *Key Performance Indicators (KPIs)*.

Secondly, **two Post Module Assignments (PMAs)** (3 and 4), examining *teamworking* and *partnering*, were submitted due to their relevance to the areas of concern to the proposed industrial contributor.

Finally, merely for information purposes and to indicate the areas tackled at the time, an **appendix** (5) to that phase, has been included. It comprises the *proceedings of an industrial-academic workshop on the theme of Partnering*, as described in chapter 4 of this Executive Summary, and *related correspondence* generated during the creation and development of the focus group event.

The BAA reports submitted during the developmental phase were critical for the establishment of access to the industrial organisation and the identification of the particular construction project that was studied during the following phase.

1.2.2 Exploratory Phase

In the exploratory phase of the research that was to follow, a **presentation** (6) was developed and given to top management members of BAA, in order to highlight relevant research interests and gain access to their organisation to conduct research. This presentation has been submitted to the Portfolio and led BAA, the construction client, to grant permission to investigate the construction of the largest private railway built in the UK in over one century.

The emergent **Heathrow Express (HEX) case study** (7) comprises *6 chapters* and was submitted to this Portfolio as the formative piece of work which has not only established the main research themes and highlighted some of the potential human and organisational factors of success in construction projects but more importantly paved the way for the development of a framework of knowledge for dissemination to and evaluation by the industry.

The case study retrospectively investigated the construction of the Heathrow Express railway, focusing on the organisational, management and human aspects which enabled this project to overcome the consequences of a major accident and progress to be a flagship project for the industry.

Finally, **one PMA** (8) of direct relevance to the HEX case study and findings has also been included with the submissions of that phase, as it was dealing with the topic of *Innovation* and was considered equally important for the follow-up investigation of HEX emergent themes.

Overall, the significance of the submissions made to the Portfolio during that phase, partially lie in the utilisation of the findings for the development of a framework of knowledge on project success, as can be seen in the work submitted in the next phase.

1.2.3 Conceptualisation Phase

This phase is the most significant of the overall research and so is the corresponding submission. During this phase the findings of the HEX case study were abstracted and conceptualised in a good practice framework. This became known as the **CONSTRUCT© framework** (9) of good practice. This descriptive framework and *the route to its development* form the main body of the submission made to the Portfolio at the time. This submission is accompanied by a **CD-ROM** containing the self-extracting, *interactive framework*.

The framework presents the good practices that HEX had implemented. They were enriched with additional proven ways put forward by other practitioners and academics in order to build a knowledge base of practices that had led to success and that could be considered by practitioners wishing to improve their own projects.

As CONSTRUCT© is aimed at practitioners, its review by industry was considered crucial and took place in the final phase of this research.

1.2.4 Evaluation Phase

The evaluation phase is represented by the **CONSTRUCT© evaluation** (10) submission. The content and context of the CONSTRUCT© framework was reviewed by experts in construction and manufacturing sectors and this submission presents the *process* and *findings* of this review. It follows and is directly linked to the framework development. It is based on the *evaluation questionnaire* developed (and contained in

the interactive CD-ROM) and refers to the *evaluation process*, comprising the *completed evaluation forms* and *relevant correspondence* with the evaluators.

Chapter 2 Theoretical Foundations & Research Purpose

The approach and culture of this research, correspond with a genuine and personally internalised philosophy based on a holistic view of reality and its phenomena. This philosophy, signifying "a move toward being nondisciplinary" and a step away from the "blinders of ... specialities", recognises the systemic and interrelated nature of the phenomena under study (Trochim, 2002a).

The theoretical stances discussed in this chapter, were of central relevance and contribution to this work. They were distilled and amalgamated innovatively[1] to provide the solid and rigorous constituents and drivers of this research and define its purpose and relevance. Hence, their study not only contributed to the plurality and diversity of perspectives, but also added richness and meaningfulness to the results put forward.

2.1 The multi-disciplinary nature of this research

This was a strongly interdisciplinary research, bringing together streams of thought as diverse as psychology and mathematics[2]. This inquiry has drawn on a range of theoretical domains of social and management science, including psychology, organisational behaviour, organisation development and organisational and individual

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[1] For an introduction to the pertinent role and characteristics of the "qualitative researcher as bricoleur and quilt maker" and the "multiple interpretive practices", see Denzin & Lincoln (2000:1-28).

[2] Note the timelessness of Bertalanffy's comment: *"If we survey the various fields of modern science, we notice a dramatic and amazing evolution. Similar conceptions and principles have arisen in quite different realms, although this parallelism of ideas is the result of independent developments, and the workers in the individual fields are hardly aware of the common trend. Thus, the principles of wholeness, of organization, and of the dynamic conception of reality become apparent in all fields of science"* (Bertalanffy, 1952, cited in Kast & Rosenzweig, 1981:98).

learning (Antonacopoulou, 1995, 1996, 1999; Argyris & Schon, 1974, 1978; Kolb, 1984; Lewin, 1951; Maslow, 1954; Vygotsky, 1962).

A central stream of thought that contributed to this investigation was humanistic psychotherapy, as part of therapeutic psychology (Kirchenbaum & Henderson, 1990; Rogers, 1965). In parallel, the systems (Beer, 1980; Checkland, 1981; Cummings, 1980) and contingency (Denzin & Lincoln, 2000; Kast & Rosenzweig, 1981) approaches have provided the backdrop of inspiration and were related to the principles of Cantor's infinite set theory (Dauben, 1979; Jourdain, 1991; Papamichael, Balis, Giannikos, Notaras & Soldatos, 1984; Suber, 1998; Tiles, 1989), from the domain of mathematics, adopted as a building block of the knowledge framework introduced by this research.

2.1.1 The "non-directive" approach

Overall, this research was initially inspired by a seemingly unrelated theoretical domain: psychotherapy and, in particular, the Rogerian school of thought in therapeutic psychology. Carl Rogers[3] was the founder of a major new approach to psychotherapy: the 'non-directive', 'client-centred', 'person-centred' approach. Clearly, Rogers' approach not only has strong implications for therapeutic psychology but also notable influence in the social and political spheres (Kirchenbaum & Henderson, 1990:87), including teaching and education.

Consequently, his influence and approach have transcended the domains of psychology and psychotherapy and have entered the realms of this research:

> *"His message was deceptively simple, yet profound in its implications: 'All individuals have within themselves the ability to guide their own lives in a manner that is both personally satisfying and socially constructive. In a particular type of*

[3] Carl Rogers (1902-1987) was the most influential psychologist in American history and a leader of the humanistic psychology movement (Kirchenbaum & Henderson, 1990).

> *helping relationship, we free the individuals to find their inner wisdom and confidence, and they will make increasingly healthier and more constructive choices'" (Kirchenbaum & Henderson, 1990:xiv).*

It is with this message that the philosophy of this research converged. The notions of *counsellor* and *client* were replaced with those of *researcher* and *target audience* (in this case, primarily, members of the construction industry), respectively. The analogous message states that the researcher does not intend making choices for the research audience. Instead, this research is aimed at helping members of the construction industry assume their *own* initiative and guide their *own* decisions to make the most *constructive* choices for their organisations, projects and themselves. Effectively, this is the basis of the 'person-centred' approach.

The "non-directive", "person-centred" approach is in strong agreement with the 'contingency' orientation of this research, in place of a 'prescriptive' one (Denzin & Lincoln, 2000). According to the contingency approach, research is not aimed at providing solutions. Instead, it makes recommendations and proposals. What is being recommended and proposed is not the 'best practice' but the 'good practice'.

It is recognised that different organisations and individuals may be at varying stages of development and be experiencing different issues which they need to tackle. Hence, the practices being presented and proposed do not claim to be the 'best' for all but 'good' and 'fit for (a particular) purpose' (Blockley & Godfrey, 2000; Nicolaides, 1999a). The contingency approach enables a deeper understanding of complex situations. It steers away from prescriptive, 'generally' applicable solutions (Kast & Rosenzweig, 1981).

By combining the contingency approach with the *research* relationship (in place of the Rogerian *therapeutic* relationship), as established above, the research also assumes the 'non-directive' instead of the 'directive' approach. Therefore, it does not value

"social conformity and the right of the more able to direct the less able" but appreciates "the right of every individual to be ... independent and to maintain his [or her] ... [personal] integrity" (Kirchenbaum & Henderson, 1990:87).

2.1.2 The 'experiential learning' perspective

Experiential Learning is considered as a descendant of Carl Rogers' humanistic approaches to therapeutic psychology (Kolb, 1984). The notion of 'integrity', in this case, does not solely refer to the known character trait. This research, recognising interrelationships across (seemingly) different scientific areas, links 'integrity' with the notions of 'learning' and 'knowledge', to reach what Kolb (1984) and Bennis (1982) describe as 'experiential learning' and 'integrative learning', respectively.

The concept of 'integrated learning' derives originally from Experiential Learning, defined by Kolb (1984) as the "process whereby knowledge is created through the transformation of experience". Hence, in this sense, 'integrity' and 'integrative knowledge' act as interfaces that link social knowledge to new topics and phenomena of study.

> *"Integrative knowledge ... stands with one foot on the shore of the conventions of social knowledge and one foot in the canoe of an emergent future- a most uncomfortable and taxing position, one that positively demands commitment to either forging ahead or jumping back to safety." (Kolb, 1984:225-226).*

Experience and its transformation are significant for this research, as it is proposed that they lead to meaningful knowledge to improve the construction process. In particular, aspects pertinent not only to the experiential learning process (Kolb, 1984:38), but also to the accomplishment of this research purpose, were:

- focus on the *process* (i.e. context) of learning and adaptation and not on the content
- acknowledgement of knowledge as a dynamic and "transformation" process and not as a static element
- recognition of the transformative nature of learning and its effect on experience

2.1.3 The "action" orientation

A practice closely interlinked with the tradition of experiential learning, influential for the domains of organisational behaviour, organisation development and social psychology and of relevance to this research and particularly its future aspirations, was the 'action research' method developed by Kurt Lewin (1951).

The action research approach recognised the need and benefits of linking research to action so that members of organisations could utilise research results to manage change. Therefore, it was built on collaboration between researchers and organisational participants. It consisted of a self-renewing cycle of data collection, data analysis, solution devise, implementation and so on (Cummings & Worley, 1997). This approach considered learning as an integrated process that embarks from the current experience and proceeds with the collection of data about that experience. Following the data collection, data are analysed and synthesised. The results are fed back to the participants of the initial experience to aid their decision-making on changed practices (Kolb, 1984:21).

Overall, the strategic approach followed by this research, bears many similarities with the Lewinian Experiential Learning Model (Kolb, 1984:21). When comparing the main components of this research[4] with Lewin's four-stage cycle of learning (i.e. "concrete

[4] The main components or phases of the realisation of this research, presented in part II of this Executive Summary, comprise: (a) development, (b) exploration, (c) conceptualisation, and (d) evaluation.

experience"; "observations and reflections"; "formation of abstract concepts and generalisations"; "testing implications of concepts in new situations"), there emerges a correspondence between them. In particular, an agreement is exhibited in the sequence of the four main research activities performed and Lewin's stages of learning from experience.

In addition, it was Lewin's concern for the integration of practice and theory (Kolb, 1984:9) that was of relevance here. The action approach has proved useful for *planned-*change interventions (Kolb, 1984:8). This research, as will be seen later, has studied the results of *unplanned* change[5] and, therefore, has *not directly* utilised the action research methodology.

This inquiry, aiming to provide an interface between proven good practice and industrialists' decisions, integrated learning that emerged from unplanned change into the efforts of business improvement. This learning was deemed capable of feeding back into planned-change interventions in future endeavours.

2.1.4 The 'philomathic' path

Remaining in the domain of learning, two further concepts are directly related to this investigation as they are essential for specifying and reaching the intended audience. The two concepts of *Mathophobia* and *Philomathia*[6] (Antonacopoulou, 1995, 1999), derived from the Greek word for learning, namely *mathisis*, are concerned with the personal and organisational factors affecting individuals' receptivity to learning.

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[5] Discussed in the Heathrow Express (HEX) case study, part of the research Portfolio.

[6] 'Mathophobia' and 'Philomathia' *"describe respectively the negative and positive attitudes of managers towards the need to learn. Their identification is not restricted to manifestations of individuals' learning behaviour alone, but rather they illustrate the complex set of psychological, mental and emotional aspects underlying individuals' reactions in relation to learning" (Antonacopoulou, 1999:222).*

The emergent good practice proposals are aimed at the *"philomathic"* managers of construction and other organisations. These are individuals striving to improve themselves and actively and consciously learn, moving beyond the contextual boundaries of their organisations. They show "personal initiative" and take full advantage of learning opportunities within and outside their job. This concept transcends the notion of "self-development" in that it *"describes the richness of individuals' cognitive maps, the psychological and emotional factors which underlie their positive response to an identified learning need"* (Antonacopoulou, 1999:223).

Consequently, the interrelation between "philomathia" and "self-development" leads to another party of the intended audience of this research: the 'learning managers'. This concept extends beyond the self-direction and resourcefulness of the "philomathic" individual, to embrace the emotional competence *"in understanding and addressing the 'internal conflict' between the personal need of self-actualisation and self-fulfilment (psychological needs) against the need for belonging, security and acceptability as a member of a social group (social needs)"* (Antonacopoulou, 1999:223-4)[7].

Eventually, targeting the proposals of this research to *philomathic* and -in extension- *learning* managers *and* organisations (see also Senge, 1990), takes into account their positive attitude to learning. This implies that the results of this investigation are not aimed at persuading recipients of the requirement for improvement and change in their industry. Instead, these results go one step further and target those individuals' *need to learn* about proven good practices in order to strive towards the *undisputed* need for improvement and change. Hence, the effectiveness of this research is strengthened. So

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[7] See Maslow (1954) and Davis & Newstrom (1989) for accounts of self-actualisation psychology and the psychological needs for self-fulfilment and self-actualisation as derived from Maslow's 'hierarchy of needs'.

is the potential for take up and implementation of the practices proposed to the appropriate audience.

2.1.5 The 'usable knowledge' philosophy

Wider implications for organisational performance were considered in relation to experience, its transformation, and the resultant knowledge. Generally, links have been shown between organisational knowledge and organisational performance, deriving from the learning processes of organisations [Snyder & Cummings (1996) cited in Cummings & Worley (1997)]. Overall, positive relationships between organisation learning and organisation performance have been shown (e.g. Konaka & Takeuchi, 1995; Prahalad & Hamel, 1990; Senge, 1990; Senge, Roberts, Ross, Smith & Kleiner, 1995). These relationships have also been proposed by Argyris & Schon (1974, 1978) who put forward the value of experiential learning for the management of organisations and its contribution to organisational and individual effectiveness.

Hence, this research considered effects of organisational learning concepts on the overall performance of construction organisations. Overall, this has provided direction for the research endeavours to provide a guiding interface between proven good practice and industrialists' decisions towards better practice, and to contribute to the documentation and future implementation of the good practice path. This provision was also guided by the *routes* of experiential learning: the co-existing individual and organisational values and action founded on valid information, choice and commitment (Argyris & Schon, 1974, 1978; Kolb, 1984).

This aspired bridge between proven good practice and industrialists' informed choice towards change and improvement was also to be guided by Argyris's elaboration on concepts and research methods that can lead to 'usable knowledge' (Argyris, 1982, 1983, 1985). These concepts were in agreement with the notion and practice of 'useful

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organisational research', as promoted and practised at the Centre for Effective Organizations, University of Southern California (http://www.marshall.usc.edu/web/CEO.cfm?doc_id=663, retrieved February 12, 2002) and by like-minded professionals such as Lawler III et al (1985), Hillebrandt & Cannon (1994b) and Cohen & Gibson (2000).

2.1.6 The "systems" view

Ultimately, the notions explored above have been thought of as guides to the systemic view assumed by this research. Having recognised the links between "experience", "learning" and "action", the systems approach was used as a basis for integration, by encouraging the holistic consideration of relationships and interactions between all components and features of the "experience" under investigation. Hence, a *system* is recognised as "an organised, unitary whole" existing within an even broader *supra-system* (Kast & Rosenzweig, 1981:98). The systems approach highlights the significance of relations and interrelations that may influence the study of a particular area or the proposal of recommendations.

Finally, the framework proposed by this research has been conceptualised within these principles. More specifically, another stimulus was identified in yet another domain: the mathematical one. The *infinite set theory* (Dauben, 1979; Jourdain, 1991; Papamichael et al, 1984; Suber, 1998; Tiles, 1989) was combined with the *systems approach* for a meaningful representation of the research proposals. As such, it recognised the linkages between systems and sub-systems, indicated their relations and promoted a holistic view of the complex construction environment.

Overall, it was recognised that "systems thinking is the discipline that integrates the others, fusing them into a coherent body of theory and practice" (Weiss, 1996:5).

2.2 Understanding the Key Issues: the UK Construction Industry

Following the externalisation of the theoretical foundations of this investigation, this section delves into literature surrounding practical issues connected with the management of the construction process. It paints the picture emanating from the review of this literature and leads to a view of prevailing characteristics and practices of UK construction, focusing on particular concerns of this investigation.

The UK construction industry output in 1998 was estimated at £58 billion, equivalent to approximately 10% of the UK GDP (Office of National Statistics [ONS], 2001, 2002). The majority of this was from the private sector and a high proportion was from repair and maintenance work as opposed to new infrastructure (Flanagan, Ingram & Marsh, 1998). These trends continued along similar lines while in the middle of 2000 higher growth in infrastructure work was observed. The total volume of construction output continued growing, excluding a brief decline in the second half of 2000. During the first three quarters of 2001, the output was estimated at approximately £53 billion (DTI, 2002).

Employment in the industry, reported at about 1.4 million in 1999, is predominantly male (over 90%) (Court & Moralee, 1995; Gale, 1992), with a clear trend towards older workers (DETR, 2000). Overall, finding and retaining new recruits is a problem for the industry (Agapiou, Price & McCaffer, 1995; Sommerville, 1996). A shortage of key trade and professional skills, despite rising workloads between the mid-1990s and early 2000s, posed significant questions as to the industry's capacity to continue increasing its output (DTI, 2002).

Nevertheless, the output levels are not equivalent to the industry's profitability. The gross profit margin for construction companies represents approximately 1% of the

project cost (Flanagan et al, 1998). Overall, this sector is usually seen as backward looking, lacking imagination and seriously lacking an innovative culture (OST, 1995). Traditionally, the British construction industry is seen to be operating within a negative environment of adversity and litigation, low productivity, low profit margins and low customer service, with contractual arrangements and working relationships being two of the main problematic areas (e.g. Akintoye, Macintosh & Fitzerald, 2000).

There is lack of a team-based culture and collaboration in construction projects (Banwell, 1964; Higgin & Jessop, 1965; Latham, 1994; NEDO, 1988) and the selection of a new 'team' for each separate project "inhibits learning, innovation and the development of skilled and experienced teams" (Egan, 1998). Meanwhile, considerable attention has been paid to the investigation of enabling or inhibiting parameters of inter-organisational collaboration (Barlow & Cohen, 1996; Barlow et al, 1997; Bennett & Jayes, 1995; Bennett, Ingram & Jayes, 1996; Green, 1999; Green & McDermott, 1996; Holti & Standing, 1996; Holti & Standing, 1997; Nicolinini, Holti & Smalley, 2001). Generally, it is recognised that the UK construction industry is underachieving with low profitability and low customer service (Egan, 1998; Nicolini et al, 2001).

The construction industry operates within a highly competitive environment and is broadly characterised by a fragmented industrial structure and a powerful working culture. This competitive environment is also characterised by an inherent instability with frequently fluctuating levels of work force and output (Whittington, Livingston & Lucas, 1992). The industry tends to approach these changes and lack of stability in a reactive way and therefore adjusts its business strategy and changes its management and organisational structures (Hillebrandt & Cannon, 1994a) as part of an ongoing state of change, at an industrial, company and project level.

As a result, workforce requirements are targeted through subcontracting, which is seen to promote flexibility and lower capital expenditure (Whittington et al, 1992). This preference for sub-contracting affects once again the management of the construction process, with particular effects on contractual arrangements.

This, in effect, leads to further changes in the ways in which management control is exerted and responsibility diffused under different types of contracting approaches, perpetuating the cycles of fragmentation and instability. Directly linked to these issues are the topics of risk management; risk assessment and risk control. These may be undermined when the increased complexity leads to the effacement of liabilities and the misconceived risk transfer.

Research by Whittington et al (1992:32) suggests that

> *"even though in theory there may be a direct contractual basis for exerting control, in practice (because of the potential disruption to work if contractors have to be replaced) … such dramatic penalties as dismissal will not be enforced until there have been flagrant breaches of safety procedures."*

Indeed, as it will be seen in the construction case studied as part of this research, even following a major accident, the client did not proceed to dismiss the contractor[8].

In addition, the short-termism and subcontracting culture appear to have a negative effect on the co-ordination of activities and process and the effective, two-way communication between parties between and along the planning and construction stages of a project, with significant implications for the project management (Whittington et al 1992:36).

[8] This is further elaborated in Portfolio submission no.7.

2.2.1 The Latham Review

Flanagan et al (1998) examined nine major reports, ranging from the 1944 Simon Report to the 1994 Latham Report, that have reviewed the practices and performance of the industry. Although this is elaborated in chapter 5 of this Executive Summary, it is worth mentioning that, until the 1994 Latham Review of the industry, little meaningful change had occurred (Flanagan et al, 1998).

Nevertheless, since that landmark review, some positive action has been taken, including:

- The establishment of the Construction Industry Board (CIB), as a strategic forum for debate within the industry.
- Legislation on fair payment and adjudication put in place through the Housing Grants, Construction and Regeneration Act 1996 (Arden, 1996).
- An increased use of partnering and framework agreements (targeting fragmentation) in place of contract-based procurement and project management.
- An increasing interest in successful tools and methods proven in other industries, such as teamworking, TQM, JIT and benchmarking.

In addition, following the Latham recommendations for a co-operation-based culture in UK construction (Latham, 1994:39), there has been more research addressing relevant issues and more government-funded research programmes encouraging such research initiatives (e.g. Innovative Manufacturing Initiative [IMI], Construction as a Manufacturing Process [CMP]). For instance, research projects have focused on the improvement of teamwork in construction; overcoming barriers to communication; the enhancement of understanding among different parties involved in the construction process (e.g. building designer and site worker); and the development of better client-supplier relations (e.g. Bennett & Jayes, 1995; Bresnen, 1996; Bresnen & Marshall,

2000; Dainty, Briscoe & Millett, 2001a, 2001b; Holti, Nicolini & Smalley, 2000; Warwick Manufacturing Group, 1999).

2.2.2 'Rethinking Construction'

Nevertheless, the persistence of the main body of problematic areas experienced, lead to improvement still strongly featuring in the construction agenda. More recently, the requirements for improvement and change were once again addressed in the 'Rethinking Construction' report produced by the government-commissioned Construction Task Force, headed by Sir John Egan (Egan, 1998).

According to this report:

> *"much of construction does not yet recognise that its people are its greatest asset.... Too much talent is simply wasted, particularly through failure to recognise the significant contribution that suppliers can make to innovation. ... Difficulties [are] posed by ... the fragmented structure of the industry, but construction cannot afford not to get the best from the people who create value for clients and profits for companies." (Egan, 1998:17)*

Overall, particular areas for attention were highlighted (Egan, 1998). Firstly, the area of fragmentation was pointed out. This was attributed to the increased use of subcontracting, resulting from the small firms (under eight employees) that account for the majority of UK construction members. Fragmentation was linked with the discontinuity of teamworking and the troublesome contractual relations.

Secondly, client dissatisfaction was highlighted. The report showed the construction industry's main clients perceiving the industry as unreliable; not delivering consistent quality and value for money; spending too many resources in making good defects and in litigation.

Thirdly, areas in need of modernisation and improvement were identified as: *profitability, capital investment, training, and clients*. More specifically, the unpredictable and low profit margins were highlighted. So was the constantly decreasing capital

investment (having been reduced by two thirds between 1968 and 1998) which has led to dramatic falls in in-house Research and Development (a drop of 80% between 1981 and 1998). Increases in training were also emphasised, given skills shortages resulting from the ageing skilled workforce and the transient nature of new recruits. Finally, the need to educate clients was stressed. This would promote the sense of accountability and best value, instead of lowest price, encouraging a joint move towards good practice.

Overall, Sir John Egan recognised that "the industry can and indeed must do better" and established that "through the application of best practices ... the industry and its clients can collectively act to reverse these trends" (http://www.m4i.org.uk/about/faqs.html, retrieved June 14, 2001).

With this message in mind, "5 Key Drivers for Change" were established and linked to "4 Project Process Improvements" that were finally aimed at "7 Targets for Improvement" (Egan, 1998). This system became known as '5-4-7' (http://www.cbpp.org.uk/cbpp/about_cbpp/rethinking.jsp, retrieved February 28, 2002) and is presented in figure 2.1.

The five Key Drivers to Change, as shown in figure 2.1, signified the following:

> *"**Committed Leadership**: Management believing in and being totally committed to driving forward an agenda for improvement, cultural and operational changes throughout the whole of the organisation.*
> ***A focus on the customer**: The best companies provide precisely what the customer needs, when the customer needs it and at a price that reflects the product's value to the customer.*
> ***Integrate the process and the team around the product**: The most successful businesses do not fragment their operations – they work back from the customer's needs and focus on the product and the value it delivers to the customer. The process and the production team are then integrated to deliver value to the customer efficiently and eliminate waste in all its forms.*
> ***A quality driven agenda**: Quality means the total package – not only zero defects but right first time, exceeding customer expectations, delivery on time and to budget, innovating for the benefit of the client and stripping out waste in all its forms.*

> ***Commitment to people**: This means not only decent site conditions, fair wages and care for the health and safety of the work force. It means a commitment to training and development of managers and supervisors, respect for all participants in the process and a no-blame culture." (http://www.cbpp.org.uk/cbpp/about_cbpp/5.jsp, retrieved February 27, 2002).*

Consequently, the five drivers were to lead to project process improvements in the following areas:

- product development
- partnering the supply chain
- project implementation
- production of components

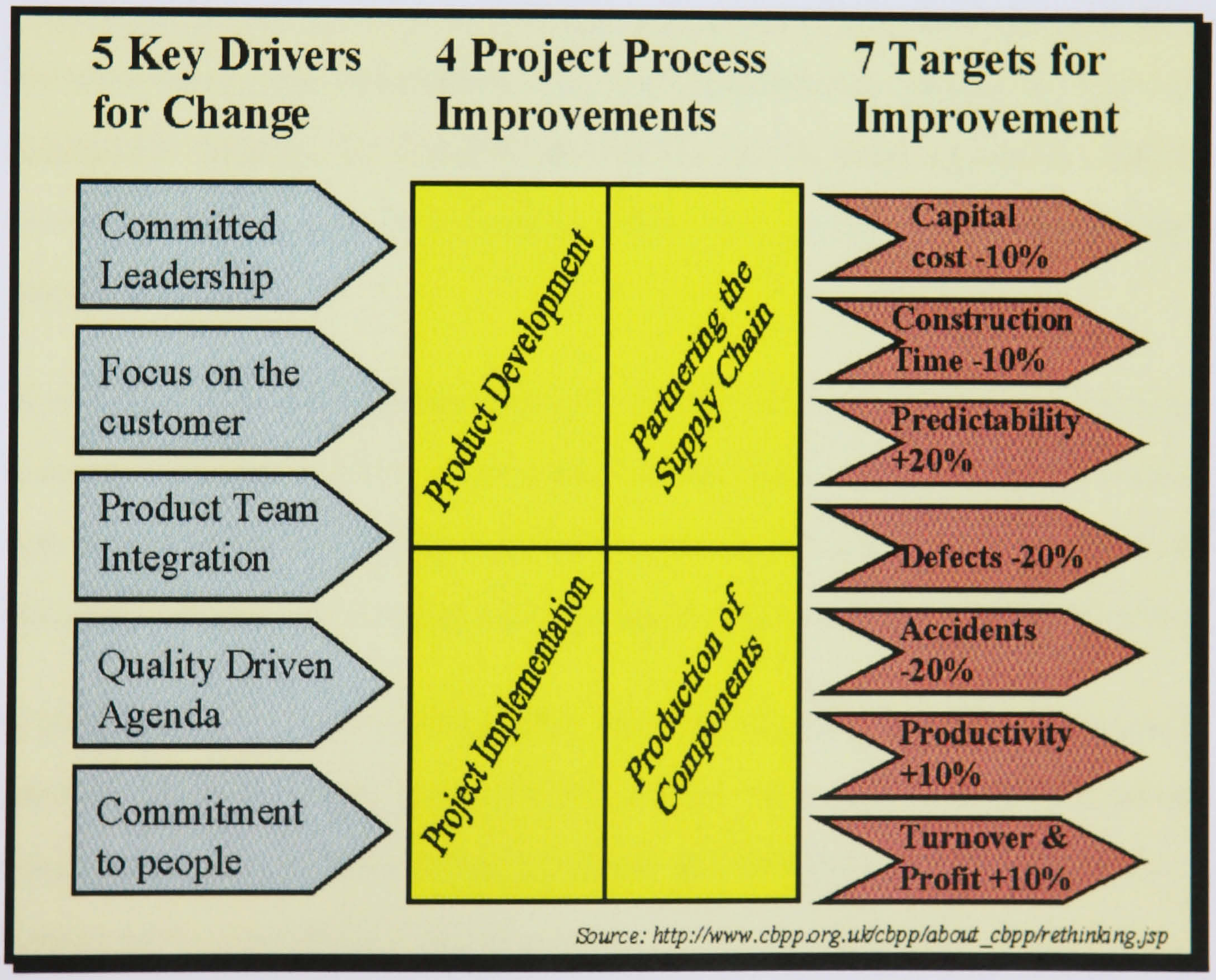

Figure 2.1 "Rethinking Construction" '5-4-7'

Finally, the seven targets for improvement, as presented in figure 2.1, were to be achieved. These targets concerned individual organisations and the industry as a whole.

As such, they were setting:

> *"...clear measurable objectives, and then giving them focus by adopting quantified targets, milestones and performance indicators – in terms of predictability, cost, time and quality. [The] targets [were to] ... be set for improving the quality and efficiency of construction processes – in terms of safety and labour productivity for example. In this way ... companies and their staff share in the benefits of success. They also enable clients to differentiate between the best and the rest, providing a rational basis for selection and ... reward[ing] excellence." (http://www.cbpp.org.uk/cbpp/about_cbpp/7.jsp, retrieved February 27, 2002).*

2.3 Relevance and impact of this research

This particular research recognises the importance of the drivers of change, individually and cumulatively, and acknowledges the recommendations for improvement in the UK construction industry. To improve the industry it has been proposed that the construction sector needs to collaborate with its clients to apply best practice (Egan, 1998).

Nevertheless, it is recognised that while the intention for such collaboration may exist, knowledge on best practice is not widely or adequately shared within the industry actors. Lessons from construction projects as well as learning from other sectors are not being adequately disseminated and the resulting knowledge is therefore not utilised.

In particular, the 'Rethinking Construction' report (http://www.connectbestpractice.com/, retrieved March 29, 2000), stated that the industry "falls short ... in its management skills –customer satisfaction, efficiency, quality and ultimately profits–". As a result, it highlighted the requirement and challenge to

> ***"bring the best of the industry's practices to the attention of all companies*** *so that it becomes the norm to deliver buildings on time, for a predictable cost and to a consistent standard of performance" (http://www.connectthebestpractice.com/, retrieved March 29, 2000).*

This work is a response to the challenge set. It addresses the perceived lack of consolidated knowledge on best practice. Nevertheless, it moves beyond and away

from the notion of 'best practice'. Following its non-directive and contingency foundations, it recognises that bringing *good* practices to the attention of companies would encourage the industry to satisfy its customers and perform in a more efficient and effective manner. It is believed and put forward that 'good practice' can be considered by industrial actors and adopted accordingly in order to enable them match it to their particular requirements and contingent factors to achieve change and improvement.

In this case, the collection and communication of the positive experiences and practices of industrialists has been connected to the concept of 'organisational memory' (Whittington et al, 1992:37). Organisational memory encourages and enables a company to learn from its mistakes. Organisational theory emphasises the role of formal (written) records in developing this memory. However, communication in the construction industry is usually verbal and unrecorded; this, together with the fragmented nature of the industry, disable the diffusion of knowledge emerging from any one project.

> *"The lack of any consistent formal performance review suggests that even major contractors fail to capitalise on previous experience. The typical response to this is that every project is unique, making the transfer of knowledge from one project to another inappropriate. This seems a dubious premise; it would be highly unlikely that certain common decisions and tasks do not occur." (Whittington et al, 1992:37).*

This research considers the uniqueness of capital projects and the possible practical difficulties this may pose in the diffusion of good practice. Therefore, it assumes the stance that any one given model of *best* practice, prescribing practical steps for implementation, will not in this instance suffice as a generator and diffuser of practice to projects as unique as those experienced in civil engineering. Therefore, the requirement is established for a *flexible* method to bring *good* practice to the attention of varied companies with dissimilar or unique circumstances to address.

Finally, all analyses and reviews of the construction industry have concluded that this is a conservative sector with low levels of innovation, research and development and difficulties to lead or even adopt new practices (Hillebrandt & Cannon, 1994a). This has led to the recommendation that the industry is considered from a holistic viewpoint, reflecting the reality and addressing the needs of the operating climate of the industry by avoiding 'piecemeal reform measures'.

Hence, this research, recognising the diversity of each project and organisation and the uniqueness of construction projects, views the construction environment as a whole and works away from prescriptive solutions. Having observed the prescriptive nature of all previous recommendations, accompanied by a continuing state of stagnation and lack of meaningful improvement or change in the construction industry (e.g. Nicolini et al, 2001), it is believed that a non-prescriptive approach will acknowledge the contingency factors experienced by construction projects and their participants.

Until now, minimal work has been reported in the literature towards this direction. Nonetheless, it is worth mentioning recent developments denoting the possibility for non-prescriptive avenues opening up in the area of construction management research. Nicolini (2002), taking as a starting point Lewin's investigation of the 'social climate' (Lewin, 1984; 1951) and considering contributions from Liu (1998), Pinto, Pinto & Prescott (1993) and Shenhar (1997), coins the notion of 'project chemistry'. Within a multi-disciplinary approach, Nicolini (2002) considers behavioural and relational aspects of project success and produces a preliminary conceptual tool aimed at raising awareness, amongst construction management researchers, of the impact of the human factor in construction projects. Nevertheless, such attempts aimed directly at construction management *industrialists* have not been widely reported in literature (Belout, 1998; Fabi & Petersen, 1992).

2.4 Research aim and objectives

Having recognised the gaps in existing theory and practice, (i.e. areas not sufficiently addressed by practitioners or academics), areas for particular attention were identified. Hence, the aim of this research was to address those areas in order to bridge the existing gaps: *bringing good practice to the attention of companies operating within the fragmented UK construction sector*, was the aim of this research and its contribution to the industry's efforts to change and improve.

The aim of this research was directly supported by the following objectives:

- To explore key success organisational and human factors;
- To identify the specific methods and practices that contributed to these success factors in order to derive proven examples of good practice;
- To understand further academic and industrial opinion and experience of good practice;
- To consolidate the emergent success factors with the additional examples of good practice identified in literature into a conceptual framework aimed to accurately retain and transfer the knowledge on successful practices to the industry;
- To present industry with a flexible and effective way of learning about proven good practice and enlightening their decision-making on selecting practices for implementation in their own project.

Chapter 3 Methodological Framework

This chapter is an account of the research context. It discusses and presents its philosophical and methodological frames of reference.

In general, this inquiry assumed a *contingency* as opposed to a *prescriptive* approach (Denzin & Lincoln, 2000). Hence, it focused on *good* and not *best* practice and developed *research themes* instead of *research hypotheses, according to Peter Checkland's suggestions (cited in Pattison, 1995)*. Finally, it made *recommendations* and *proposals* instead of offering *solutions*. Accordingly, the philosophical and methodological approaches assumed advocated the contingency principles.

Two main and contrasting streams of research philosophies identified in literature have been referred to as *positivistic* or *scientific* and *humanistic* or *phenomenological*. Whereas the former uses quantitative methodologies to test hypothetico-deductive generalisations, the latter inductively appreciates context-specific human experience through qualitative methodologies (Easterby-Smith, Thorpe & Lowe, 1991; Giddens, 1976; Hughes, 1976; Patton, 1990).

Therefore, this doctoral research, interested in exploring, understanding and evaluating "context-specific human experience" (Patton, 1990:37-38) was conducted within a humanistic (phenomenological) philosophical framework.

3.1 The qualitative approach

This was an inquiry into the complex systems within the construction environment. Hence, a qualitative methodology was chosen, not only in accord with the humanistic research paradigm (Easterby-Smith et al, 1991; Hussey & Hussey, 1997; Simon, 1969),

but also in support of the in-depth investigation and understanding of such complex systems. It has been recognised that a qualitative inquiry enables the observation of potential links and interdependencies between complex and multiple parameters explored (Patton, 1990:49-51), as in the case of construction.

This qualitative approach was also compatible with the exploratory character of the investigation. The sought objectives were the understanding and exploration of patterns emerging from data and not the construction of hypotheses to test or the building of theories (Hussey & Hussey, 1997:55). This inquiry, belonging to the realms of the humanistic philosophical paradigm, employed the qualitative research methodologies of case study and evaluation (Patton, 1990:11).

3.2 Case study methodology

The selected research methodology was required to be suitable for:

- the exploration of key success factors of a human and organisational nature;
- the identification of the specific methods and practices that contributed to this success with a view to understanding and exploring further those proven examples of good practice

These objectives were accompanied by the importance of selecting a methodology that would enable further research, after the exploration of these issues. In addition, this methodology would have to fit in with the philosophy of the research design and not lead towards prescription but description. Moreover, the complexity of the construction environment was to be acknowledged and supported through the strategy to be chosen.

One methodology emerged from the literature as satisfying these criteria: the case study[9]. It was professed as the most suitable for exploring and understanding the interrelations and dynamics within an *individual* setting (Eisenhardt, 1989; Hussey & Hussey, 1997). Also, it was acknowledged as "almost synonymous with the descriptive type of research" (Simon, 1969:276), and particularly suitable in situations where the resultant rich information is to be further used for follow up research purposes. Moreover, the case study would allow this inquiry retain a holistic approach and the meaningfulness of real-life events (Yin, 1994).

The choice of a case was to be made with learning and evaluation in mind and not generalisation. Hence, it was not based on the random and representative statistical sampling that leads to generalisation from the sample to a larger population.

Instead, purposeful sampling [or purposive, according to Cohen and Mannion (1985:98-101)] was used to select a case that would provide opportunities for an intensive study and extraction of similarly intensive knowledge and learning (Patton, 1987:51-53)[10].

In particular, the *purposeful sampling* approach referred to as *extreme, deviant* (or *unique*, according to Yin, 1994:39) *case* was employed to locate and enable concentration on an 'a-typical' and information-rich case.

> *"Unusual or special cases may be particularly troublesome or especially enlightening, such as outstanding successes or notable failures. ... The logic of extreme case sampling is that lessons may be learned about unusual conditions or extreme outcomes which are relevant to improving more typical programs. ... In many instances more can be learned from intensively studying extreme or*

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[9] Described by Yin (1994) as the *"empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident"*.

[10] *"The power of purposeful sampling lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of evaluation, thus the term 'purposeful' sampling"* (Patton, 1987:51).

> *unusual cases than can be learned from statistical depictions of what the average case is like." (Patton, 1987:52-53).*

Consequently, to satisfy these parameters and requirements, the Heathrow Express (HEX) construction project was selected. As is described in chapter 5 of this Executive Summary, and further studied in submission 7 of the research Portfolio, the HEX case came as the exception to industry norms, rules and expectations, and provided the opportunity to conduct a retrospective investigation of a significant and atypical project.

With *learning* as one of the main purposes of selection, this case fell into the *intrinsic* classification. There was *intrinsic* interest in it and was conducted to improve understanding and appreciation of its characteristics and practices. This distinguished it from other cases undertaken for theory-building or the understanding of generic phenomena or abstract constructs (Stake, 1998).

On the epistemological question "what can be learned from the single case?" (Stake, 1998:86), the HEX 'information-rich case' would prove that "a great deal can be learned from a few exemplars of the phenomenon in question ... describe[d] ... holistically" (Patton, 1990:53-54).

Indeed, it was confirmed that it is not uncommon for qualitative inquiry to purposefully elect to concentrate on as small samples as the *single* case (Patton, 1990:169). It was noted that the smaller the number of cases selected for study, the greater the depth of study and analysis [Glesne & Peshkin (1992) quoted in Creswell (1998:63)]. Depth and richness were prominent characteristics of this endeavour and as indicated by the literature would be better achieved through the selected methodological approach.

3.2.1 Methods

To achieve this depth of study (and, subsequently, of analysis), rich data on experiences and views were to be sought.

To achieve the sought depth in the data to be collected, interviews and documentary study were used together with a few observations. Primarily, the central method used for data collection in this case study was the interview. Semi-structured interviews were conducted with fifteen participants from the project organisation. These focused on the participants' own experience of the project and their accounts of events.

Secondarily, documents were reviewed, consisting of the retrieval and review of documents from the project organisation, that is, primary sources. These comprised newsletters, brochures, leaflets, annual reports and minutes from meetings. Finally, observation was used to a much lesser degree. This consisted of observation of board meetings and attendance at an event organised to increase communication and integration with suppliers.

Following the data collection, an in-depth analysis[11] took place that revealed a pattern of key practices and methods that had been employed in the HEX project and were related to its success.

At that stage, an appropriate format was sought for the meaningful representation of the resultant information in order to enable industry evaluate and use it as a source of

[11] Although it was recognised that "we have few agreed-on canons for qualitative data analysis, in the sense of shared ground rules for drawing conclusions and verifying their sturdiness" (Miles & Huberman, 1984:16), the analysis, based primarily on the affinity or KJ method (Cohen, 1995; Mizuno, 1988; Mizuno & Akao, 1994), carefully considered procedural suggestions and guidelines to ensure a valid and reliable outcome.

information when making decisions on implementing good practice to achieve the much needed improvement and change in the sector.

The use of the case study methodology enabled and encouraged the further exploration of the emergent topics. Literature was advising that it was possible to complement and carry forward the "clue-providing" functions of the case study methodology through other research methodologies and methods (Simon, 1969:276). These are explored in the following section.

3.3 Evaluation Methodology

Following the meaningful and rich information on key successful practices that emerged from the study of the HEX construction project and from additional literature review, a conceptual framework was constructed to represent individual practices and their interrelations[12]. The effectiveness and meaningfulness of this framework for the industry was to be examined. Hence, the ensuing part of the investigation took the form of an evaluation. Evaluation referred to the systematic and empirical 'data-based inquiry' on success and effectiveness. This effectiveness and associated accomplishments were judged by their

> *"usefulness in making human actions and interventions more effective and by [their] practical utility to decision makers, policymakers and others who have a stake in efforts to improve the world" (Patton, 1990:11-12).*

Argyris, Putnam and Smith (1985) refer to evaluation as a type of 'action science' or applied research. Hence, whereas academic research aims to contribute to knowledge, build theory and justify the occurrence of phenomena, the purpose of (this) evaluative

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[12] This is the subject of chapter 5 of this Executive Summary and is presented in detail in Portfolio submission no. 9.

research was to primarily inform decision-making and action, and transfer and apply knowledge to solve problems associated with UK construction.

3.3.1 Methods

Although the goals of the evaluation methodology are distinguished from more traditional social research and are widely recognised for providing feedback to aid decision-making (Trochim, 2002e), there appears to be "no single best plan for an evaluation" (Cronbach, 1982:231).

Guidance for planning this particular evaluation came directly from the purpose sought: to evaluate the conceptual framework that had emerged from the data analysis. This would be an evaluation of both content and context; the good practices presented, and their industrial relevance and applicability.

To achieve these objectives and address the specific areas of enquiry, the evaluation targetted the industrial community. The issue of the evaluators' sample was addressed by considering the following points:

- The emergent knowledge was addressing issues of prime relevance to the construction industry and to other sectors (particularly manufacturing) where some of the good practices had been encountered.

- The ultimate aim of this research was to *inform* members of the construction industry (and their clients) of good practice, in order to facilitate their decision-making. Hence, it was presumed that individuals and organisations interested in receiving that information, had *already* recognised the need for change and improvement in the industry (as this had been indicated time after time and lately by the Construction Task

Force). Therefore, persuading them of that need was not relevant in this case.

Hence, members from the construction and manufacturing sectors were selected to evaluate this framework. With reference to the construction practitioners, their awareness of and interest in improving and changing their sector was derived from their participation in the Movement for Innovation (M4I) initiative. Their management/leading role in Demonstration Projects and seniority in their organisations, indicated that they already possessed several years of professional experience and, overall, satisfied the set criteria. Evaluators selected from other sectors satisfied the equivalent criteria, while participation in Demonstration Projects was replaced by their involvement in other major projects in their respective sectors.

Therefore, according to these criteria, thirty-five experts from construction and other industries were invited to provide their 'expert opinion' (Simon, 1969) on the emergent knowledge framework and its potential contribution to the recommended change and improvement in construction.

> *"By 'expert opinion' I mean the judgements and estimates made by people who have spent much of their time working with a particular subject and who have gathered much general information that has been filtered through their minds and stored in their memories" (Simon, 1969:274).*

Simon (1969:274) distinguishes between the use of *expert opinion* 'as a source of general guidance' at the beginning of research and 'as the final data' on which conclusions are based. This latter use, which is of relevance in this case, can be compared to the expert opinion of a doctor or land surveyor on the basis of which a jury bases its decision.

As the purpose of the evaluation was not that of generalisation, it was the expertise of evaluators that was important rather than the quantity (Simon, 1969:276).

In order to obtain the required views and opinions from the experts, a questionnaire was designed[13]. This was to accompany the knowledge framework that was to be reviewed. The questionnaire comprised 12 questions, divided into 3 distinct parts. Of the 12 questions, 5 were open-ended; 3 multiple choice; and 4 were Likert scale questions (French, 1985; Oppenheim, 1992; Trochim, 2002d).

Initially, a 'General Information' section collected information on personal details, professional experience and duration of review prior to the evaluation. Consequently, Part A examined the overall context and content of the framework and collected participants' views on strengths, weaknesses and proposed improvements that they detected, along with improvements they wished to propose. Part B asked respondents to comment on the applicability of the proposed framework. Finally, Part C referred to the specific clusters of good practices presented by the framework and collected information on the participants' experience of these practices and their effectiveness at the time.

3.4 Methodological impact

Overall, it is claimed that qualitative research produces rich data from fewer individual participants than its quantitative counterpart. Nevertheless, the data collected by both techniques need to be analysed in an equally methodical fashion. However, the interpretative nature of the qualitative analysis is more suitable for and better able to produce more detailed, sensitive and insightful results. This has also been the experience in this inquiry. Based on results of this nature, there is a greater likelihood of

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[13] A copy of the evaluation questionnaire is provided on the interactive CONSTRUCT© CD-ROM, in portfolio submission no. 9, and also in submission no. 10.

having the most beneficial outcome of deeper and richer innovation, both in the results themselves and the recommendations to be derived from them (Walker, 1985).

3.4.1 Triangulation

Whereas positivist research tends to deal with a few variables and a large number of cases, qualitative research depends on few cases and a large number of variables (Ragin, 1987). Denzin and Lincoln (1998:3) point out the interpretive, humanistic approach of phenomenologists employing multiple methods *"to make sense of, or interpret, phenomena in terms of the meanings people bring to them"*.

Overall, multiple methods have been used in this investigation to explore and understand the phenomena in question. The multiplicity of approaches and methods used to study the same phenomenon in greater detail and with greater accuracy, has resulted in several forms of triangulation (Jarvis, 1999:126).

Firstly, varied data sources have been used. The case study interviews involved multiple people from a variety of senior positions and from different organisations. In addition, the expert opinion of the evaluation has been sought from multiple individuals, who, in most cases did not know one another, to obtain their views on the same questions. This falls under the category of *data triangulation* (Denzin, 1978).

Secondly, multiple theoretical perspectives (as presented in chapter 2 of the Executive Summary) have been used within the interpretative framework of the same set of data. This is referred to as *theory triangulation* by Denzin (1978).

Finally, as has been shown in this chapter, this inquiry has used multiple methodologies and multiple methods. The different sources of evidence utilised have required not only different sets of competences but also different methodological approaches. It is noted that the multiple sources of evidence were "converging on the same set of facts or

findings" (Yin, 1994:78). The specific methods comprised: documentary evidence, interviews, observations, expert opinion. This approach indicates that there has been *methodological triangulation* (Denzin, 1978).

PART II REALISATION

Chapter 4 Developmental Phase

The initial inspiration for this research comes from the author's research activities in the area of construction management, upon joining the Warwick Manufacturing Group (WMG) as a Research Fellow with the Economic and Social Sciences Research Council (ESRC) Business Processes Resource Centre (BPRC).

The development of this doctoral work commenced with an in-depth cognisance of the nature and characteristics of the UK construction industry, seeking to identify the important themes for both academic and industrial communities. This provided the foundations for the development of the overall research strategy, as it shed light into the main areas of interest for construction researchers and practitioners and highlighted parts left unexplored or in need of particular attention. This developmental phase comprised the following stages:

- In-depth review of primary and secondary literature;
- identification of key topics and people involved in the area of construction management;
- meetings and exploratory discussions with construction academics and industrialists;
- generation of draft research proposals addressing topical issues and areas.

4.1 Identifying opportunities for development

Those initial explorations indicated that the UK construction industry is characterised by ailing working practices resulting in a fragmented and counter-productive sector with a

wide scope for improvement. The construction sector was shown to be lacking customer focus, trust between individuals and organisations and flexibility to cope with change (Flanagan et al, 1998).

The industry had been the subject of concern for consecutive governments with a number of reports reviewing its problems and practices between 1944 and 1994 (Banwell, 1964; British Property Federation [BPF], 1983; Emmerson, 1956, cited in Flanagan et al, 1998; Latham, 1994; National Economic Development Office [NEDO], 1967; Simon, 1944, cited in Flanagan et al, 1998; Tavistock, 1963, cited in Flanagan et al, 1998; Tavistock, 1966). Table 4.1, based on Flanagan et al (1998) shows the improvement areas recommended by those previous industry reports.

Latham (1993, cited in Simister, 1994) commented that the problems identified by previous reports were still in existence and any changes in the industry did not bring any positive effects. In his own words, *"it has been a depressing experience to re-read previous reports to the Government, including those of Sir Harold Emmerson (1962) or the Banwell Committee (1964). Many of the problems which they tackled still persist a generation later"* (Latham, 1993, cited in Simister, 1994).

At the time, the industry was once again the focus of governmental proposals for improved efficiency and more effective working practices. It was the Latham (1994) report, reviewing the procurement and contractual arrangements in the UK construction industry, that strongly proposed and emphatically encouraged the sector to 'construct teams' prior to constructing the product specified by customers.

Areas identified for improvement	Simon 1944	Emms'n 1956	Emms'n 1962	Tavist'k 1963	Banwell 1964	Tavist'k 1966	NEDO 1967	BPF 1983	Latham 1994
ORGANISATION									
Outstripped of technology developments	X	X	X		X	X			
Adherence to outmoded procedures		X	X		X		X		
Development of subcontracting/specialists	X	X	X		X		X		
Interdependence of activities				X	X	X	X	X	
Division of responsibility	X			X		X		X	
Uncertainty	X			X		X			
PEOPLE									
Relationships/cooperation		X		X		X		X	
Integration of design and construction			X	X	X	X	X	X	X
Partnering									X
EFFICIENCY									
Low productivity and poor return		X	X	X	X	X	X	X	X
Standardisation		X			X		X		X
Construction as a manufacturing process		X		X	X		X		X
PRE-CONSTRUCTION									
Role of the building owner	X		X		X	X		X	X
Fragmented customer base									X
Effective briefing					X	X		X	X
Effective planning and coordination	X				X	X	X	X	X
Management of design						X		X	X
COMPETITIVE TENDERING									
Criticism of competitive tendering – outmoded	X		X		X	X	X	X	X
Reduction of subsequent changes	X				X		X		X
Selective tendering	X		X		X	X	X	X	X
Negotiation	X				X		X		X
SITE MANAGEMENT									
Lack of information	X								
Training	X	X			X	X			X
Coordination role	X				X				X
Division of responsibility	X								X
Benefit of early contractor input					X	X	X		X
Reduction of changes	X				X				X
Adoption of incentives									
LEGAL/CONTRACTUAL									
Increased litigation/arbitration								X	X
Increased claims and variations	X				X		X	X	X
Prompt agreement – claims and variations								X	X
PAYMENT									
Prompt and regular payment			X		X		X		X
Revamp of payment procedures					X		X		X

Table 4.1 Improvement areas identified by previous UK construction industry reports (adapted from Flanagan et al, 1998:14).

Following previous reports incompletely implemented (Latham, 1994:vii), Sir Michael Latham pointed out the opportunity to change the cultural stereotype of this industrial sector. Ways to achieve this change were to include: embracing fewer adversarial contractual terms, similar to the ones put forward by the New Engineering Contract (e.g. Murdoch & Hughes, 1996; Broome, 1997) and recognising the significance of the client's role in the construction and design processes.

The Latham recommendations were seen as a response to the same concerns raised and observations made by the academic community at the time. The construction process was being described as long and inefficient (Hillebrandt, 1984) and partnering was being investigated as a way of bringing forward the required improvement and change in UK construction (Bennett & Jayes, 1995).

Hence, the author became interested in the situation prevailing in the industry and the possible establishment of the aetiology and the possible paths towards a healthier construction sector. Research ideas in the areas of partnering and teamworking, of historical relevance to the development of this research, were developed. Those initial ideas and research interests spurred the effort to bring academia and industry closer together, to facilitate an exchange of views and eventually combine academic rigour with industrial relevance, to produce intellectually sound and practically useful results.

4.2 Linking academia with industry

The first major step towards bringing the academic and industrial communities closer together, with a view to sharing and exchanging knowledge and experience, was

achieved through the organisation of a Partnering focus group[14] in 1997. This was held at the University of Warwick and was organised jointly by the author and a senior researcher also attached to the ESRC BPRC.

The author's particular contribution was associated with the identification of academics who had shown strong interest in the improvement of construction through their research interests and activities. Hence, the academic participants comprised those individuals with whom the author had previously initiated meetings, as part of the fact-finding journey into primary research topics and their investigators.

The focus group was entitled "Partnering in Construction: Is This the Answer to the Cultural Change That We Need?". It brought together construction management and other scientists investigating human and organisational factors of the UK construction sector with members of the construction, aerospace and automotive industries. The two latter sectors had already implemented partnering and partnership sourcing respectively, and were invited to share their experience with construction industry participants interested in embarking on the recommended improvements. Representatives from Short Brothers and the Rover Group offered their insight into their experience of concepts that were at the time aspirations of the construction sector. This insight generated interesting discussion with delegates from construction companies and their clients.

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[14] For information purposes, the proceedings of the focus group, accompanied by samples of correspondence sent by the author to prospective participants, form submission no. 5, appended to the research Portfolio.

4.3 Developing research themes with practical relevance

With this focus group as an instigator of follow-on events, the role of the construction industry client was emerging as a topical one that should not be overlooked by the industry. This had not only been proposed in the past (e.g. BPF, 1983; NEDO, 1967) but was again constituting an area of interest for Government and academia (Bresnen, 1996; Latham, 1994). It was becoming evident that the greater involvement and potential benefit from the client's role recognition and encouragement proposed by Latham (1994) was what the industrial participants of the focus group were also advocating.

One of the most important and large clients of the construction industry, and a participant of the focus group, stood out with its attempts not only to respond to the Latham report recommendations but to precede them and initiate proactive changes. BAA, the then relatively recently privatised British Airport Authority, was making some pioneering steps towards more effective and efficient working and relationships with their suppliers and contractors that signified a wish to break down barriers and establish closer and more long-term relations (BAA, 1995).

In response to an invitation to take a closer look at certain areas close to BAA's interests, this research commenced developing themes for subsequent exploration. Initially, extensive meetings with BAA's top management took place to identify topics of particular interest to senior members of BAA's Group Project Services (GPS). The GPS division, closely working with Sir John Egan, then Chief Executive of BAA, was also involved team-building for the refurbishment of the Heathrow and Gatwick airport terminals. Consequently, topics close to BAA's concerns and compatible with this

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research were further explored. They referred to the concepts of 'team working'[15], 'partnering'[16] and 'Key Performance Indicators[17] (KPIs) for the human resource of the company.

It is noteworthy that the then Chief Executive of BAA, was to become instigator of yet another move of change in the construction industry as head of the Construction Task Force aimed at the improvement of the sector. The strong relevance and impact of the ensuing recommendations (Egan, 1998) on the development of this research commenced during its exploratory phase, presented in chapter 6. The resultant work came to form the nucleus of this Portfolio, with all the promising implications of its nucleic character.

Hence, following the developmental stage of this research, highlighted by the establishment of academic and industrial networks and potential research themes, there followed the exploratory phase presented in the following chapter.

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[15] This 'Human Factors in Industry' PMA corresponds to Portfolio submission no. 3.
[16] This 'Project Planning, Management & Control' PMA corresponds to Portfolio submission no. 4.
[17] This report forms part of Portfolio submission no. 2.

Chapter 5 Exploratory Phase

Succeeding the developmental phase of the research, as presented in the previous chapter, was the exploration of key practices that would indicate ways to reach and reap the fruits of new and innovative thinking in support of change in construction. These were the *ways* envisaged to bridge gaps between *recommendations* for change and its *practical achievement.*

The solid exploratory phase was critical for the overall advancement of the research, and the identification and clarification of areas and topics that would later provide the catalytic vehicle for innovation and a meaningful contribution to industry. At the start of the exploratory phase, Portfolio submission no. 6, the presentation given to BAA's top management team, succeeded in gaining research access to the organisation in order to conduct an in-depth study.

5.1 The HEX case

The case studied [18] was that of the Heathrow Express (HEX) railway construction, the largest private railway built in over a century, commissioned by BAA to connect Heathrow airport to central London. BAA, expecting six million passengers in the first full year of operation, allocated 73% of its £600m investment in public transport to this project.

The significance of this case was closely related to its effective collaborative working practices, rarely experienced in construction. Team-working in this sector, as part of a

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[18] This has been submitted to the Portfolio as entry no. 7.

wider Human Resources Management (HRM) system, has traditionally been underdeveloped and undervalued (Belout, 1998; Fellows, Langford, Newcombe, Urry, 2001; Green, 2002; Langford et al, 1995; Legge, 1995; Saad & Jones, 1998) and conflict and crisis have been characteristically associated with its culture (Gale, 1992; Loosemore, 1996, 1998, 1999a, 1999b, 1999c; Loosemore & Hughes, 1998, 2001; Loosemore, Nguyen & Denis, 2000). HEX was atypical in that it employed organisational and human practices known to other industries but not normally associated with construction.

Furthermore, similar to the construction sector in general, it had to face a multitude of problems ranging from organisational and human to contractual and technological. However, in October 1994, it experienced a critical accident –one of civil engineering's most serious tunnelling accidents in decades (New Civil Engineer [NCE], 1998). At that stage, the project completion and commissioning was put back from December 1997 to early 1999.

Nevertheless, despite one year's delay, after the tunnelling accident, the project was completed and commissioned to the operating company on 1st June 1998, only six months after the *original* completion deadline. Unlike other failing cases, it had developed positive ways to deal with the ensuing crisis and organisational issues and managed to approach its time, cost and quality targets with greater ease than most construction projects.

Overall, the HEX case was regarded as a major success in the construction industry as it signified a diversion from the norm (Lownds, 1998; NCE, 1998; People Management, 1997) by paying particular attention to its people, who in turn, made this success possible. Its achievements at human and organisational levels were recognised by the Chartered Institute of Personnel and Development (CIPD) with its award in 1998. In

addition, the work carried out by the empowered geotechnics contractor, was unanimously awarded with the 1997 Quality Award of the UK Construction News journal (Stent, 1997).

Although the Demonstration Projects have been introduced since HEX was studied, it appears that no other project has had such an impact or left its name in civil engineering history for both an immense 'failure' and an even greater success widely recognised by the industry. The HEX case succeeded by steering away from the adversarial, un-integrated and inefficient ways of the industry. It transcended from problems and crises to approach the team-based and collaborative types of working advocated at the time by Latham (1994), more recently Egan (1998) and numerous others before them (see Flanagan et al, 1998).

5.2 Case study objectives and process

The objectives of the case study were exploratory and, hence, compatible with the evaluation and learning orientation of this research. They set out to explore the actions taken by HEX participants to achieve an unusually successful result against the odds of traditional construction management practices and the critical accident experienced. This exploration aimed to identify and understand the factors that had acted as the catalysts of this project success.

The study concentrated on the investigation of the construction of the infrastructure works, including the rail link portal at Heathrow Airport Terminal 4. This was considered highly appropriate as it was during that particular project phase that the serious accident took place and consequently led to the crisis followed by significant, unplanned changes in the organisation, structure, character and, eventually, outcome of the project.

The research commenced with attendance and observation of project meetings and follow up meetings with the client's top management to solidify research themes and objectives. There followed the extensive fieldwork which commenced with the review of principally secondary data pertaining to the project activities and progressed to in-depth, semi-structured interviews conducted with key, senior management project members, originating from the client's, contractor's and subcontractors' organisations.

Although a detailed account of the fieldwork is contained in the case study submitted to the research Portfolio as submission no. 7, it is considered appropriate at this point to refer to the data collected at the interviews and the way in which they were converted to the Heathrow Express case study findings presented in section 5.3 of this Executive Summary.

According to the exploratory nature of this research, the interviews produced rich data stemming from people's *perceptions*, *attitudes* and *beliefs* about their *own involvement* with HEX and their *experience* of the structure and patterns of work, including the special circumstances of the project, in comparison to their previous experience. Data from the in-depth interviews were transcribed verbatim.

The content of these transcriptions was analysed in a qualitative manner, using the traditional 'cut and paste' manner (Dey, 1993; Hussey & Hussey, 1997; Lewando-Hundt, Beckerleg, El Alem & Abed, 1997; Lofland, 1995). This allowed a detailed analysis of the raw data down to individual paragraph, sentence and word. This type of analysis enabled the researcher to search for and locate similar themes emerging in the units of analysis.

A first categorisation of the units was carried out and resulted into groups bearing a common theme. These initial themes correspond with the core practices and methods referred to in section 5.3. Subsequently, these were further considered and grouped

into thematic units which resulted into the 'top-level' factors characterising the HEX success as presented in section 5.3.

Finally, through the use of the Affinity technique (Cohen, 1995; Cohen & Mannion, 1985; Mizuno, 1988), a structure of categories and sub-categories, derived through their organisation by 'mutual affinity', led to the cluster of the four HEX success factors discussed in section 6.2.

5.3 Case Study Findings

The incisive study of the HEX project organisation, culture, and working practices, led to the identification of a set of organisational and human factors. These were the factors found to have enabled the HEX organisation achieve its budget, schedule and quality objectives, generally accepted as the top-level objectives of construction projects (Chua, Kog & Loh, 1999).

The critical accident added excess pressure on its structure and operation and the consequent crisis destabilised the course of the project and led to a series of unplanned changes. These unplanned changes could have involved punitive measures for those considered responsible, stricter control assumed by the project management and the associated conflict, claims, litigation, delays and excessive costs. That would have made the project fit the traditional construction industry picture painted by observers of the industry, including Langford et al (1995), Hillebrandt (1984), and Hillebrandt & Cannon (1994a, 1994b).

In antithesis, the changes observed were all along a continuum of constructive change and improvement, as had been recommended by Egan (1998) and Latham (1994). The changes observed were directly related to the organisational and human factors

identified as the 'success factors'. The *top-level* factors found to be contributory to the HEX success comprised improvements in or changes of:

- organisational structure
- contractual arrangements
- management style
- supply chain management
- training and development

The top-level factors were strongly interrelated. They comprised the achievement of, for example, management and involvement of the supply chain; a more appropriate a more appropriate organisational structure aided by a new contractual form; a new management style; commitment to training and development.

These top-level changes were the result of methods and practices that had made possible the changes and the achievement of the main successes. Correspondingly, those methods and practices, interlinked with the HEX success factors, were the ones previously disassociated from construction practice and partially held responsible for the problems of this sector (e.g. Latham, 1994). In support of this stance, their use and implementation was considered the basis of the HEX project success. Some of the core practices and methods included:

- Team-building and team-working
- Trust
- Collaboration
- Open-communication
- Integration of design and construction activities
- An educated client
- Streamlined contract procedures and clear contractual obligations
- Prompt payments
- Incentivisation
- Reduction of changes
- Project leadership
- Planning and co-ordination of activities
- Vision
- Training and development
- Streamlined commercial activities

- Conflict resolution at source
- Involvement and participation
- Flatter organisational structure

Overall, and in comparison to the areas highlighted by all previous industry reports (as depicted in table 4.1), it became obvious that the HEX route to success, following the critical accident, had tackled the areas shown in table 5.1.

PEOPLE
Integration of design and construction
Partnering
PRE-CONSTRUCTION
Role of the building owner
Effective briefing
Effective planning and coordination
Management of design
SITE MANAGEMENT
Training
Coordination role
Division of responsibility
Benefit of early contractor input
Reduction of changes
LEGAL/CONTRACTUAL
Increased litigation/arbitration
Increased claims and variations
Prompt agreement – claims and variations
PAYMENT
Prompt and regular payment
Revamp of payment procedures

Table 5.1 HEX achievement areas according to previous recommendations

In addition, juxtaposing the HEX achievements to Egan's recommendations and '5-4-7' scheme (previously presented in figure 2.1), it became evident that the HEX

construction project, had addressed all 5 Key Drivers for change, as shown in figure 5.1.

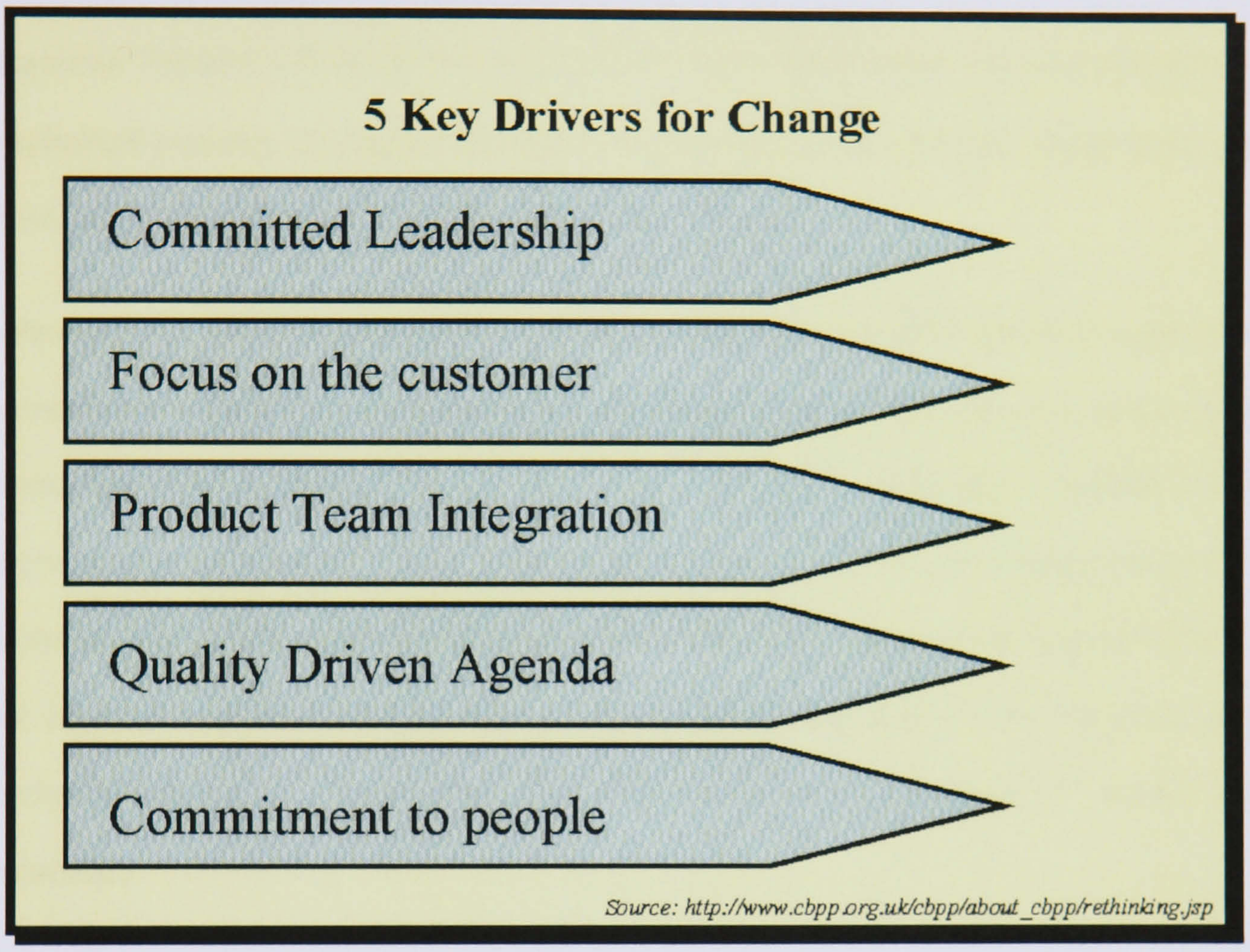

Figure 5.1 Drivers for Change achieved by HEX

It emerged that, in this particular case, tackling areas compatible with the Egan recommendations had helped the specific project achieve improvements and success. However, what was greatly contributing to the debate surrounding the need for change in the industry, was the *identification of the practices* themselves used to make change happen and lead to this success. The study of this case had brought to the light some of the practical methods and practices that had led to the accomplishment of the change drivers and had satisfied several improvement targets.

The practical ways in which the change was to be driven constituted the missing link between recommending and implementing change, between theory and practice. Contrary to prescriptive approaches, the practices were not to be turned into 'Critical Success Factors' (CSFs) to be distributed to other companies with the promise of a replicated process and equal success. The choice of the 'intrinsic' single case study was, purposely, leading away from this uncertain path.

Alternatively, with the continuing improvement needs of UK construction in mind, it was considered important to safeguard the knowledge acquired from the HEX case. Equally important was considered the *transfer* of that resultant knowledge to members of the construction community[19]. The missing link between theoretical proposals and practical actions, that is, the practices implemented by HEX and identified as successful drivers of improvement and change, was to be elaborated and shared with members of the industry wishing to better their own experience and knowledge of proven good practices.

The way to achieving this is presented in chapter 6.

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[19] Please refer to Portfolio submission no.8 for an exposition of the proposed utilisation and transfer of knowledge that had emerged from the HEX project.

Chapter 6 Conceptualisation Phase

Conceptualisation refers to the abstraction of knowledge, comprising successful practices and their interrelated factors and examples, and its representation within a meaningful metaphorical[20] scheme (see Trochim, 2002c, for a relevant discussion). Firstly, the metaphorical notations were to reflect on its presentation and meaning; the scheme was to connect theoretical factors to practical concepts. Secondly, the metaphorical nature was to denote the transference and movement of concepts from one domain to another; these domains comprised the HEX project, other construction projects and projects in other industrial sectors. Overall, this scheme was required to be flexible and capable to carry and transfer the result of a widely relevant and applicable conceptualisation.

6.1 Aim, purpose and objectives

The HEX-derived *good* practice was considered vital for addressing the lack of such consolidated knowledge. The purpose of the conceptualisation phase was central in *devising and making available the catalytic vehicle for abstracting, presenting and transferring the ensuing knowledge to the construction community.*

It was considered most important to convey the multiple levels of success factors and practices and depict their interrelations and interdependencies. In this way, the complexity, richness and depth of this information would be retained and accurately

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[20] The term 'metaphorical' is derived from the Greek word *metaphora*, signifying change and transference, both in terms of *meaning* and *location*. Hence, it is purposely used to describe this research phase and its result in two distinctive but related ways.

shown. That would ensure an abstraction or conceptualisation as representative as possible of the HEX experience.

Therefore, the overall **objectives** of this phase comprised:

- The safeguarding and accurate portrayal of original knowledge that emerged from the HEX construction project;

- The enrichment and support of that original knowledge by relevant success factors and practices proven by previous application and/or advocated by current research;

- The appropriate conceptualisation and 'packaging' of the resultant good practice knowledge to ensure the retention of richness and originality during transfer and the conveyance of the holistic character and descriptive and informative nature of the subsequent concept.

Description, as opposed to prescription, and information, as opposed to persuasion, were required qualities of any resultant vehicle. Human parameters and behavioural implications were closely linked with the practices that this vehicle was to present and, therefore, the use of a 'model' could not present the dynamics of this human involvement (Popper, 1991). This research was to avoid the pitfalls of 'best practice' model-building.

The path to the fulfilment and realisation of these significant objectives and aims is presented in the following sections.

6.2 EnVISIONing a good practice framework

The factors identified in the exploratory phase of the research provided the first prompts towards the consolidation of the emergent good practices into a structured frame of reference. The corresponding representation format sought was to act as a catalyst

between recommendations for change and practices that had achieved exactly that. Hence, it needed to satisfy three requirements:

- Firstly, emit the dynamism and interrelations abundant between the resultant themes to convey their true character and significance.

- Secondly, be flexible, adaptable to many situations and environments and practical enough for dissemination to and consultation by and with industrialists.

- Thirdly, its flexibility was to allow additional success factors and good practices to be added to it, should the need arise in the future.

With these needs in mind, the HEX success factors, were thoroughly re-examined, studied, and categorised[21] into four interrelated top level factors, shown in figure 6.1 as:

- Building the single team (A)
- Establishing trust (B)
- Streamlining contract and procurement procedures (Γ)
- Involving the supply chain (Δ)

This cluster of four, interrelated, top level success factors was defined and provided the central building block of a holistic schematic depiction conveying knowledge and experience emerging from this particular case.

[21] As explored in Portfolio submission no. 9.

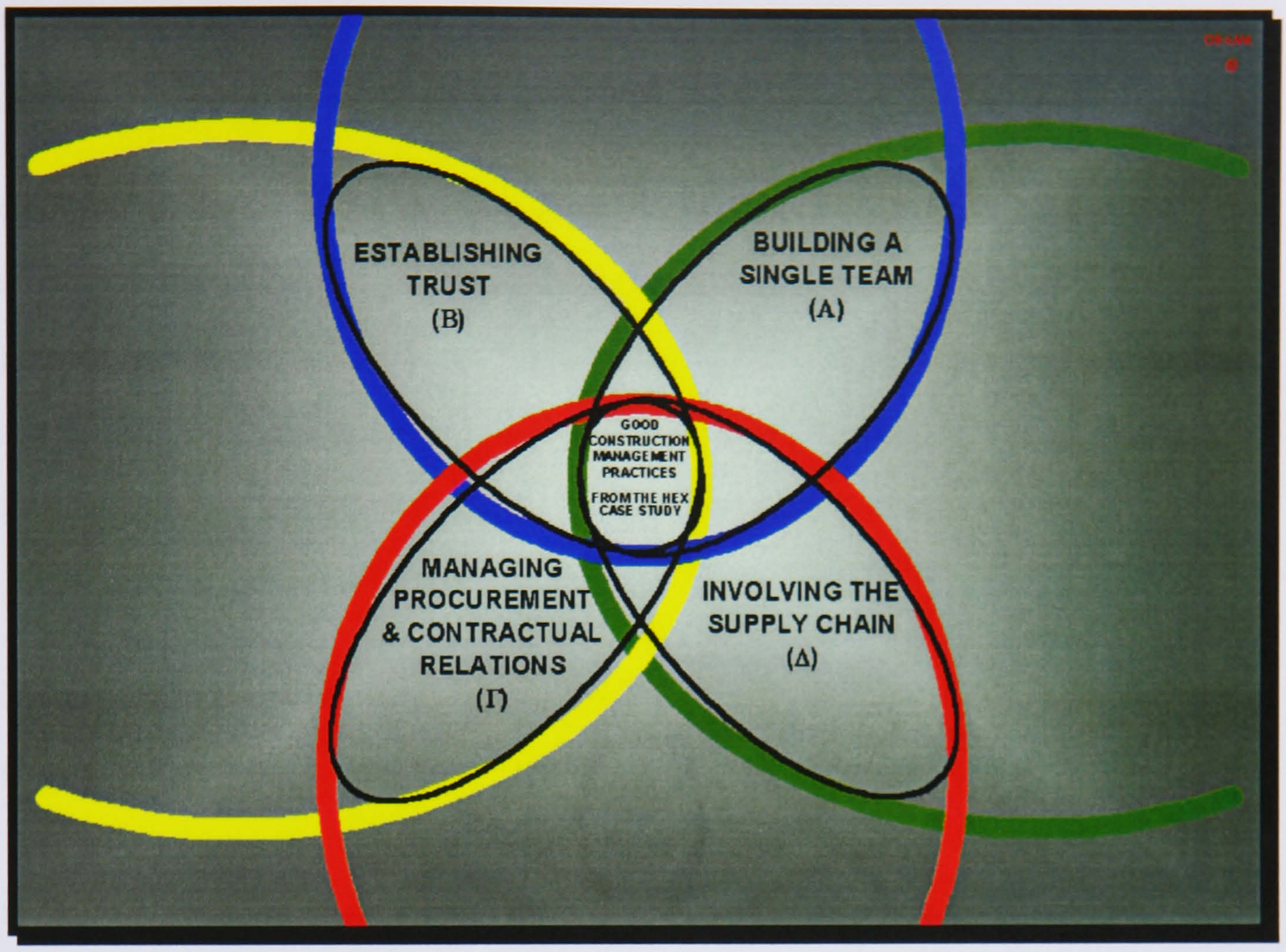

Figure 6.1 HEX: good construction management practices

This schematic framework, a first and firm step towards the abstraction and conceptualisation of the HEX knowledge, was referred to as ORAMA[22], thanks to its visionary character and qualities.

ORAMA had been developed within a systemic frame of reference, considering the multiplicity of contributing factors and environments (Pattison, 1995; Pettigrew, Ferlie & McKee, 1992;). The mathematical principles of infinite sets (Dauben, 1979; Jourdain, 1991; Papamichael et al, 1984; Suber, 1998; Tiles, 1989) enabled the appreciation and

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[22] The term ORAMA derived from the Greek word for 'vision'.

depiction of interrelations and the combination of multiple success and factors, on corresponding levels of detail and depth[23].

ORAMA had proven flexible and capable of representing the dynamism exhibited by the case study findings. However, after the early stages of its population with multiple levels of HEX successful practices, its capacity for representing complex information was tested further. It was becoming apparent that the framework was experiencing the limitations of its software[24] (Trochim, 2002c) and could not adequately support the numerous emergent levels of information.

Hence, ORAMA served as a springboard for coming closer to achieving the desired targets and guided the subsequent search for suitable representation techniques.

6.3 Building on the HEX good practice

Following the initial conceptualisation efforts, fresh knowledge from the continuing review, study and collection of good practice came to complement and strengthen existing findings.

Initially, that knowledge was constituted by success factors and practices proposed by literature. Academic reports and additional sources were reviewed and subsequent recommendations for improving construction effectiveness were identified (e.g. Bennett & Jayes, 1995; Blockley & Godfrey, 2000; Cornick & Mather, 1999; Drucker & White, 1996; Flanagan et al, 1998; Saad & Jones, 1998; Lownds, 1998; Nesan & Holt, 1999; Pearn, 1998). Those were well worth reporting to industrialists searching for ways to

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[23] The inspiration from the mathematics of infinite sets is also referred to in Portfolio submissions nos. 8 and 9.

[24] Initially, ORAMA© was designed using the MS PowerPoint software package.

bring them closer to the Construction Task Force recommendations and for this purpose they were categorised into one or more of the four domains of the framework.

In addition, further success stories were emerging following the efforts of more organisations to 'rethink construction'. In particular, the 'Demonstration Projects', nominated by industrial initiatives such as 'Movement for Innovation' (M4I) for actively seeking to employ best practice to improve construction effectiveness and efficiency, were showing the change efforts taking place in the sector. Those were judged as worthy of dissemination and selected projects were added to existing material.

Furthermore, good practice in construction was also the subject of international efforts to improve the sector. As an illustration, examples of the Australian experience were further reviewed and added to the ensuing 'good practice knowledge base' to illustrate additional recommendations and practices for approaching success (New South Wales Government, 1998, 1999, 2000).

Moreover, the framework was enriched by experience of effective ways of working from the manufacturing sector (Hill, 1995; Lamming, 1993, 1996; Storey, 1994; Womack & Jones, 1996; Womack, Jones & Roos, 1990).

Gradually, what used to be represented by ORAMA as the 'HEX good practice framework' was transformed into a much broader and pluralistic framework of information and knowledge for the construction industry. In addition, it was argued that other sectors would be able to consult this framework to acquire information on proven practices or add their own experiences for the benefit of other philomathic and learning managers and their organisations. This was to be an additional feature of the emergent framework that would complement its open-systems orientation. In practice, it would provide additional opportunities to benefit from a wider collection of valuable experience.

6.4 Mapping CONSTRUCTive practices

In light of the wealth of good practice proposals generated, an advanced framework, enabling representation and use of multiple and complex levels of interrelated factors and practices, was developed.

This framework, conceived and built in accordance with the holistic approach of this research, was, primarily, based on the 'Mind Mapping' technique (Buzan & Buzan, 1993). Mind mapping utilises the full range of cortical skills of the brain and can be applied by individuals and organisations alike to enhance the generation, demonstration and learning of ideas and information.

In addition, this framework shared similar objectives and characteristics with the process of *Concept Mapping,* developed by Professor Bill Trochim (Trochim, 2002b) at Cornell University. Hence, it was

> *"a structured process, focused on a topic or construct of interest, involving input from one or more participants, that produces an interpretable pictorial view (concept map) of their ideas and concepts and how these are interrelated" (Trochim, 2002b).*

Consequently, to succeed and improve on the previous software used, a new, practical, flexible and user-friendly tool was identified and selected: the Mindmanager™ software (Mindjet, 1999)[25]. It enabled the development of ideas according to the mindmapping principles (Buzan & Buzan, 1993) and was compatible with the principles of Infinite Set Theory (e.g. Suber, 1998). Overall, it possessed the capabilities of conveying the dynamic nature of the emergent framework and its structure of information and relationships.

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[25] The MindManager™ software package (v.4.0.81) was developed by Mindjet Inc. (1999).

Eventually, through the content and context metamorphoses of the collection of good project practices, the sought catalytic vehicle for innovation and meaningful industrial contribution had been devised. The catalyst was now referred to as 'the CONSTRUCT© framework of good practice'.

CONSTRUCT© was given this name to denote its obvious ties with the construction environment. Of equal importance were the related denotations of (a) a concept synthesised by numerous parts (noun) and (b) a command or request to intellectually and physically construct (verb of the imperative mode).

6.5 The CONSTRUCT© framework of good practice: structure and significance

The CONSTRUCT© framework presents multiple levels of interlinked success factors and practices in an interactive, hyperlinked (HTTP) format.

It comprises five levels with each level consisting of multiple notions. Each notion, illustrates a good practice recommended by literature, and is the centre of the following level, leading to interrelated practices. The HEX good practices were incorporated into excerpts from the case study findings and constituted a further layer of information. Most practices were linked to original documents and to on-line World Wide Web (WWW) sites of relevance.

The first of five levels, as shown in figure 6.2, comprises four main domains into which good practices were categorised. Namely:

(A) Building a 'single' project team (a unified, inter-organisational project team)

(B) Establishing a culture of trust between individuals and organisations

(Γ) Managing procurement and contractual relations to support the constructive culture emerging

(Δ) Encouraging and ensuring the involvement of the supply chain in the 'single' project team

Methods and practices identified to be contributing to one or more of the four main domains (A, B, Γ, Δ) were categorised accordingly. Hence, each domain was connected to practices that had rendered it successful (that is, methods that had helped achieve that domain or state). Figures 6.3, 6.4, 6.5 and 6.6 depict this second level of the CONSTRUCT© framework. As may be seen in either of the figures, each of the four main domains is linked to yet another, the third, level of the framework. This third level, comprises the practices associated with its achievement (e.g. using partnering to build a single team, and so on).

Accordingly, figure 6.7 illustrates the third level of CONSTRUCT©. It corresponds directly to domain (Δ), and as such provides links to the practices employed or proposed towards involving the supply chain. In general, the third level acts as a gateway to more detailed and specific accounts of successful practices used by industry and/or proposed by academia.

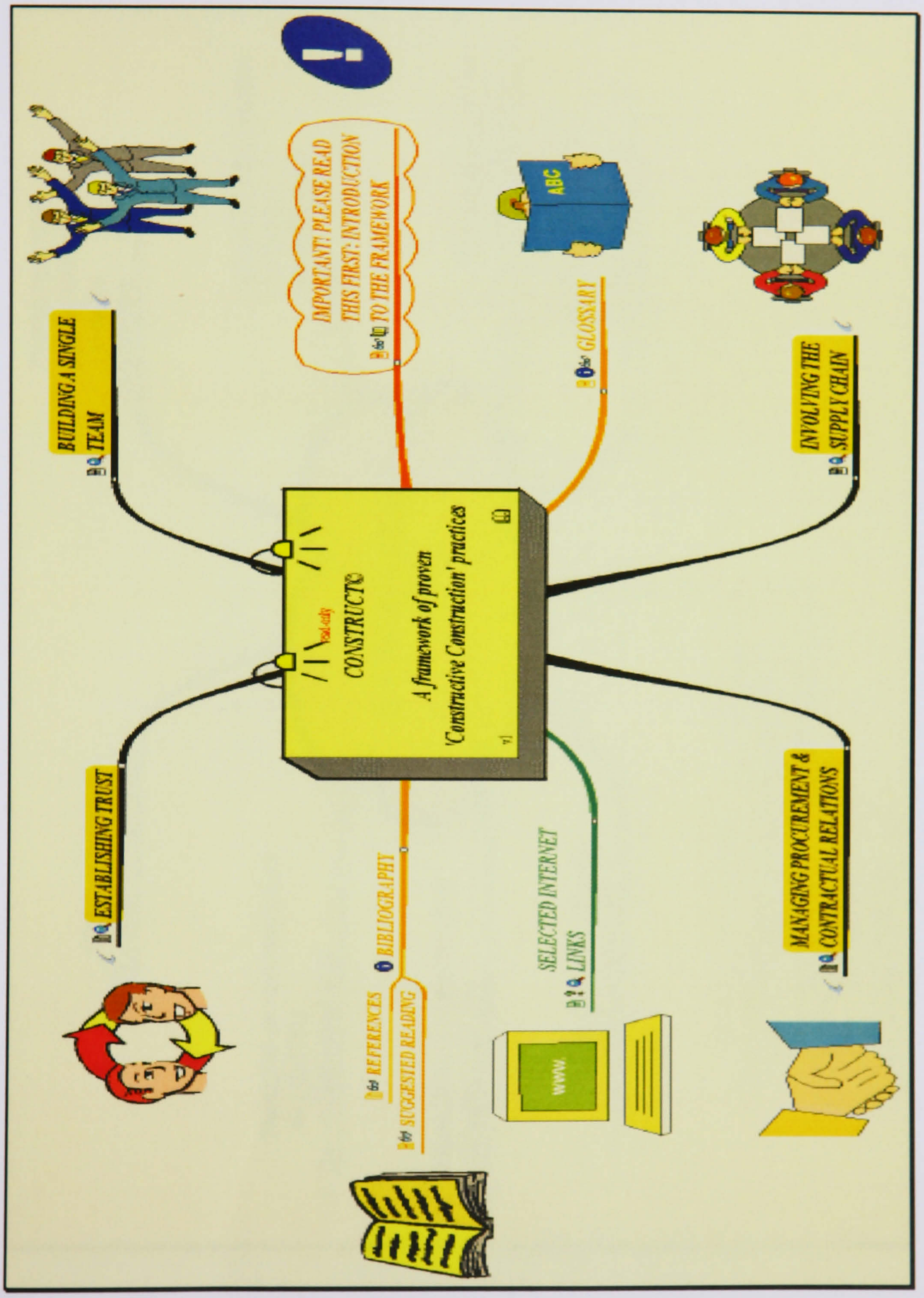

Figure 6.2 CONSTRUCT©: Top Level Key Successful Practices (domains A, B, Γ, Δ*)*

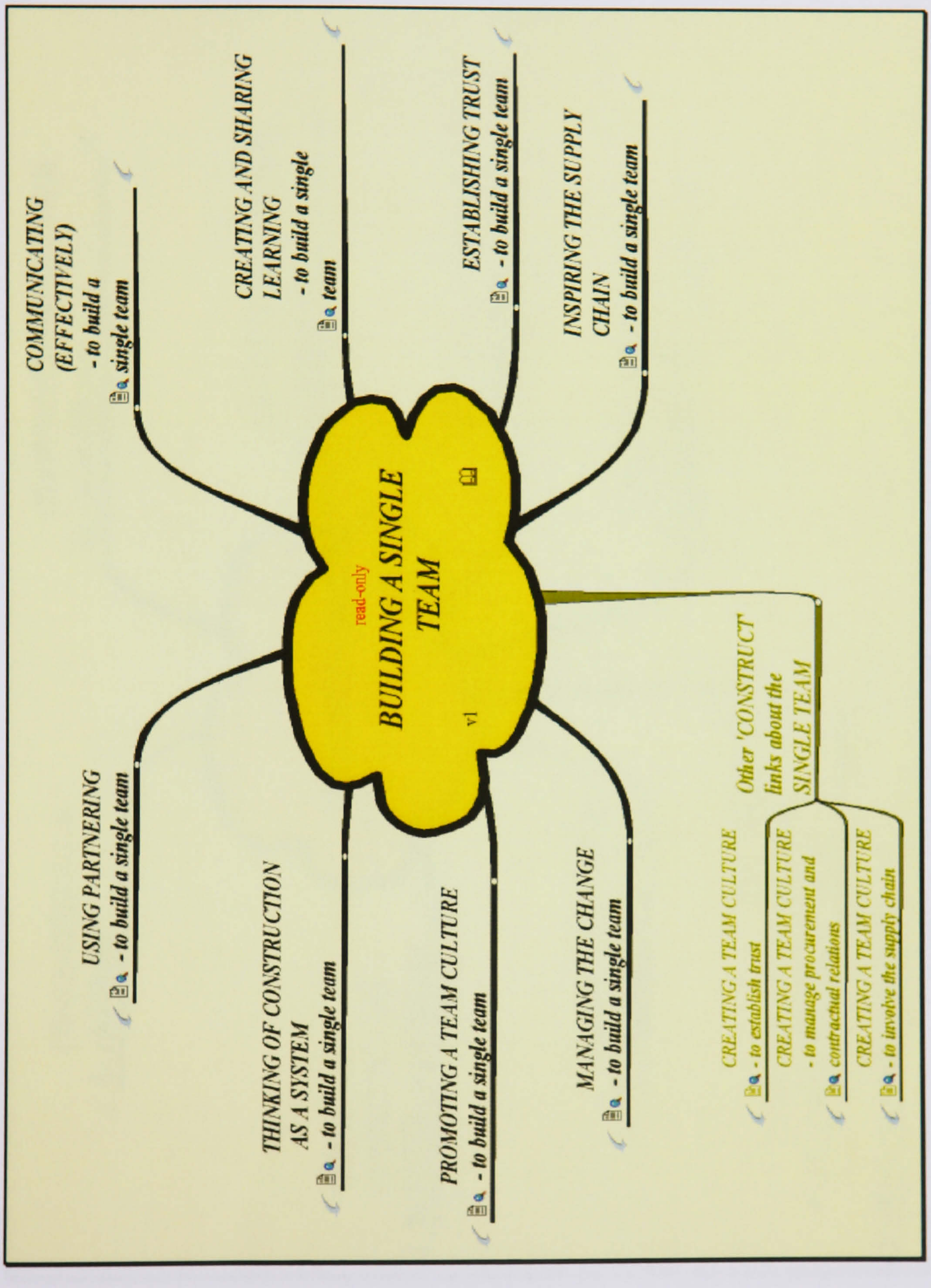

Figure 6.3 CONSTRUCT© second level: Building a 'single' team (domain A)

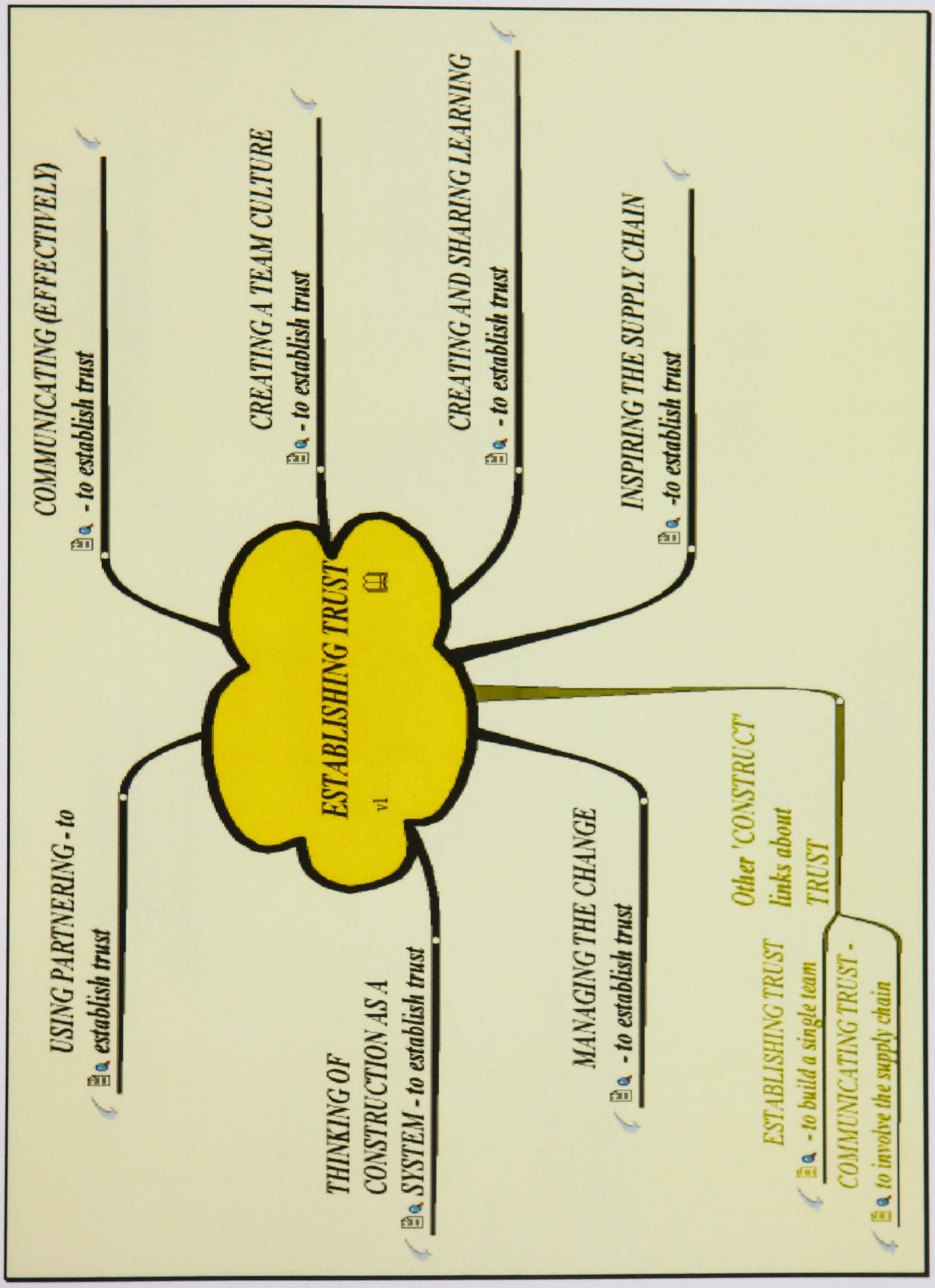

Figure 6.4 CONSTRUCT© second level: Establishing trust (domain B*)*

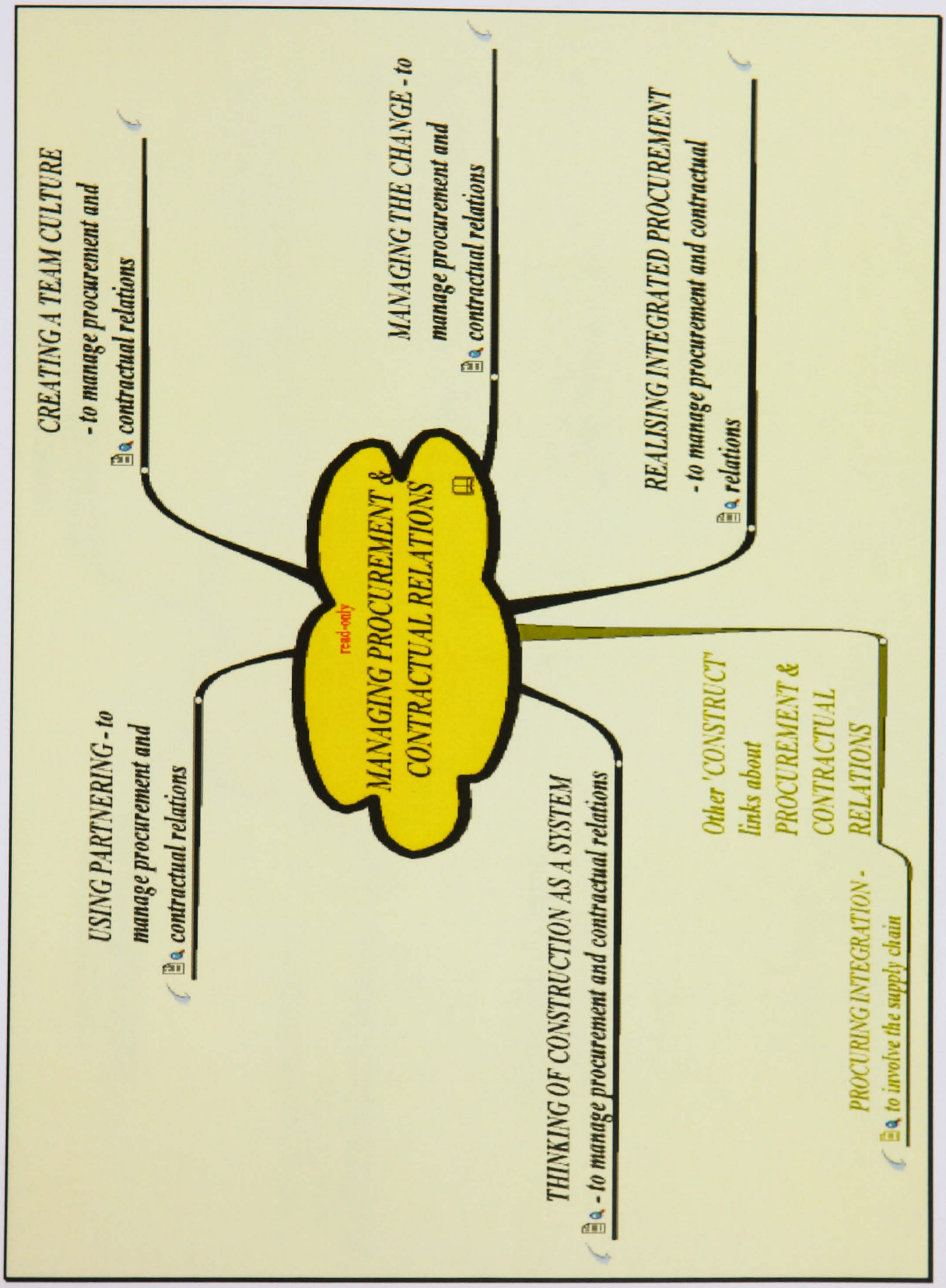

Figure 6.5 CONSTRUCT© second level: Managing procurement and contractual relations (domain Γ)

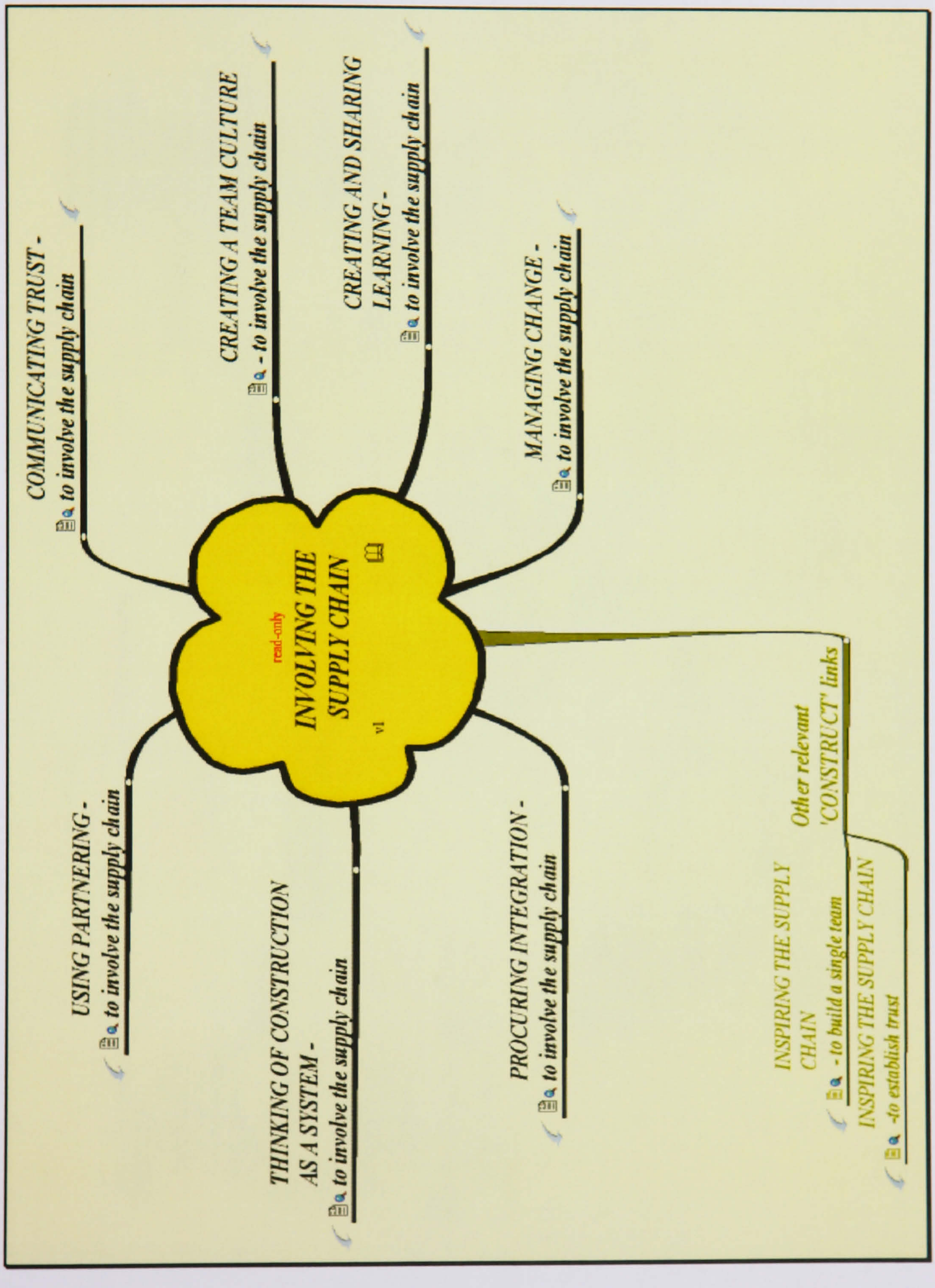

Figure 6.6 CONSTRUCT© second level: Involving the supply chain (domain Δ)

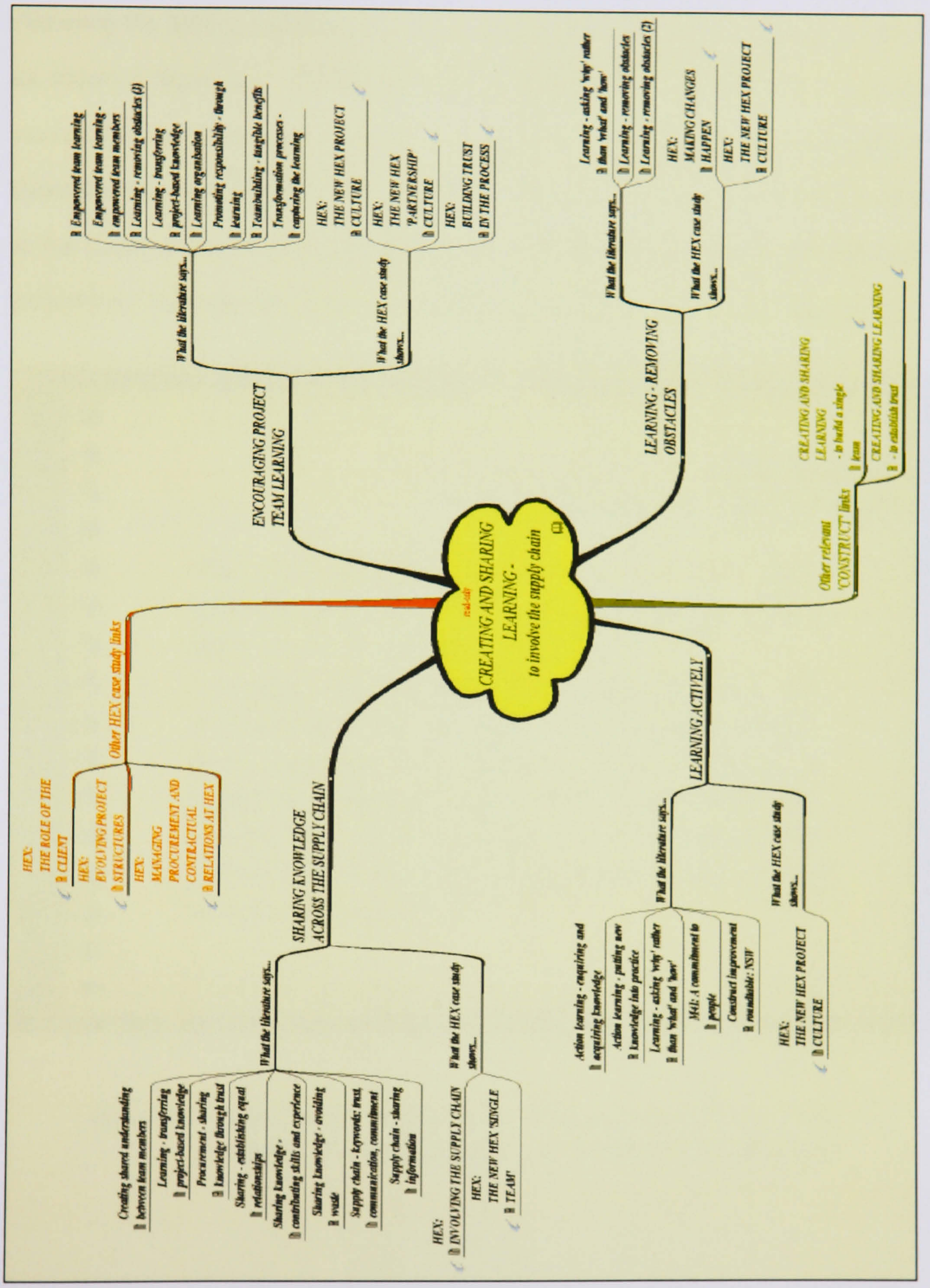

Figure 6.7 CONSTRUCT© third level (domain Δ): Creating and sharing learning to involve the supply chain

Following the links provided by the mindmap entitled 'Creating and Sharing Learning', as shown in figure 6.7, a further level of the framework is reached. This fourth level incorporates quotations or summaries derived from the in-depth literature review[26]. Illustrations of this CONSTRUCT© level are presented in figures 6.8 and 6.9, referring to the 'Creating and Sharing Learning' mindmap links (figure 6.7) entitled 'Encouraging project team learning' and 'Sharing knowledge across the supply chain', respectively.

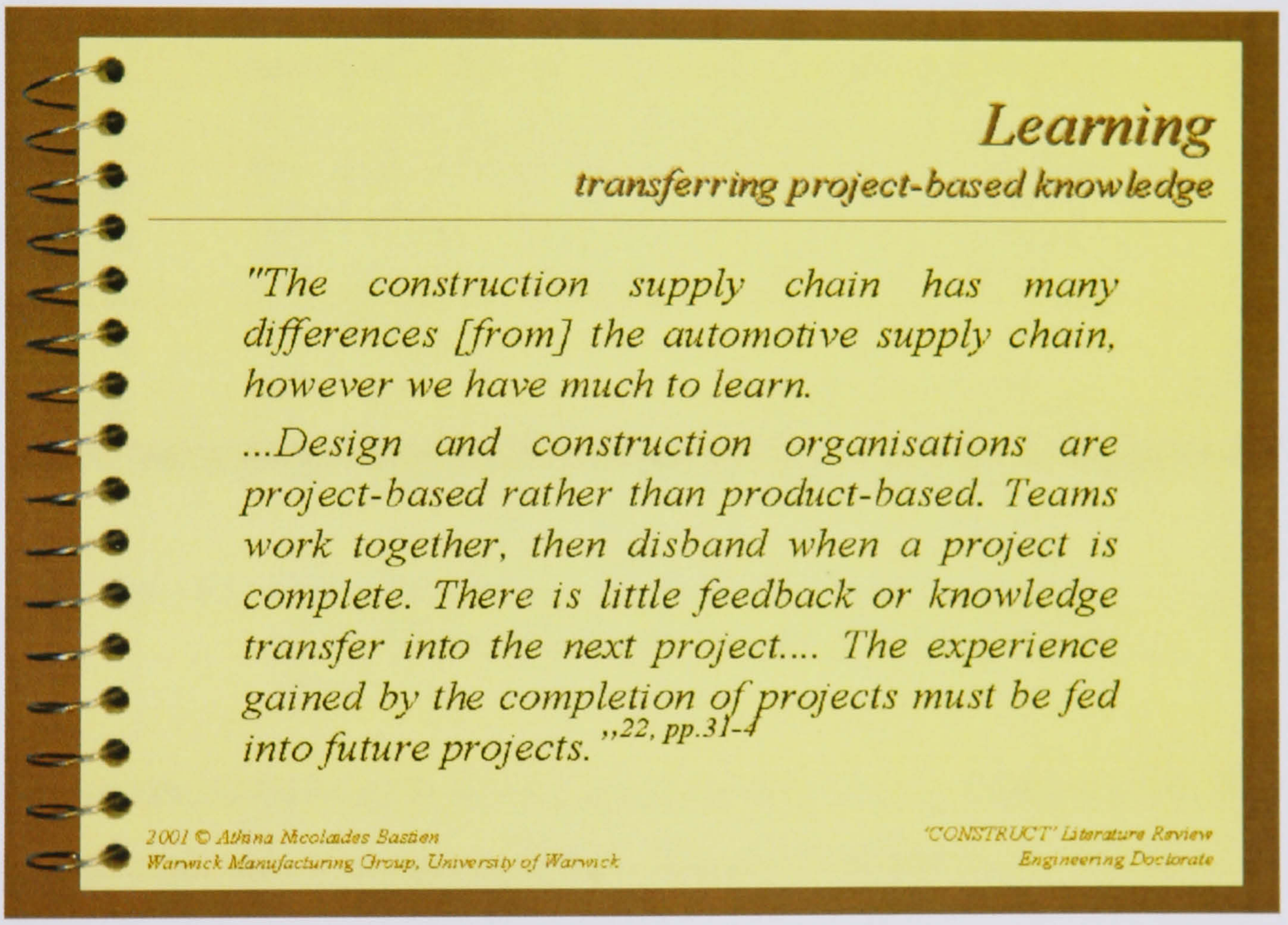

Figure 6.8 CONSTRUCT© fourth level: Literature source (Pearn, 1998) linked to 'Encouraging project team learning' theme (domain Δ)

[26] Please refer to section 6.3 of this Executive Summary and to Portfolio submission no.9.

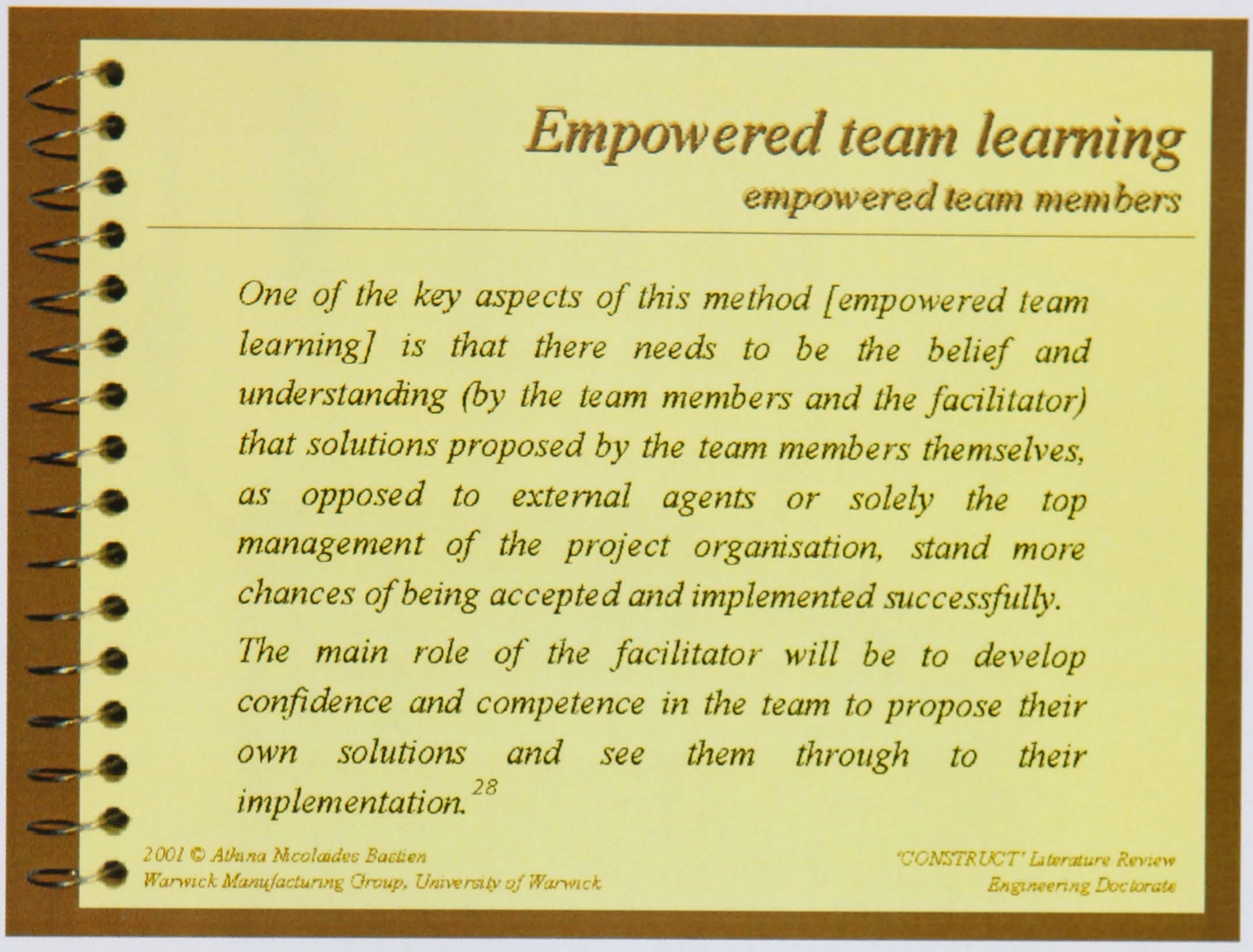

Figure 6.9 CONSTRUCT© fourth level: Literature source (Flanagan et al, 1998) linked to 'Sharing knowledge across the supply chain' theme (domain Δ)

Furthermore, by following the corresponding links of the third level mindmaps, the HEX-specific information is reached, as shown in figure 6.10. Entitled "HEX: The New HEX 'Single Team'", this is an example of the case study clusters of excerpts[27], presenting the good practices employed within that case. These clusters of information, the HEX mindmaps, are distinctively presented from all other literature sources, as they are the direct result of the empirical research conducted. They lead to a further level of in-depth

[27] For a more detailed discussion, please refer to Portfolio submission no.9.

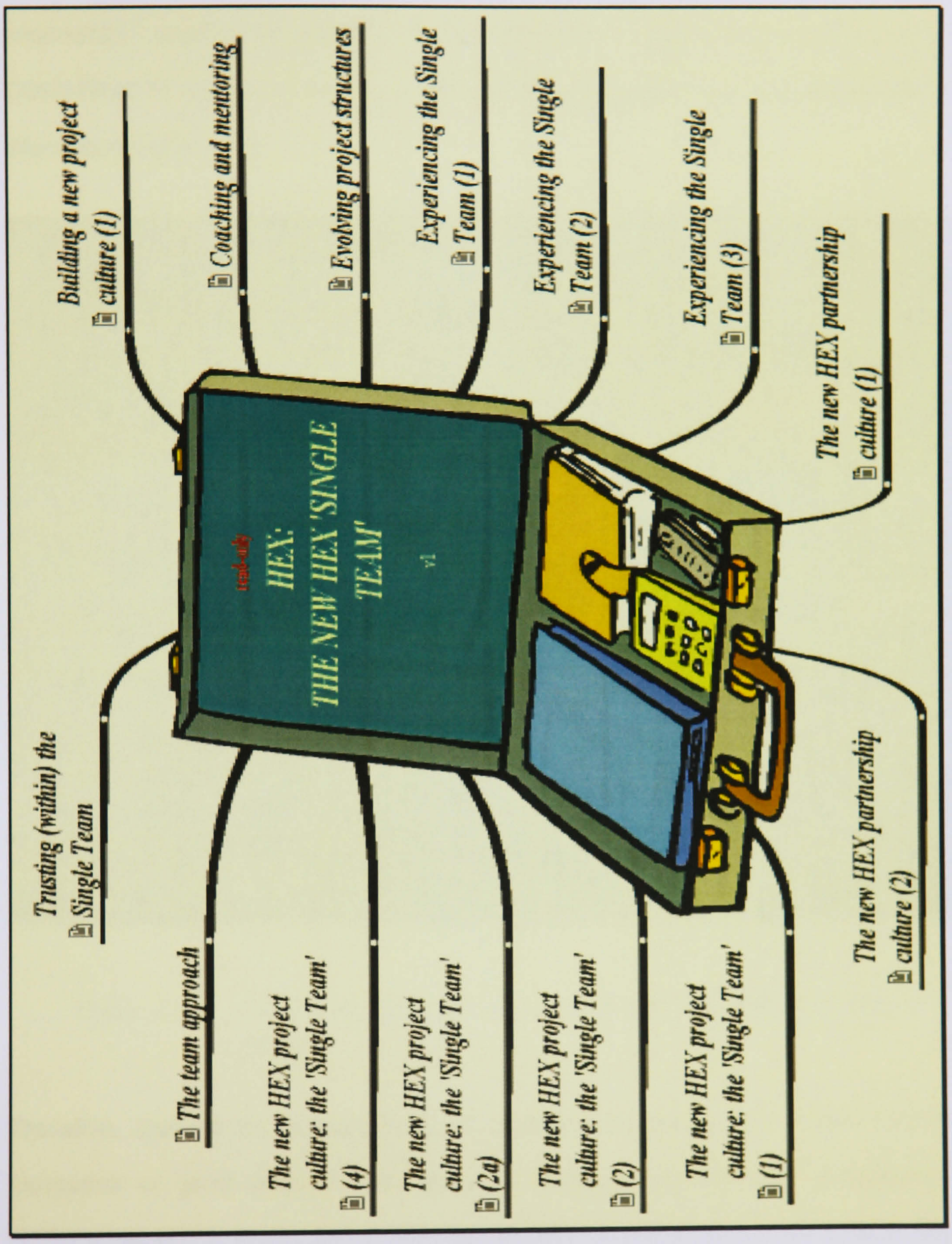

Figure 6.10 CONSTRUCT© fourth level: HEX: The New 'Single Team'

information, based on the practices reported by HEX. An example of this fifth level of CONSTRUCT© is given in figure 6.11, which is directly hyperlinked to the fourth level of information (figure 6.10).

The new HEX project culture:
experiencing the 'Single Team' (1)

Generally, it was felt that the new Single Team was stronger, with a much broader background and shared skills and abilities, than usually experienced in traditional construction projects.

It was recognised, unanimously by research participants, that this team was enabled to offer more concise solutions at a critical time for the project course, progression and development.

An interesting comment was that, "had there been no collapse, the members of the project team would have had little knowledge and understanding of the Client, as is the case in the typical contracts."

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Heathrow Express Case Study
Engineering Doctorate

Figure 6.11 CONSTRUCT© fifth level: A hyperlinked HEX case study excerpt

Therefore, founded on in-depth study of practice and theory, 'the CONSTRUCT© framework of good practice' was ready to contribute by informing industrialists' decision-making. It is noteworthy that the targetted audience of *industrialists* in this investigation refers to the 'learning' or 'philomathic' managers. Therefore, the utilisation of CONSTRUCT© is contingent upon the resourcefulness, inquisitive nature and creative approach to learning that is attributed to this audience (Antonacopoulou, 1995, 1996, 1999). As the philomathic learning is characterised as *conscious* and *active*,

these industrialists are viewed capable of delving into those levels and specific areas of knowledge, featured in CONSTRUCT©, that *they* consider more appropriate for dealing with or addressing a particular improvement need within their organisations. It is through this active and creative approach that individual learning managers and their organisations are likely to *experience* and *integrate* the knowledge gained (Bennis, 1982; Kolb, 1984) and develop and improve themselves in a conscious manner, appropriate for their individual circumstances and characteristics (Kirchenbaum & Henderson, 1990; Rogers, 1965).

This stance and approach is further supported by previous research into construction contractors' learning styles and mechanisms for knowledge acquisition aimed at improvement through the adoption of new ways of working (Kululanga, McCaffer, Price & Edum-Fotwe, 1999). It has emerged that individual learning and the majority of learning mechanisms and tools share a high potential for imbibing knowledge that can lead to change and improvement in the construction industry (Kululanga et al, 1999).

Hence, the relevance, usefulness and contribution of the CONSTRUCT© framework to industry were to be evaluated accordingly. The evaluation phase is presented in chapter 7.

Chapter 7 Evaluation Phase

The CONSTRUCT© framework had been devised as a catalyst for communicating consolidated information on good practice and informing decision-making. It was imperative that an academic research aiming to contribute to the industrial requirements of improvement and change assessed its own effectiveness and put its claims to the test. Hence, the usefulness and industrial relevance of the content and features of the emergent framework were to be systematically evaluated.

7.1 Evaluation process

On the basis of the intended use of CONSTRUCT© and its specified industrial audience, it was imperative that the applicability and potential effectiveness of the idea of this framework were assessed by its potential users[28]. The involvement of industrialists in the review and evaluation of the CONSTRUCT© framework was paramount. Given the possible relevance of the framework to sectors additional to construction, practitioners from construction and other sectors were selected as potential evaluators. As elaborated in section 3.3.1 of this Executive Summary, all were required to have one main characteristic in common: expertise acquired through lengthy professional experience and managerial responsibility.

The communication with the expert evaluators was performed solely by electronic mail (e-mail). Initially, a potential group of 35 expert evaluators was identified and sent a solicitation, by e-mail, informing them of CONSTRUCT© and inviting their expert

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[28] For a detailed discussion of the methodological and other practical considerations concerning the choice of the evaluation methodology and its applicability in this investigation please refer to chapter 9 and in particular section 9.2.3.

opinion on it. Of the 35 potential participants, 23 had experience in the construction sector and 12 primarily in manufacturing. The solicitation e-mail, equivalent to a postal request to participate in a survey, has been shown to increase response (Kanuk & Berenson, 1975) and is considered imperative (Mehta & Sivadas, 1995 cited in Sheehan & Hoy, 1999). As such, it provided prospective participants with detailed information on the research and particularly the objectives of CONSTRUCT© together with the opportunity to opt-out from the evaluation and not be sent the review CD-ROM or other material. Once a reviewer expressed interest in evaluating the framework, they were sent a CD-ROM with a self-launching version of CONSTRUCT©, containing an evaluation questionnaire to mark their responses[29].

In total, following further e-mail interchanges[30], a 57% response was achieved. Hence, the final group of expert evaluators comprised a total of 20 practitioners, 12 from the construction sector and 8 from other sectors, of which 7 were from manufacturing. All of the latter 7 were practising in the automotive sector while some also had experience in aerospace, component supply, defence and telecommunications.

7.2 Evaluation results

Overall, findings have been categorised into 'construction' and 'non-construction' sectors in order to retain their distinctive features.

In terms of the construction industry evaluators, as can be seen in figure 7.1, out of 11 who responded to this question, 7 found the framework 'helpful', 5 characterised it as

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[29] A copy of the evaluation form is provided on the interactive CONSTRUCT© CD-ROM, in Portfolio submission no. 9, and is also available in Portfolio submission no. 10.

[30] Samples of e-mails interchanged with potential evaluators are provided in Portfolio submission no. 10.

'interesting', 'promising', 'easy to follow', and practical, while 4 participants thought it was 'well-developed' and 'well-structured'. The framework was confirmed as 'descriptive' by 5 evaluators. Three construction participants thought CONSTRUCT© was 'complicated'.

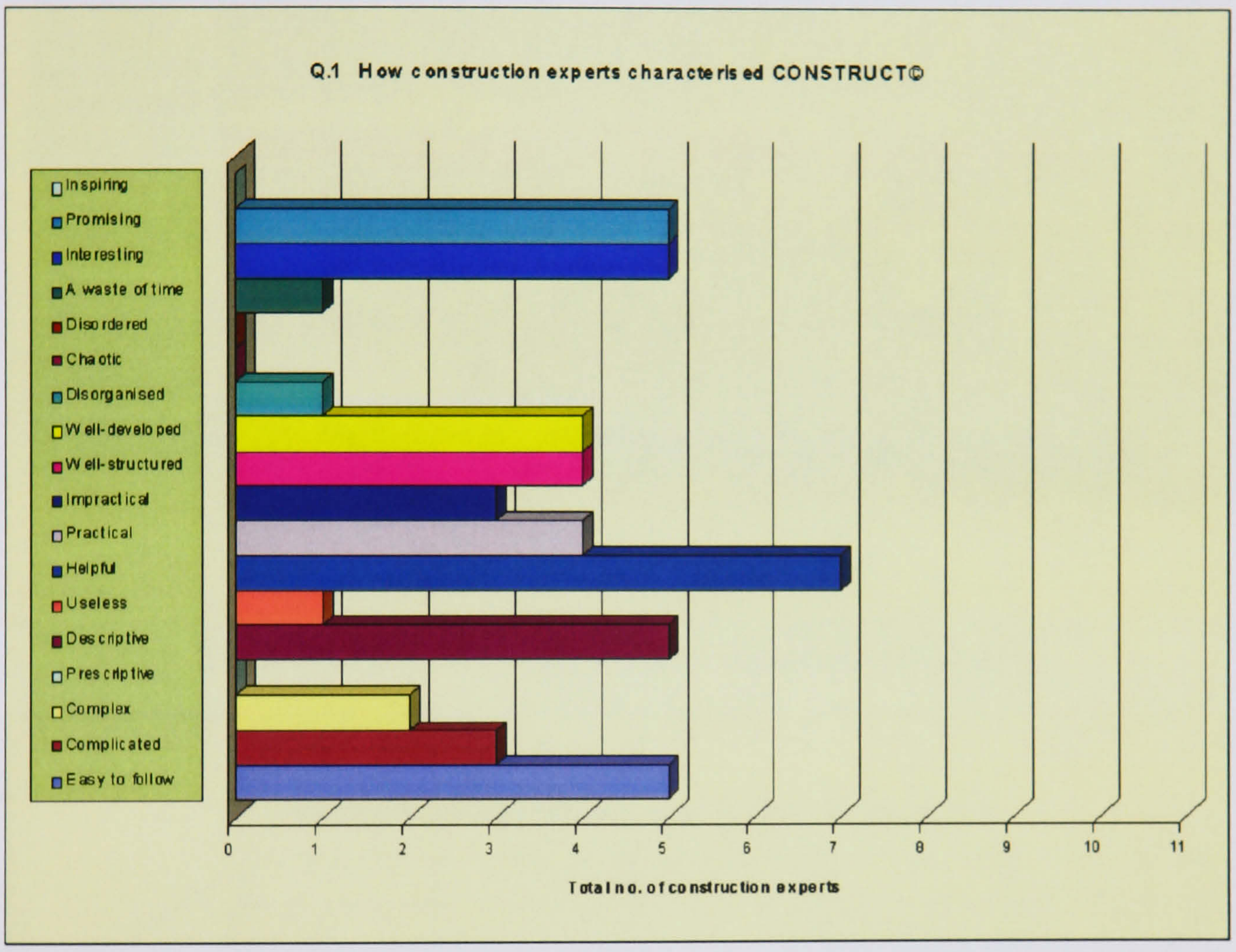

Figure 7.1 CONSTRUCT© evaluation: Q1; construction experts

From the 8 evaluators belonging to other sectors, as shown in figure 7.2, no-one considered the framework 'complicated', while 7 out of 8 found it 'easy to follow'. CONSTRUCT© was considered 'interesting' by all evaluators, while 7 believed it was 'well-structured', 6 found it 'well-developed' and 5 said it was 'promising'. The framework was confirmed as 'descriptive' by 6 experts.

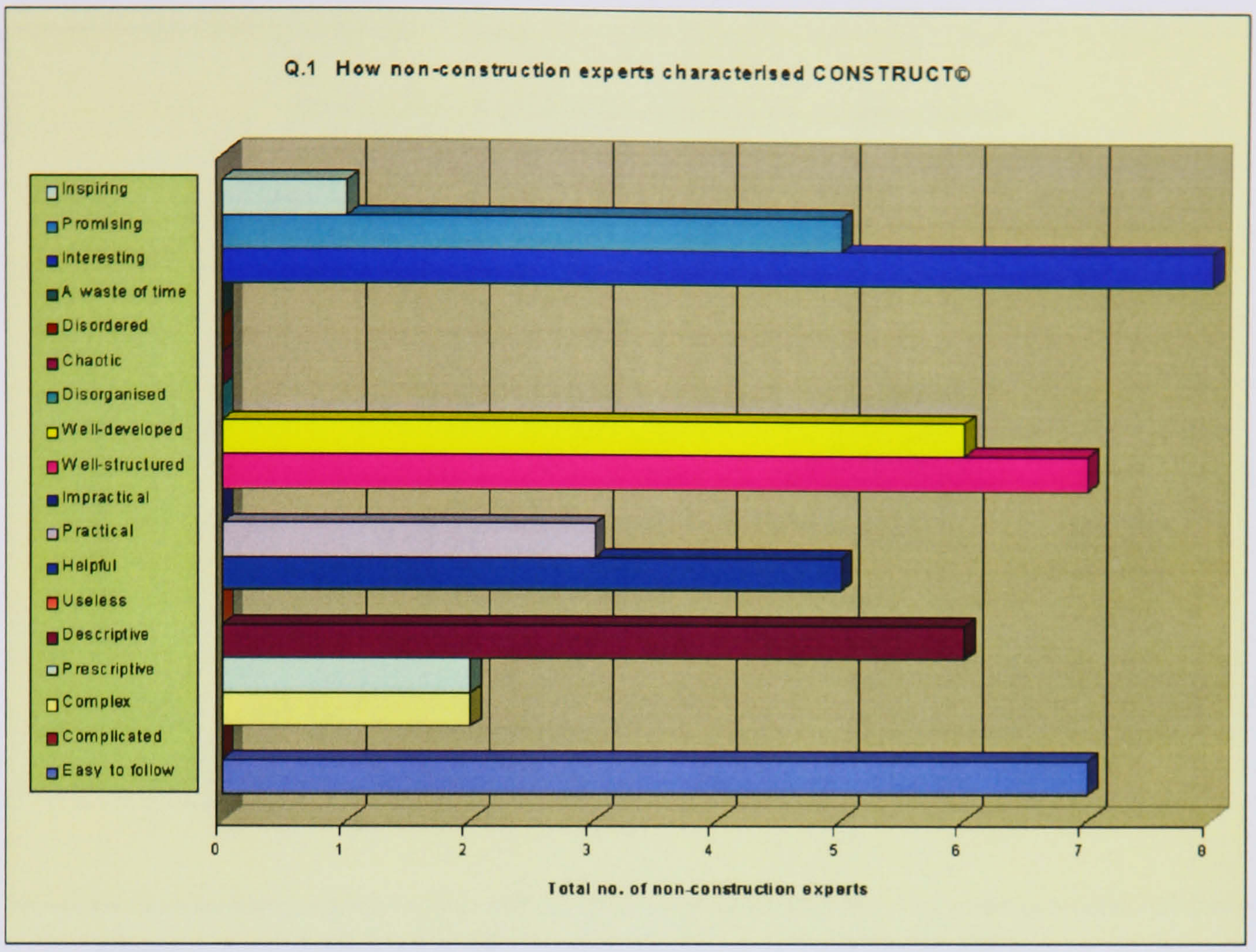

Figure 7.2 CONSTRUCT© evaluation: Q1; non-construction experts

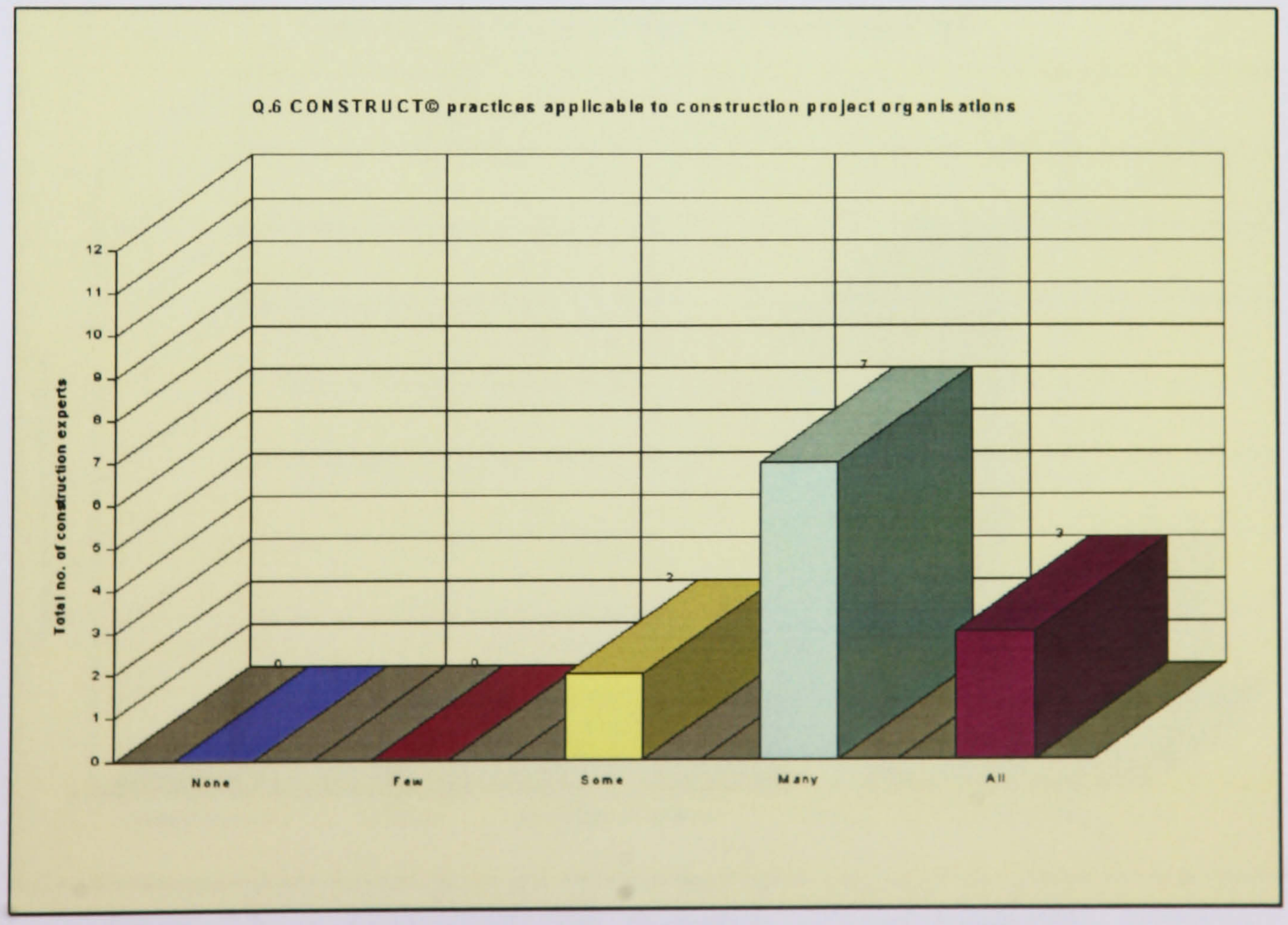

Figure 7.3 CONSTRUCT© evaluation: Q6; construction experts

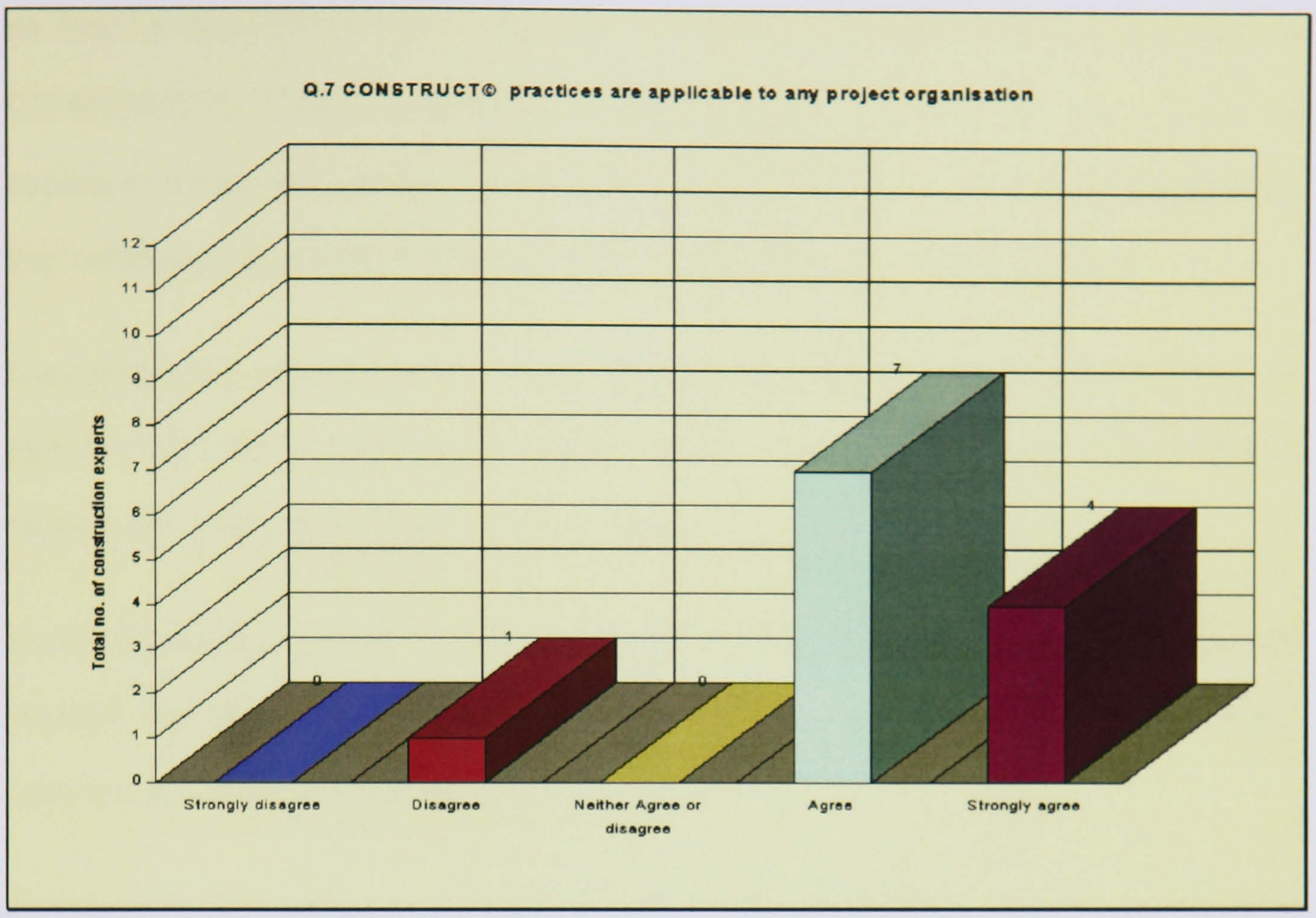

Figure 7.4 CONSTRUCT© evaluation: Q7; construction experts

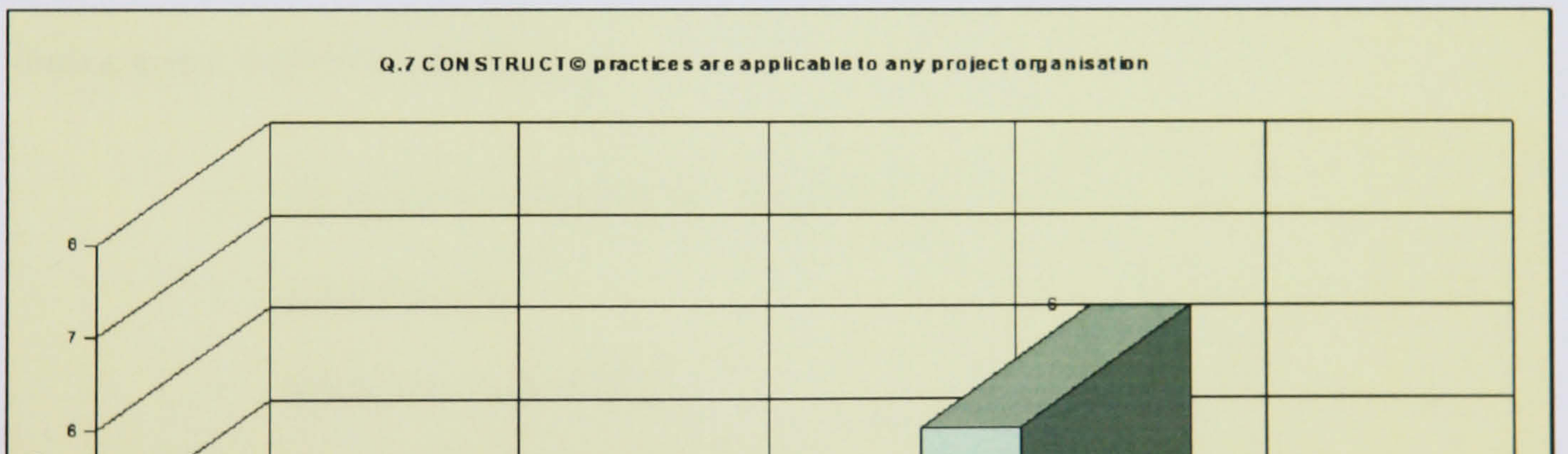

Figure 7.5 CONSTRUCT© evaluation: Q7; non-construction experts

As may be seen in figure 7.3, in connection with the ideas and practices presented by CONSTRUCT©, 7 of 12 construction industry experts answered that 'many' could be applied to construction project organisations, while 3 said that 'all' could be applied, with the remaining 2 believing that 'some' of the presented ideas could be applied.

Concerning the same practices and ideas being applicable to project organisations, in general, 7 of the 12 construction experts 'agreed' whereas 4 'strongly agreed' and 1 'disagreed'. This is graphically depicted in figure 7.4.

As demonstrated in figure 7.5, in the same question, 6 of the 8 non-construction experts 'agreed' that the CONSTRUCT© practices and ideas were applicable to any project organisation and the remaining 2 'strongly agreed'.

Furthermore, this evaluation brought to light certain areas with which the construction experts were not particularly familiar with or had not practised extensively in the sector. These areas were the following:

- Establishing/recognising 'virtual' teams
- Lean thinking
- 'Real-time' networking
- Systems thinking
- The importance of the contract used in establishing a team culture

These were the areas constituting ground for further investigation in future research.

In addition, the evaluation showed that non-construction experts had knowledge of or direct experience of most of the areas which construction experts had limited exposure to. In particular, 'lean thinking' and 'systems thinking' were the two areas with the most striking difference between the two groups. Therefore, those could be regarded as

areas where knowledge and learning transfer could become possible, given further research and application.

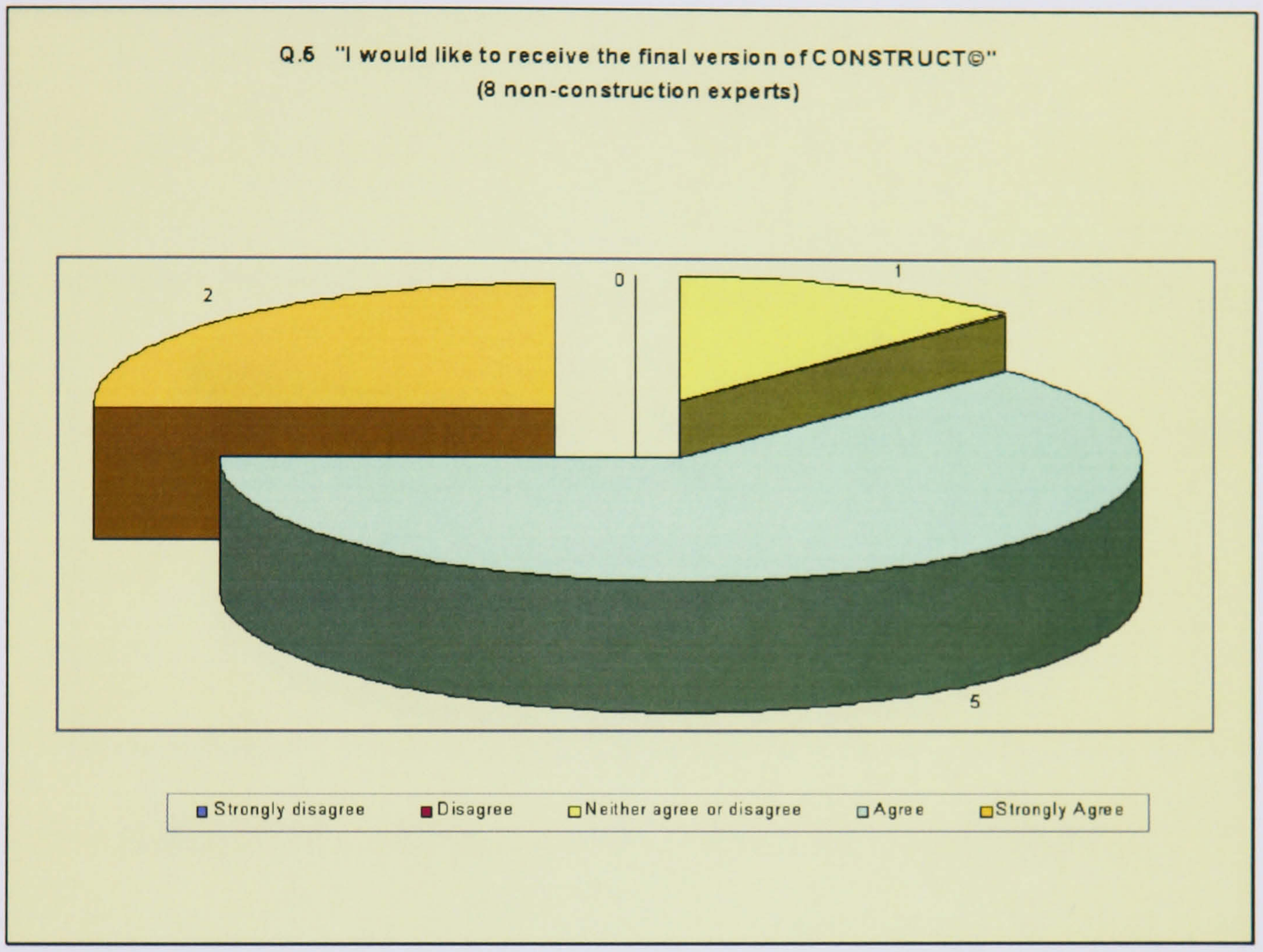

Figure 7.6 CONSTRUCT© evaluation: Q5; non-construction experts

Finally, as is being demonstrated in figures 7.6 and 7.7, respectively, when practitioners from other industries were asked if they were interested in a copy of the final version of CONSTRUCT©, 2 of 8 'strongly agreed'; 5 'agreed' and 1 was 'undecided'. Finally, when 12 construction experts were asked the same question (Q.5), 2 'strongly agreed'; 9 'agreed' and 1 was 'undecided'.

7.3 Evaluation implications

Apart from indications about cultural and other organisational differences between the experts belonging to construction and other industries, in this instance, the evaluation

findings depict an overall positive image of CONSTRUCT© with similarly positive and encouraging views regarding its wider applicability.

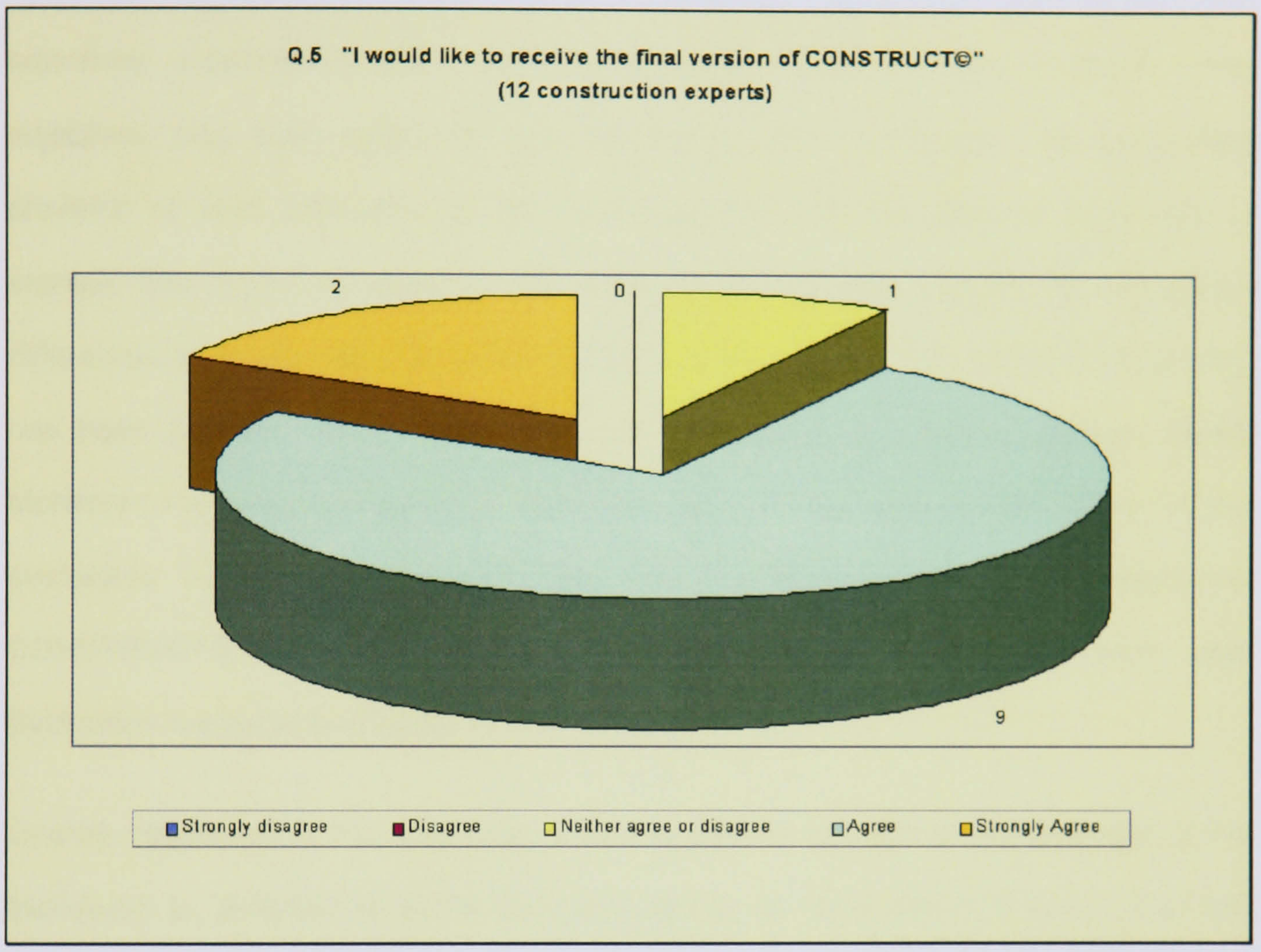

Figure 7.1 CONSTRUCT© evaluation: Q5; construction experts

The expert evaluation of CONSTRUCT© has come to verify its descriptive, as opposed to prescriptive, nature. All construction professionals reported that ideas and practices presented by the framework could indeed be applied to construction companies. Their wider applicability in project organisations, in general, was strongly confirmed by evaluators from the other industrial sectors.

In addition, the open questions have returned a wealth of content and context suggestions and recommendations for successive versions of the framework and have emphasised the positive attributes to be retained and built upon.

For instance, it is noted that in response to question 1 of the Evaluation Questionnaire, the construction practitioners have refrained from describing the framework under evaluation as 'inspiring'. Nevertheless, it became evident that they used other adjectives available to them for characterising CONSTRUCT©. Amongst those adjectives they have opted for are: 'interesting' and 'promising'. The purposeful provision of such adjectives by the researcher has enabled different individuals to express their personal views on the same object and has catered for semantical differences stemming from personal experience. For example, the adjective 'promising' has been provided by the researcher as a synonym of 'inspiring' (Roget, 1995). Moreover, the ready availability of dedicated space for the personal expression of the evaluators, in the same question, has led to additional ways of describing the CONSTRUCT© framework, such as 'imaginatively presented' and 'novel' (see Evaluation results appended to portfolio submission 10).

Overall, responses to this and other similar questions highlighted the potential of the framework to 'enlighten industrial decision-making' as mentioned in section 2.4 of this Executive Summary.Furthermore, areas requiring further exploration within the construction environment have been identified and can be used as the starting point of follow-up attempts to educate construction actors and enable them to take advantage of knowledge on practices and methodologies proposed by academia or practised by other industrialists.

Overall, the evaluation played a central role in assessing and confirming the industrial relevance of the proposed framework. It emerged that CONSTRUCT© is successful at bringing knowledge of good practice to the attention of the industry and its clients. This knowledge has been characterised as applicable to construction and other projects. Therefore, the CONSTRUCT© framework of good practice does rise to the challenge

set by the Construction Task Force and contributes to the improvement of the construction industry.

PART III CONCLUSION

Chapter 8 Future Work

> *"Empirical research is often a matter of progressively lowering your aspirations. You begin by wanting to study all the facets of an important problem or a fascinating social phenomenon. But it soon becomes clear that choices must be made. Unless you are willing to devote most of your professional life to a single study, you have to settle for less." (Miles & Huberman, 1984:36).*

This doctoral Portfolio is the culmination of an industrially-relevant academic research programme. Considering the notion of "doing research that is useful for theory and practice" (Lawler III et al, 1985) as one of the central requirements and characteristics interwoven in the fabrics of this research Portfolio, this section looks into ways in which the current work can be improved and extended.

8.1 Developing CONSTRUCT© further

It is intended that the content and context of the CONSTRUCT© framework be developed further. Initially, taking into serious consideration the evaluators' comments, contextual elements of the framework will be enriched and updated. These elements refer to the structure and presentation of the framework and it is expected that the proposed changes increase its overall usability and functionality. The framework will become more user-friendly with the addition of Java[31] frames to help the navigation and top level viewing and accessing of all separate parts.

[31] Please refer to the glossary for an explanation of Java.

In addition, CONSTRUCT© shall be converted into other Microsoft applications, such as Word, PowerPoint and even Project. This is expected to cater for a variety of situations and requirements and make the presentation appropriate to the users and their circumstances.

Additional practices and ideas proposed by the evaluators will be reviewed and incorporated into an updated version of CONSTRUCT©. This will further enrich the knowledge already exhibited and will make the framework more relevant to additional situations. Furthermore, newly researched successful practices will populate the framework with up-to-date information.

Moreover, the possibility of marketing CONSTRUCT© as a stand-alone database of construction project management good practice is being considered. Subject to careful market research the framework could be released and marketed to construction industrialists interested in improving their practices and making better-informed project management decisions. Some interest for the potential of this framework has been expressed by industrialists and consideration is now being given to establishing links with interested publishing houses, specialising in construction topics.

8.2 Areas for further investigation

The CONSTRUCT© evaluation and its results have acted as a springboard for identifying further areas of investigation. Areas and topics that need to be addressed in construction have been identified and will be further considered with a view to realising the Egan recommendations and improvement targets.

A need for further information and education has emerged with relation to some of the topics presented. These are the areas having received the lowest scores, representing practices that the practitioners had not heard of before or initiatives in which they have

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not participated. In particular, the following topics provide an incentive for future research:

- Systems thinking
- Lean thinking
- The importance of contract in building teams
- Virtual teamworking

The difference between numbers of construction participants who were familiar with the term 'lean thinking' and those who had actually initiated it in their own organisations or had participated in it (10 versus 5 participants) indicates that the actual implementation of 'lean thinking' in construction is an area that provides opportunities for practical implementation of the concept.

Another indication for further research and application work lies in the domain of 'systems thinking' which had been familiar to only 3 of 12 participants and had been used by 2 of 12. Therefore, this is yet another area which requires further research and application in the construction environment as it is closely related with the Egan Drivers of Change and the required improvements.

Furthermore, from the responses of non-construction participants it appears that certain topics (e.g. lean thinking and systems thinking) are more familiar to manufacturing sector participants than to their construction counterparts. Consequently, the knowledge of and learning from these initiatives could be shared with construction in a move to promote the needed change and improvement in the sector.

Therefore, emphasis will be given to all these areas in order to propose up to date findings and information and disseminate them to interested parties.

8.3 Working with industry

As a step forward from the evaluation of the current version of CONSTRUCT©, it is also proposed that communication is maintained with members of the construction industry; in particular with companies that have recorded their feedback and interest in developments of the framework.

Hence, it is suggested that these organisations are brought together in a forum to enable them to share their experiences of Demonstration and other construction projects. They would thus be given the opportunity to present to each their own success stories. For the same purpose, links could be established with the CBPP to involve additional interested parties and promote the idea of the forum.

Some of these individuals and companies could act as evaluators of the follow-up versions of the framework with a view to improving and enriching it.

It is also proposed that the same construction organisations are approached in the future and invited to contribute further in research programmes by becoming the focus of case studies. The objective of this could be to define key successful practices for construction companies/civil engineering projects. Additionally, depending on the choice of the analysis methods and theoretical framework chosen, derive some generalisations or build theory (grounded on the data) onto which conclusions could be drawn and further investigation programmes be based.

8.4 Disseminating knowledge and experience

It is a genuine intention of this author, to sustain close ties with other academic colleagues and industrial participants, in order to disseminate the knowledge gained

throughout this research in a variety of ways and to as wide a selection of audiences as possible.

For instance, papers based on the experience and process of the research and the outcomes of the research itself are currently in the process of being written, with a view to being submitted for publication in relevant journals or books and presentation in conferences. The objective will be to address both academic and industrial audiences with a view to initiating a debate and further improvement of the emergent tools and ideas.

The lessons learned from this research process will also be passed on to other researchers intending to pursue postgraduate research and it is envisaged that this could be enabled through the research supervision of postgraduate students.

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Chapter 9 Research Overview

The dual nature and purpose of this professional doctorate, and their implications for the resultant contribution and innovation, is the epicentre of this chapter. This discussion highlights the choices made and exhibits how they have contributed to serving different purposes and audiences and reaching outcomes that that are meaningful and usable for both theory and practice.

Firstly, as is expected of academic research of a doctoral standard, this doctoral work is academically founded in terms of the rigour of theoretical frameworks, approaches and strategies used to examine particular issues and produce academically sound results.

In addition to these academic attributes, this doctorate has been, from its inception stages, very closely related to the industrial environment and participants. In this case, the construction industry, with a focus on the civil engineering area. Hence, links were established with industrial organisations and the input of practitioners was sought throughout the course of this research to ensure that the results produced were industrially relevant, meaningful, applicable and potentially usable as recommendations to real-life problems within an industrial context.

Consequently, in order to satisfy academic requirements *and* industrial concerns, this research considered multiple research typologies and classifications and flexibly selected and adopted corresponding approaches to address audiences and conjoin purposes. The attributes of specific research types and corresponding outcomes are presented throughout this discussion as they indicate the links and relations purposely drawn between the documented and practised research approaches. These latter have purposely supported innovative and contributory outcomes, as experienced and proclaimed throughout this doctoral research.

9.1 Research typologies and purposes

Research purpose has been analysed and discussed at length by Patton (1990) and Easterby-Smith et al (1991). This analysis and discussion has generated a typology of research *purposes*, ranging from *basic research*, *applied research*, *summative evaluation research*, *formative evaluation*, to *action research*. Patton's (1990) typology is comparable with the main research classifications presented by Easterby-Smith et al (1991). Their classifications range from *pure* to *applied* and to *action research*. The distinctions between these classifications refer, primarily, to the expected *outcomes* of respective research types.

From the conception, to the execution and to this current reflection on this doctoral research, a continuum of research practice and purpose was considered. This was based on the study and appreciation of typologies and classifications established by literature (e.g. Easterby-Smith et al, 1991; Patton, 1990) and their relevance to this research. Hence, this continuum, signifying not only the research type but also the 'expected outcome' and 'purpose', was defined as a range from *basic or pure* research to *applied* and to *summative evaluation*.

9.2 Innovation and Contribution

> *"It is quite unrealistic to expect great discoveries from every doctoral project, but it seems that the chances will be improved if one incorporates both pure and applied elements in the research." (Easterby-Smith et al, 1991:9)*

As shown in this chapter, the two-fold nature and purpose of this doctorate meant that its contribution and innovation were founded on a complex typology. Hence, the achievement of academic and industrial challenges has been made possible through the combination of *three* distinct research approaches. These were deemed appropriate for meeting respective purposes and proposing topical solutions. Initially, *pure* or *basic*

research was conducted. This was followed by *applied* research. Finally, *summative evaluation research* was carried out.

In this Executive Summary, the combination of these three research approaches is referred to as an 'action-*oriented*' approach. This term indicates their theoretical and practical movement on the continuum, away from the basic and towards the action research. This 'action-*orientation*' of the research approach (see also Argyris, 1985, and Lawler III et al, 1985), enabled this inquiry contribute to a real-life situation, directly where a gap had been noted, and address it with the conceptualisation and evaluation of an innovative framework.

The adoption, incorporation and dynamic use and development of *three* different research approaches in *one single* doctoral programme is highlighted as a significant part of both the contribution and the innovation that this inquiry experienced and puts forward to academic and industrial audiences. The boundary lines between different approaches were not seen as demarcations of prohibited zones[32]. Refreshingly, they were perceived as hurdles on a running track. They were carefully considered and appreciated and, following methodical research training, they were eliminated to reveal a track paved with multiple research approaches. Hence, at any given time, the most *suitable* approach for producing the most *appropriate* result, leading to solutions that were rigorous and meaningful for the *particular* audience and purpose, was available to be selected and used. In other words, approaches that were 'fit for purpose' were chosen (Blockley & Godfrey, 2000; Nicolaides, 1999a).

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[32] *"Debates about the meaningfulness, rigor, significance, and relevance of various approaches to research are regular features of university life. ... Research can be a highly political activity that generates opposing opinions and strong emotions. ... Researchers engaged in research at various points along the [research type] continuum have very strong opinions and feelings about researchers at other points along the continuum..."* (Patton, 1990:158).

9.2.1 Pure contribution

Firstly, it is claimed that one of the outcomes of pure research is '*reflection*' (Easterby-Smith et al, 1991). Reflection refers to already established ideas, theories or techniques being reconsidered within a different organisational or social environment. For instance, the applicability and relevance of the concept of 'partnership sourcing', developed primarily in the automotive sector, examined within the construction sector fulfils the purpose of reflection. This could result in further ideas, changes and adaptations of this concept. Although this type of pure research does not share as revolutionary outcomes as those of 'discovery' or 'invention', it is an appropriate and fruitful form of research for doctorates (Easterby-Smith et al, 1991).

It needs to be noted that since the first phases of this doctoral research, strong interrelations were evident between pure and action-oriented approaches and intended purposes. Nevertheless, the first phases of this doctoral research were primarily of a pure or basic orientation. This not only contributed to the academic requirements of this doctoral programme but also set a rigorous basis for the innovation that was to follow.

Specifically, the case study conducted, derived a number of organisational and human factors that supported a particular construction project on its route to success. These factors (i.e. teamworking; supply chain management) had previously been experienced in other industrial contexts such as manufacturing (e.g. Dainty et al, 2001a, 2001b; Lamming, 1993; Storey, 1994; Womack & Jones, 1994; Womack et al, 1990). Nevertheless, their examination within the new context of construction generated further ideas about their applicability to this new environment and inspired further research approaches that produced additional and deeper results on more practical levels; this time directly relevant to members of this different business environment (construction).

In addition, the choice of the particular inquiry paradigm and research strategy for the extraction and examination of the relevant information, that is, phenomenology and the 'information-rich' case study, respectively, enabled the inductive and holistic appreciation within a "context-specific setting" (Patton, 1990:37). The case study methodology provided the most suitable platform for extracting rich and meaningful results from an *individual* setting (Eisenhardt, 1989; Hussey & Hussey, 1997; Yin, 1994). Furthermore, the results from this 'intrinsic' case (Stake, 1998) led away from the examination of abstract concepts and emphasised the *learning* orientation of the inquiry and its contribution. Overall, this approach provided a solid and rigorous platform that enriched and strengthened the whole inquiry and its findings and outcomes. These were to be carried forward to the next phases of this doctoral investigation.

Hence, the contribution of this research, during the basic or pure research phase, entailed primarily 'reflective' outcomes, that were openly disseminated through conference proceedings (Nicolaides, 1998, 1999b), a working paper and conference presentation (Bastien, 2000) and a relevant publication aimed at primarily academic audiences (Bastien, 2001).

Following the pure research undertaken during the first stages of this investigation, the research interests, requirements and audiences of the continuing research effort, shifted evidently towards the industrial context. To meet these renewed purposes, the research approach also shifted towards an applied orientation.

9.2.2 Applied research and innovation

One of the main differences between pure (basic) and applied research is the "source of questions". Whereas pure research responds to questions stemming from an academic discipline, applied research addresses issues experienced in real-life. Therefore, it aims to "generate potential solutions to human and societal problems"

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(Patton, 1990:154). Of utmost significance and pertinence to the approach followed by this investigation is the thesis that:

> *"Applied researchers take the findings, understandings, and explanations of basic research and **apply** them to real-world problems and experiences. This means that the applied researcher searches for applications of basic disciplinary knowledge to real-world problems" (Patton, 1990:154).*

This describes the experience of the current research in the most accurate and precise manner. Contrary to the basic research tradition, the purpose of the data collected by the case study methods did not stop at their analysis and reporting of findings. Instead, the basic research findings were ***applied*** to real-life to generate proposals for the specific concerns of the construction industry. This is where the thread of innovation started unfolding through the tightly knitted research pattern.

Another characteristic shared by both accounts of applied research (Patton, 1990:154) and by its implementation in the current investigation, is that of *disciplinal multiplicity*. In accordance with the literature propositions, this inquiry applied a multidisciplinary approach (as presented in chapter 2 of this Executive Summary). It brought the corresponding insights and learning into the proposals aimed at addressing industrial concerns.

A lesson learned from assuming a multidisciplinary view and delving into other pools of knowledge, seemingly unrelated to the topic or area of investigation, has shown that, tapping into other practices, ideas, philosophies and methods, indirectly affecting a research domain, can be a source of innovation and further inspiration and knowledge not imagined before.

It is believed that the theoretical and methodological triangulation achieved, contributed to the innovative character of the inquiry not only by supporting the research process

and findings but also, by contributing an approach not frequently met in construction management research.

The CONSTRUCT© framework of good practice was built on the founding principles of multiple disciplines and methods. Primarily, the ways in which tools, techniques and methods were combined and built, in order to convey the developed knowledge to the industry, had a direct effect on the innovation of the solution proposed. The incorporation of theoretical (disciplinary) and philosophical approaches (e.g. systems thinking, phenomenology, holism) with academically derived findings, was translated into industrially meaningful proposals.

Therefore, this original conceptualisation was innovative in its own right as not only was it deeply multidisciplinary but also 'non-directive' and descriptive, unlike prescriptive models met in literature (e.g. Chua et al, 1999; Chua, Kog, Loh & Jaselskis, 1997; Sanvido, Parfitt, Guveris & Coyle, 1992). The CONSTRUCT© framework of knowledge is an innovative tool also due to its departure from what is known as a 'best practice model'. As a result, the character of this framework also departed from the prescriptive to a descriptive and flexible approach, applicable in a variety of specified situations. This is the approach that allows people to think for themselves and make their own, well-informed, decisions to achieve their objectives (Lincoln, 1990).

It is noteworthy, that the conceptualisation and development of the proposed framework, based on the systems and contingency approach, acknowledges variations in individual and organisational characteristics and requirements and their role in decision making. Therefore, it is significant for the industrial contribution of this framework that it does not *prescribe* CSFs or *best* practice but unearths and puts forward proven successful practices.

9.2.3 Summative evaluation and innovations

On the research continuum already established, applied research is followed by evaluation[33]. The summative type of evaluation is of direct relevance in this case, as it was employed to consider and assess the applicability and potential effectiveness of the CONSTRUCT© framework, product of pure and applied research.

Whereas applied research seeks to appreciate real-life problems and generate potential solutions (as was performed in this investigation), evaluation research assesses the methods and processes by which proposed solutions can be achieved. More specifically,

> *"summative evaluations serve the purpose of rendering an overall judgement about the effectiveness of a [proposed solution] for the purpose of saying that* ***the idea itself*** *is or is not effective and, therefore, has the potential of being generalizable*[34] *to other situations" (Patton, 1990:155).*

As chapter 7 of this Executive Summary showed, the content, context and applicability of the CONSTRUCT© framework -proposed during the applied research phase of the typology continuum-, was expertly evaluated by members of the construction and manufacturing sectors. The purpose of this summative evaluation was closely related to the specificity of intended audiences and conditions (Patton, 1990). In other words, limited generalisation was sought from the framework evaluation. The effectiveness of the idea and its potential application were being evaluated with the audience of 'learning' managers in mind and the processes of information-seeking and decision-making.

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[33] Evaluation research is divided into 'formative' and 'summative' (Herman, Morris & Fritz-Gibbon, 1987; Patton, 1990). 'Formative' evaluation focuses on the results of the implementation and further improvement of the concept or process being studied, solely within a single setting, e.g. programme, project, company.

[34] Generalisation, in this sense, refers to decisions reached as to the expansion, continuation or termination of the idea evaluated.

As shown in this Executive Summary, the 'generalisations' derived from this evaluation appreciated and judged the framework in a positive way. The innovation of CONSTRUCT© was confirmed as was its flexibility and adaptability to construction organisations and other industries seeking to improve and change.

9.3 Finally...

This research contributes to the industry's need and efforts to change and improve. It accepted the challenge of bridging the gap between theory and practice and brings knowledge on good practice to interested parties, to aid their decision-making when taking action to achieve change. A central achievement is the production of rigorous *and* 'usable' knowledge (Argyris, 1985).

The practical problem of communicating academic or scientific knowledge to practitioners in a useable format was acknowledged (Argyris, 1982, 1983, 1985) and thoroughly considered. The interactive knowledge framework developed, CONSTRUCT©, was positively perceived by experts in construction and manufacturing. The experts' involvement was an additional benefit of the research method applied at that stage (that is, summative evaluation) as it *empowered* them to contribute to this framework and make it more usable and suitable for a specific industrial audience and purpose (Argyris, 1982, 1983, 1985; Nesan & Holt, 1999).

In the same way, this investigation addressed the need 'to improve the uptake of research results' and 'to increase the involvement of the construction industry and its clients in research', as identified by the Construction Research and Innovation Strategy Panel (CRISP) (CRISP, 1999). Therefore, this inquiry, through its action-orientation, increases the creation and sharing of knowledge and improves the interaction between

researcher and industrialists. Hence, it responds to strategic aims set up by CRISP, as part of the overall policy concern for improving and changing UK construction.

Furthermore, it has been suggested that humanistic investigations, depend on their audience to draw their own conclusions and interpretations (House, 1977). The present inquiry has involved its intended audience in purposely sharing their overall evaluation, interpretations and conclusions with the researcher. Hence, the question of *'pragmatic'* or *'face'* validity (Kvale, 1989; Patton, 1990) was addressed. A response to the issues of usefulness, usability and applicability was highly desirable (Miles & Huberman, 1994). On the premise that *"the ultimate test of ...credibility... is the response of information users and readers to* [it]..." (Patton, 1990:469), the face validity of the innovative contribution made by this research was affirmed.

In addition, the active involvement of the multi-sectoral industrial audience constituted a step towards the ultimate (and possibly longitudinal and post-doctoral) objectives of this work:

(a) the *sharing of the emerging knowledge* on successful project-based practices of construction and other sectors, and

(b) *the dissemination of the good practices being followed by the leaders in industry and advocated by researchers in academia to those genuinely wishing to join the leaders*.

In support of this, it has been stated that good qualitative research contributes to the:

> *"(a) levels of understanding and sophistication and (b) the ability of participants and stakeholders to take action during and after an inquiry and to negotiate on behalf of themselves and their own interests" (Lincoln, 1990, cited in Miles & Huberman, 1994:280).*

This reliance on the research audience comes as an indirect answer to Soltis's (1990, cited in Miles & Huberman, 1994:295) questions regarding the utilisation of research findings and results: 'Is consciousness-raising without action support enough?'; 'Do I have the right to change others?'; 'Is that paternalistic?'. The stance this humanistic investigation assumed and sustained is that, in this particular case, industrialists interested in changing and improving their projects and sector were invited to evaluate the non-prescriptive framework and further use it as a decision-making tool.

Using and evaluating a tool of good practice acts as an incentivisation method to approach knowledge leading to action. In this case, the industrialist experts' *voluntary* advance towards the good practice knowledge has been successfully performed and observed. The notion of 'emancipatory' research is relevant here as this research approach may "make... people aware of inequitable or oppressed positions and empower... their corrective action" (Miles & Huberman, 1994:280).

Finally, the intention of this investigation is that the incentive given leads to *awareness,* meaningful *action* towards achieving the indisputable needs for teamworking, integration, collaboration and trust (*directly stemming from the four central success factors proposed by CONSTRUCT©*) in the UK construction sector.

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