Understanding Designing and Design Management through Constituent Market Orientation and Constituent Orientation

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Abstract

The paper builds on research undertaken in Norway and Australia in constituent market orientation and models of affective design cognition to develop a more coherent and integrated theory frame for modeling designing in organisations, particularly the increasing number of design organisations undertaking virtual multidisciplinary teamwork.

Attempts to develop an integrated theory of the interactions between stakeholders have focused mainly on the properties of designed artifacts, the characteristics of the design problems and brief, or on the technical, social and communication processes. This has been less than fully satisfactory and resulted in a lack of adequate theoretical integration with underlying individual human processes, human values, motivations, feelings, eccentric proclivities, and the political foundations of human social behaviour.

This paper combines constituent market orientation with recent findings from brain research to develop theory to provide guidance for designers and design managers wishing to improve their effectiveness and efficiency in commercial contexts.

Introduction

This paper focuses on improving the performance and management of design activities through findings from constituent market orientation and affective cognition.

Improving the performance and management of design activities is important because of their key roles in innovation and social and economic development. Innovation is the process of transforming new scientific knowledge into products, systems and services that bring economic and social benefits and is strongly shaped by design activities (Commonwealth of Australia, 2001; Dept of Industry Science and Resources, 1999, pp. 3, 9-10; Innovation Summit Implementation Group, 2000; Love, 2002; Love, 2000; Love, 2000; Love, 1998; The British Council, 2001).

Designers and design teams undertake the transformation of new human knowledge into designs for real-world products, systems and services, and thus play a key role in innovation processes on which social and economic development depends. Improving design teams' performances increases commercial and social benefits by improving efficiency and effectiveness of design processes: offers immediate and direct improvements in innovation (Baird, Moore, & Jagodzinski, 2000; Sarsfield, 1998). Successful design teams offer competitive advantage. They shorten time to market, reduce life cycle costs, improve designed outcomes, minimise risk of adverse economic consequences of design failures, and reduce the intrinsic costs of the design process.

Achieving the full potential and efficiency of design teams has been elusive (CIPD, 1999; D'Hertefelt, 2000; Macmillan, Steele, Austin, Kirby, & Spence, 2001). Research has not resulted in well-developed strategies for the optimal management of multidisciplinary design teams. This is due to: conceptual difficulties; poor theoretical foundations; the direction of research efforts; and poor integration between theories, findings and theoretical perspectives, especially between human and technical issues (see, for example, Dixon, 1987; Love, 2000, 1998; Lovins, 1993; O'Doherty, 1964; Pugh, 1990). We need a unifying theoretical framework that spans across: the individual subconscious cognito-affective basis of design activities, team interactions, technical issues associated with complex design problems, communications between stakeholders, and the interactions between design activities and other organisational, business and commercial processes.

This requires pragmatically useful definitions of core concepts. The following definitions by Love (2002; 2001; 2000; 1998) align with other disciplines and with major dictionaries:

- 'Design' - a noun referring to a *specification* for making a particular artifact or for undertaking a particular activity. A distinction is drawn here between a *design* and

the manufactured outcome.

- ‘Designing’ - non-routine human internal activity leading to the production of a *design*.
- ‘Designer’ - someone who is, has been, or will be *designing*. Someone who creates *designs*
- ‘Design process’ - any process or activity that includes at least one act of ‘designing’ alongside other activities such as, calculating, drawing, information collection, many of which can be routine or automated.

This paper brings together business and organisational issues associated with design teams in commercial contexts and individuals’ behaviours and internal functioning. It points to a coherent theory stream that includes individual activities, construction of knowledge, and commercial organisations’ dynamics that offers two practical benefits:

1. Improvements to how designing is undertaken at individual and team levels to better support the vision, mission and strategic organisational outcomes of planned organisational processes.
2. Improved understanding in management as to how expertise and other resources used in designing can be better used to gain competitive advantage and organisational security.

The underlying problematic has three parts:

- The lack of a comprehensive model of designing spanning the large number of disciplines and theoretical domains that are involved, which would provide a sound basis for analyses to support improvements to designed outcomes. For a multidisciplinary field such as design research, it would be expected that theories have identifiable and theoretical support for their relationships to all of Friedman’s six sectors (Friedman, 1999). They must form at least one continuous pathway through all nine levels of Love’s (2000) meta-theoretical hierarchy.
- Epistemologically and conceptually, the body of literature of research into designing and designs is marked by confusion, conflation and confabulation of ideas and analyses (Love, 2000).
- Lack of conceptual and epistemological bridges between theories about: ‘individuals’ designing’, ‘design processes’ and ‘business processes’.

In combination, theories of constituent orientation and physiologically based theories of design cognition offer the means to address these problems and provide epistemologically sound bridges between the different classes of theories.

The theories and research findings of Constituent Market Orientation (CMO) are supported by research findings about the physiological processes underpinning human

cognition, motivation, attention, and agency. This is an important issue. Most theories about business, management, organisations, planning, design, group and individual behaviour and motivation have inadequate causally based epistemological foundations. Their justification is tenuously, and epistemologically inadequately, based on correlations between information about external properties more appropriate to theory making about simple passive physical objects. The combination of CMO and physiologically based theories of human cognition explain how the orientations of stakeholders can positively shape design processes and designed outcomes, and improve design management.

This paper consists of five sections. The second section provides an overview of constituent orientation and constituent market orientation. The third section describes the contribution new brain research findings make to providing a sound causal foundation for constituent market orientation to improve designing, design management and business outcomes. Section four demonstrates how constituent market orientation and affective cognition theories provide insight into improving design outcomes and managing design processes successfully. Section five provides a summary and a short list of improvement heuristics for designers and design management.

2 Overview of Constituent Market Orientation (CMO)

This section draws on Tellefsen's (1999; 1995) extensive research into top-management led programmatic and natural learning based on feedback from the constituents ('market-back') theory of Constituent Market Orientation (information from 235 CEOs, 244 market managers, 188 purchasing managers, 163 personnel managers, 179 union representatives, 154 PR managers, and 175 lobbying managers). His findings indicate that these theories are broadly applicable to a wide range of organisations, including design organisations.

Like all living creatures, organisations can only be understood and defined in their environmental context. When constructing a business solution, many constituencies and stakeholders determine the business idea's market value, effectiveness, and efficiency. These include: labour markets; downstream markets; collaborative markets; upstream markets including suppliers, market regulators such as industry associations; governments; and general influencers like the media and the public. Market-oriented leaders direct their attention and efforts towards these constituent markets to maximise a business unit's competitiveness. The above distribution of attention and the associated learning patterns forms the 'constituent market orientation' of an organisation.

Market orientation is a theory of environment-driven organizational learning and innovation. Individuals learn through interacting with their environment. The closer the interaction with a particular part of the environment, the more the individual learns about that part. If an individual has no direct interaction with a part of the

environment, that part will become unknown and invisible. Commonly, the constituent market orientation of an individual becomes unbalanced and results in increased focus on some constituents and partial ignorance of other constituents.

The individual's group membership configuration is the most important factor of their orientation. Intense learning occurs primarily in face-to-face groups. Groups with frequent contacts and internal double and triple-loop learning establish a strong culture with common beliefs, values, goals, priorities, language, habits and recognition patterns. In larger group contexts, they form a sub-culture. The number, type and heterogeneity of an individual's cultural traits (often referred to as the individual's personality) depend on the number and type of social groups he or she belongs to. Each individual's consciousness is limited, tending to routinise behavior, and result in focusing on a limited set of social relations. When an individual is preoccupied with something — due to habits or previous learning of beliefs, values, priorities and goals — other things are unattended, invisible or not comprehended.

Crossan et al (1999) say the same limitations apply to groups sharing mental frames, paradigms, observations and experiences. These limitations combined with in-group double-loop learning; result in many groups developing distinct, homogenous, and stable sub-cultures. These factors interact with other organisational, management and leadership factors in significant ways. An organization institutionalizes what tasks are to be carried out by whom, who works with whom, and the rules and intensity of interactions. The nature and structure of the institutionalization has profound impact on the emergence of distinct sub-cultures within industrial clusters, networks of cooperating firms, single firms, and inter- and intra-organizational work-groups. The tighter group-internal relations are, and the looser the group-external relations are, the stronger the sub-cultures of individual groups become.

The market orientation of many firms is primarily downstream. Most businesses also have other constituents (stakeholders) such as suppliers, staff, regulators, government agencies, the media and customers. The complex interconnected markets or networks in which most organisations operate dictate that a constituent orientation is required to fully realise value inherent in these markets and associated stakeholder relationships. The value of the product, systems or services is defined and created through identified interactions between the organisation and upstream and downstream constituents.

Consciousness is limited and the agents of the organisation (typically leaders or managers) become preoccupied because of previous learning, beliefs and values, leaving other parts of reality to become incomprehensible, invisible or unattended. CMO provides a means to map, define, and prioritise these alternative realities and relationships. The cognito-affective research findings provide causal explanations that support these high-level CMO models.

CMO based organisations succeed by focusing on market behaviour optimisation through managed interaction with their constituents and the development of systems and architecture which allow them to respond quickly and correctly to signals from

across their network. Specific business units or work groups may demonstrate orientations that differ from the organisation and other groups. Leaders need to support integration through programs designed to generate double loop learning across work groups and business units.

Business success depends on being oriented toward the needs of multiple constituents. Members of the organisation must know the constituencies, how they are affected by and how they value solutions. Members of the organisation must develop a common purpose and a common set of solutions. These solutions must also satisfy diverse wants, goals, and agendas of each constituent. If not, people will exit the network, whose social legitimacy is reduced (Tellefsen, 1999, 1995).

In designing, as in other forms of business, there are two main organisational traditions: organisations focused on individuals, and team-based organisations (Tellefsen, 2000). In organisations built on the individual, the overall task is divided into subsets of functionally defined sequential tasks until each sub-task is small enough to be handled by one individual. Authority is delegated down a hierarchy from individual to individual. When an overall task is split up, two organisational challenges arise:

- Hierarchic integration of expertise to manage the total task.
- Horizontal co-ordination among experts to link activities along value producing chains and networks.

Integration and co-ordination are the domains of individual managers. The line of command is the vertical integration axis and can be very efficient in stable environments. The individual focus tends to overload the hierarchy, and extensive control of lower levels, bureaucratisation, and inflexibility follows. Limited span of control produces many vertical layers. Since the hierarchy is top-down, experts at lower levels are not expected to take part in co-ordination and integration and lack the motivation and insight to do so. This tends to create adversary political groups, since only one truth can be used to legitimise the use of power and selection of means and solutions. The idea fight becomes a war of organisational dominance and personal position in the hierarchy, and directing resources to own causes.

Team-based organisation originated in the group-oriented Japanese society. The team defines purpose, goals, values, strategies, products, and the means and methods to be employed. Every team member contributes to integration and co-ordination. The organisation is driven and directed bottom-up. Instead of leaving the problem detection and solution to individuals who dictate others, team members all listen to the environment and share information in horizontal systems. The team works on the problem definition and solutions until it has reached a common understanding and consensus on what to do. Creating solutions often require more time and effort in teams. Implementation is normally faster and less prone to sub-optimisation, conflict, misunderstandings, and mistakes, but compromises may eliminate optimal solutions.

When a team works optimally, leaders emerge. Leaders at one level become members of the next level team until accumulation is reached to take care of the total task. Rewards are group based (Manz & Sims Jr., 1995). Team proponents believe that individual expertise only has value when combined with the expertise of others. Focus is on totality, integration, synergy and co-ordinated change. This allows flat structures with decisions close to the point of value creation.

Team socialisation processes can make teams self-centered, reducing their effectiveness, creativity and quality of outcomes. The lack of room for distance, alternative thoughts, and divergent and competing power structures may reduce the production of new tacit knowledge that the group solution is so adept at turning into tacit knowledge. By including members from other cultures, institutions, teams and constituencies on a rotating basis, this problem of lack of heterogeneity and inward focus can be eliminated.

Team-based organising is easily extended to creating flexible, cooperative networks within industrial clusters. These networks can be anything from strategic to taking care of one-shot innovation and design tasks where expertise from many vocations and institutions need to be combined. Often the networks consist of several hierarchy levels, from governance groups to permanent and *ad hoc* administrative, developmental, implementing and production teams.

3 – Physiological basis of human affective cognition in designing

Designing involves many internal and external phenomena relating to: designers' internal creative processes involving partially completed design solutions, underlying semiconscious 'design worlds', 'feeling-based' valuing and decision making structures; and the communication of these between designers and other stakeholders. In organisational terms, it includes: the internal processes of individuals; the group processes of multidisciplinary design teams; and interactions between design teams, other parts of their organisation, and other social and economic stakeholders. Communication between these stakeholders requires common explicit knowledge, the codification of tacit knowledge, and situations for shared experience that multiply tacit knowledge (Johannessen, Olsen, & Olaisen, 2000).

Human somato-sensory processes play a significant role in design-related activities and their management. Recent brain research indicates that all of the internal and external aspects of designing are more determined by the physiology of body processes than previously realised (see, for example, Bastick, 1982; Damasio, 1994; Miller, 2000; Reilly, 1997).

The significant roles of physiologically-based somato-sensory processes in human cognition is widely supported by the neurological literature. Studies indicate that the

affective brain and body systems associated with feelings, emotions, values and subjective perception provide the initiation and regulation of conscious thoughts, including the creative ideas essential to designing (see, for example, Badgaiyan, 2000; Bastick, 1982; Damasio, 1994; Davis, 2000; Fabri, Polonara, Quattrini, & Salvolini, 2002; Fleckenstein, 1992; Franklin, 1999; Love, 2000; Macaluso, Frith, & Driver, 2002; Miller, 2000; Mogi & Tamori, 1997; Paller, 2000; Sloman, 2001). Important to designing is the way that the areas of brain central to gathering experience for use in later circumstances, is comprehensively linked with *sensory* and *motor* systems in both top down and bottom up arrangements (Miller, 2000). Reilly (1997) concluded that processes from the *sensory motor-domain* form the neurological foundations for computation in higher-level human cognition and creative cognition.

The emerging physiological picture is that designing is based on highly interdependent cognitive, affective and motor processes consisting of multiple parallel neurological and hormonal processes operating together in both brain and body (Damasio, 1994).

Damasio (1994) has drawn attention to the way human development has occurred through a layering of new physiological systems on top of, or alongside, existing systems. This results in older systems being reused in new ways, or in collaboration with new systems. Early in evolution, the simplest 'brain' neurological/hormonal processes of an organism were concerned with managing the organism by sensing its environment through its boundary and modifying (using its motor and other physiological systems) its boundaries' responses to its environment. These primitive proto 'brain' processes are distributed through the organisms' structure and essentially concerned with 'feeling' an organisms environment and drawing on past experience to produce relatively automatic responses that maximise the organism's survival possibilities.

The strong interdependence of feeling, motor and cognitive processes in humans are a consequence of the evolution of elementary proto-'brain' systems distributed throughout early organisms. Through human evolution, the layering of new physiological systems onto, and alongside, old systems has resulted in the foundations of human design cognition being actualised through many alternative parallel processes. These underpin much of the complexity and differences that mark human responses to their environments. One of the most significant to human behaviour, and especially designing, are the separate parallel neurological pathways associated with 'direct response' and 'as if' responses. A practical example, the experience of a personal insult produces direct responses in terms of thoughts (cognitive responses), feelings and emotions (affective responses), and gross and subtle bodily behavioural and physiological changes such as heart rate (motor responses). Thinking about the same experience, results in similar, but not identical, 'as if' responses. These responses are a result of the 'as if' experience being processed by slightly different neurological and hormonal pathways some of which are more open to conscious management and manipulation.

Although actualised through multiple parallel biological systems, human cognito-affective-motor processes are limited. It is impossible for a human to think of or process everything at the same time. The internal flow of events is strongly shaped by neurological and hormonally based dispositional mechanisms grounded in each individual's prior and current experiences, mental models, habituation and the conscious direction of their attention (Badgaiyan, 2000; Damasio, 1994; Miller, 2000).

The ability of an individual to refocus their attention does more than bring a different situation to their 'mind's eye'. It results in dispositional changes to their neurological, hormonal and memory systems that influence their ability to learn, act, and make decisions. This extended physiological understanding of the basis of cognition, decision making and action provide causal explanations and epistemological foundations for the observed consequences of CMO.

If brain areas associated with the affective aspects of cognition (feelings and emotions) are damaged then the result is usually the appearance of dysfunctions such as schizophrenia, manic-depressive disorders and a profound failure to make sensible and successful judgements. Miller (2000) and Dimasio (1994) have described patients with pre-frontal cortex being strikingly normal upon superficial examination, able to carry on a conversation, with normal IQ scores and performing familiar routines without difficulty. Their ability to organise their lives is, however, profoundly impaired.

One might expect that equivalent organisational malaises might ensue where organisation models of interaction and learning do not appropriately include equivalent 'affective' processes. It indicates that models of human designing and organisational processes are likely to benefit from a broader picture of human psycho-neuro-physiological functioning. It also implies that many aspects of organisational models of designing are more easily conceptualized and addressed if account is taken of the reality that human thought processes, decision-making, precognitive processes, and actions depend on physiologically based somato-sensory and somato-motor states and processes.

Physiological somato-sensory and somato-motor aspects of human thinking are particularly relevant in understanding *closure* of cognitive activities that determines human behaviour in designing and in organisations. *Closure* refers to the usually subconscious stopping, starting, continuation or redirection of human internal or external processes. For example, the connections of axons in a developing baby's brain involve closure processes shaped by a wide variety of environmental and intrinsic forces. All human development and functioning, including design cognition is dependent on closure processes. In the case of cognition, and especially creative design cognition, physiologically based somato-sensory and somato-motor issues are important because they enable closure in cognition (Bastick, 1982).

Closure processes are implicit in Rosen's (1980) conclusion that all forms of analysis depend on 'intuition' processes that shape an individual's logic (see, also Walton, 1997). They are a core part of primary cognitive processes such as those that underpin the 'human information coordinating behaviour' that Spink (2000) identified as an important element of human information management (as in designing).

These factors point to the human activity of designing being run through with closure-based activities. Simplified models of relationships between physiologically based feeling states; closure, design cognition, and individual's internal design optimization processes are described in Love (2000)

Rosen (1980) has shown that intuitive closure processes are often faultily described in terms of object attributes (a category confusion between activity and property). For example, whether a human is correct to say that 5 is the correct answer to 2+3 usually focuses on the properties of the numbers 2,3 and 5 and the closure process is assumed to be similar. In physiological terms, according to Bastick (1982), this involves physiological self-perception processes that lead to an individual feeling confident that the answer (5) is correct. Closure happens where people's internal state moves from them feeling uncomfortable, that 'the process is not complete and fully checked'; to feeling comfortable, that it is complete, and that they can proceed.

Increased understanding of the neurological/hormonal mechanisms underpinning closure provide further physiological explanation of the causal phenomena that underpin the findings of Constituent Market Orientation research, and the benefits that accrue from moving to team and constituent orientation-based organisational models.

The implications of both these findings have not yet emerged in design theories.

4 – Constituent Relations in Designing and Design Management

Designing involves many disciplines (Friedman, 1999; Margolin, 2000) and is conceptually and epistemologically complex, especially collaborative designing involving multiple quantitatively and qualitatively based disciplines.

Throughout history people have worked together to accomplish tasks, make decisions and solve problems too big or complex for one individual. An organisation requires a common purpose, accepted by the group performing the overall task (French, Bell, & Zawacki, 1994). The task is best defined, organised and executed if the group has a shared understanding and accepts a common purpose. The group participates ideally in developing a goal hierarchy, a strategy and solutions; activities and knowledge that helps the group achieve the purpose (Aranda, Aranda, & Colon, 1998). In addition to

internal management factors, the history, culture and competitive climate influence outcomes. The organisational challenge is threefold:

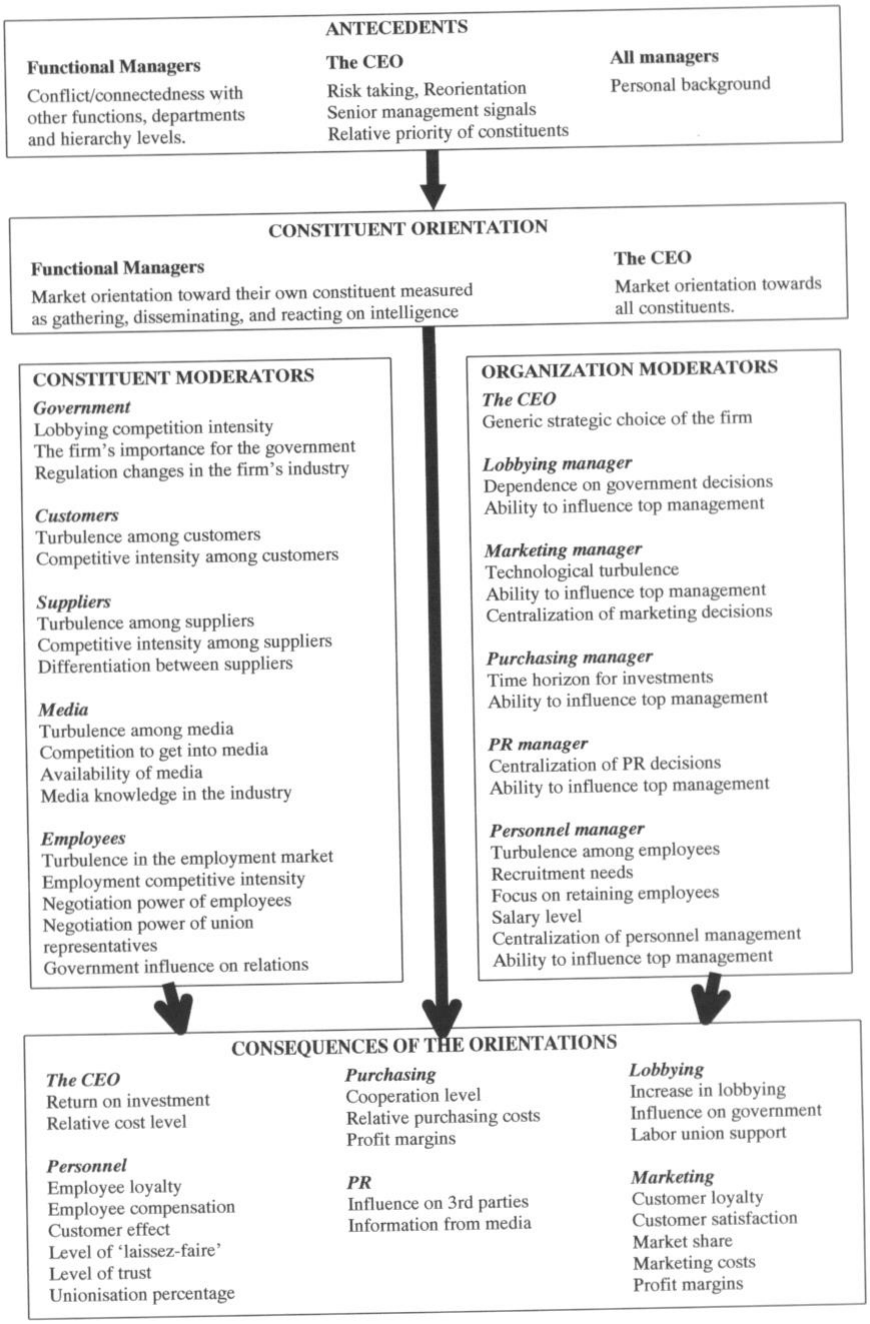
- Creating open, inclusive systems for transferring explicit knowledge and storing shared memory (single-loop learning (Argyris, 1977)).
- Establishing meetings for shared development of learning and transfer of tacit knowledge (double loop learning (Argyris, 1977), or generative learning (Senge, 1995).
- Creating a learning environment (Fifth discipline (Senge, 1995) and triple-loop learning (Argyris, 1993; Senge, 1995)).

(Tellefsen & Love, 2001) indicate that leadership of an organisation has to construct and manage four parallel systems in addition to the system for current operations. To establish and maintain a holistic business idea the leadership group needs to use:

1. The power system: Ownership that establishes who 'we' are, social legitimacy, authority to make decisions, risk-taking, the distribution of values gained and consumed (including financing of investments, distribution of revenues and costs, liquidity and profits)
2. Internal driving forces: Common beliefs, purpose, values and objectives of the organization
3. Strategy making processes: The processes and systems for developing organization-wide agreement on who 'we' are, our image, who we want to relate to and exchange values with (the stakeholders), who the 'others' are (competition and other constituents), how to compete (defining moral and wanted behavior) and with what (technology and know-how).
4. Operative management and systems: Management processes and procedures, including methods for task delegation, solving disputes, accountability, value production, value distribution, delegated risk-taking, Development and integration of real-world and virtual systems of operations.

The Constituent Market Orientation analysis of an organisation is represented in Figure 1 below (Tellefsen, 1999).

FIGURE 1: A model of constituent orientation



In Figure 1 above, the antecedents determine the extent of constituency based market-oriented learning that takes place within the organisation. This learning provides the human competitive edge that makes an organisation more effective and efficient than similar organisations. The focus of CMO here is the consequences of the direction of attention of members of an organisation towards different important constituents of

the market within which the organisation operates. Important findings that emerged from Tellefsen's research and from the ensuing theory model are as follows.

1. The higher the conflict level within an organisation, the lower the external driven learning.
2. The better the nerves among top leaders, the more market oriented learning occurs.
3. The more the leader is preoccupied with proper market orientation, the more market oriented learning occurs in the organisation.
4. Increased focus on constituents performing prime activities in the value chain (Porter, 1985) increases market oriented learning, whereas focus on others (government, media, industry organisations, etc) lowers the aggregate externally driven market oriented learning.
5. Top manager signals related to the content of market orientation increases market oriented learning in the organisation. Other signals weaken the market-oriented learning.
6. Higher environmental and internal turbulence, more intense competition, and higher degree of differentiation (from competitors) all strengthened the significance of CMO for outcomes. The opposite states of course weakened the effect derived from the learning.
7. A higher CMO led to getting more of whatever consequences are listed at the bottom of the model. The exception is the costs where higher CMO led to lower total per unit costs in an organisation.

Perhaps of most interest in terms of exploring a common ground of practice amongst stakeholders in design processes is:

8. The most important factor for a high constituent orientation is varied personal backgrounds within the leadership team. One-sided backgrounds, regardless of which it is, reduces the organisational CMO learning intensity, though it may improve learning with constituencies with same background as the leadership group.

Taken together these factors reinforce a single point for the integration of design activities into larger organisational purposes:

Simultaneous learning in many dimensions and directions is beneficial for the organisation. This learning has to be integrated through interdisciplinary and inter-organisational teams.

The obvious explanation for this is that innovations are complex and involve a series of groups that have to act together regardless of ownership and other institutional

arrangements.

Organizations that consist of heterogeneous groups with strong sub-cultures become difficult to govern and lead. Common language, perceptions, values, experiences, goals and habits are weak. Performance and behavior become unpredictable for the organization as a whole, and the organization will not be able to develop a common identity and image. The challenge to the leadership is to establish programmatic learning loops led from the center of power. The purpose of programmatic learning loops, is to establish common purpose, values, and objectives. They must also result in, a common understanding of language, facts, and the environment, with its internal processes and structure, constituents and stakeholders. From a strategic point of view, it is essential to establish definition between 'us' and 'others': the limits and borders of the organization and its competition. To establish a strong common culture in the organization, the common elements established by the leadership must be communicated to all members of the organization, and be implemented in all decisions regarding leadership style, organizational architecture, structures and processes, strategies, operations, services and products, and be reflected in all external communication with the constituents. An alternative, to this organizational approach to producing and exchanging values in the sub-groups of an organisation, is the market solution of distance and freedom of choice among the actors. Resource-based and agent-based theories of networks have explored the feasibility and economics of these alternatives: administrative versus market solutions of exchange (Conner, 1991; Dahlstrom & Nygaard, 1999; Heide, 1994).

Knowledge management is a key factor in the above issues (see, for example, Prusak, 1997). Learning theory distinguishes between tacit and explicit knowledge. Explicit knowledge can be communicated through a common language, which includes the meaning and feelings attached to body language, pictures, sound, and any form of symbols including written language. Knowledge can also be tacit, and can occur at several levels: individual, work group, networks, firm, industry, language group, etc.

5 – Summary and Conclusions

The paper has given an overview of the contributions and impacts of Constituent Market Orientation and new brain research findings for improving designing, design management, designed outcomes and business outcomes. It has sketched out an alternative theory framework aimed at improving the effectiveness and efficiency of organisations that include design activities that seamlessly stretches from the physiological underpinnings of human functioning in designing to theories of management and organisational learning.

The current lack of integrated theory impacts adversely on design management, leaving design managers managing complex design team situations on the basis of partial, contradicting, sub-optimal and, sometimes irrelevant knowledge. The lack of theory also impacts adversely on software development for supporting complex

innovation processes. Research in this area requires an integrated theory framework that draws on new knowledge from brain and neurology research, and is coherent with theories from management and organisational learning, and which pragmatically bridges across issues of structure and agency in human individual and group behaviours.

There are significant benefits for stakeholders:

- Large organisations with in-house multidisciplinary design teams: Improved economic efficiency, increased potential through innovation, minimization of cost and risks of failure.
- Organisations providing design teams services: Increased competitiveness, profitability and capacity for additional work, minimization of risk.
- Government: a direct, positive and immediate impact on the rate of innovation. Shortening of time to gaining social and economic benefits.
- Research Councils: benefits to research viability because efficient and effective multidisciplinary design activities improve the conversion of new scientific knowledge into real products, systems and services with economic and social benefits.
- Design Research field: New coherent and comprehensive theory foundations and radical extension of theory in fields of participative design, collaborative design, computer supported cooperative work, group decision support services, and virtual teamwork.
- Small businesses involved in designing: A theory model and strategies to support participation by individuals and small organisations in collaborative design teams.
- Lessens the need for ownership control of collaborative arrangements: CMO across institutions and disciplines will in crease the benefits of network solutions.

Words 4992 (excluding abstract and references)

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