

**PHYSIOLOGY OF ORGANISATIONS:
AN INTEGRATED FUNCTIONAL PERSPECTIVE**

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by

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Abstract

C.M. Dean Physiology of Organisations: An Integrated Functional Perspective

Organisational theories developed by academics are often regarded as complex and confusing by students and not very useful by managers. One solution to address these concerns expressed by the different audiences is to revisit earlier proposals which were rejected at the time, such as the theses proposed by Radcliffe-Brown during the 1930s for a single branch of science for the study of human society.

Radcliffe-Brown's single branch of science for human societies incorporates abstract, natural, and applied sciences, and the arts. His comprehensive proposal was intended to cover all audiences, but Radcliffe-Brown asserted that natural science, in the form of the study of the physiology of societies, was not yet available.

This thesis explores the practicalities of studying the physiology of organisations and proposes a project to test Radcliffe-Brown's theory. Various factors such as the concept of a natural science, interrelationships among functions and the consideration of scale and scope are considered and evaluated in order to find a practical approach to study the physiology of organisations and organised societies.

A prototype framework for the study of human physiology, based on the laws of living persistent entities, is developed and evaluated for applicability in organisations. A meta-analysis of change projects published in academic journals formed the research approach to ensure generalisability of the analysed results, and the findings were analysed within three functional categories of internal, operations and executive functions to test the feasibility of an analogous framework for organisations.

The thesis concludes that, with exceptions and areas for further research, it is possible to study the physiology of organisations and this could provide a bridge between academic theories and practical applied sciences by providing an integrated perspective on functions and their interrelationships in organisations.

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Chapter 1 Introduction

Complexity of Organisation Theories

“Organization theory has developed considerable complexity, so much complexity that doctoral students sometimes complain that it makes no sense to them. The students say they do not understand how the fragments of organization theory relate to each other, how they differ, what each has to offer. In particular, recognition has grown that organizations are quite heterogeneous. Since organizations are diverse and complex, and since they inhabit diverse and complex environments, the complexity of organization theory makes sense. But this complexity poses the classical dilemma of how complicated theories should be.” (Starbuck in Tsoukas and Knudsen, 2003: 176)

This observation, presented by Starbuck as part of his contribution in *The Oxford Handbook of Organization Theory* (2003), not only reflects the view expressed by some students, but also finds resonance in some academic circles, practising managers and management consultants. Burrell, for instance, identified the different audiences for whom organisational research is conducted and written, as a concern to be addressed in the future. He split the audience into academics, corporate management, middle management and employees and concluded that most organisational research and theoretical papers are written by academics, mostly for academics (Burrell in Tsoukas and Knudsen, 2003: 527). He suggested that corporate managers are not necessarily interested in academic theories, but in the corporate thinking of other successful organisations, while middle management’s interest lies with ideas, methods and tools that can assist them in their daily concerns (Burrell in Tsoukas and Knudsen, 2003: 526). Based on the observations of Starbuck and Burrell, these diverse interests of academics,

students and management audiences add to the perceived complexity of theories, thereby reducing the possibility of closing the gap in understanding and the application of theories and research information by different audiences. It becomes necessary to consider all three dimensions of theory and knowledge development; knowledge presentation; and knowledge validation and application by and to the audiences before the scope of the complexity of the theories and the applicability of these theories in practice can be evaluated and addressed.

Organisation and social theory, as developed by academics during the twentieth century, focuses on ontology, which explores the meaning of reality in society and organisations; and epistemology, which debates the objectivity of knowledge gained from observations in research (Burrell and Morgan, 1979: 1, 2). Burrell and Morgan summarised the development of social and organisation theory during the twentieth century by identifying and classifying the theories into paradigms, reflecting the different ontological and epistemological stances taken by the theorists (Burrell and Morgan, 1979: 23).

Management, as observed by Burrell, is not explicitly concerned with the ontology and epistemology of organisations, but instead is interested in gaining knowledge and insight into organisational theories and the potential for applying these theories within problematic organisational and environmental situations (Burrell in Tsoukas and Knudsen, 2003: 526). Morgan compared this need for insight to the use of metaphors or images, developed by theorists and management consultants, which can assist managers to understand and apply academic theories in their organisations. He accepted that a metaphor only provides a partial image of the relevant part of

organisations (Morgan, 2006: 3-5), but emphasised that metaphors can be used by management “to find fresh ways of seeing, understanding, and shaping the situations that we want to organize and manage” (Morgan, 2006: 5).

Whereas paradigms and metaphors are mainly concerned with the development of social and management theories, or generic approaches to social and organisational research, managers and decision-makers are also interested in scientific research projects providing empirical support for the theories, and practical solutions to their day-to-day concerns. This introduces the perspective of science through the application of targeted and systematic science-based techniques to gain knowledge and test theories about, and for, society and organisations (Whitley cited in Tsoukas and Knudsen, 2003: 2) and allow its practical application.

Knowledge Accumulation and Offering

The difference in audience interest and research focus as one of the reasons for the difficulty in sense-making of organisation theories requires some clarification in order to explore ways forward which could be beneficial to different audiences. The development and use of paradigms, metaphors and science is presented and discussed in more detail below.

Paradigms and Theories

Academic debates around paradigms, identified by Kuhn as the underlying laws, rules and assumptions that guide the research and interpretation of research findings (Clegg in Tsoukas and Knudsen, 2003: 541), were fuelled by the work of Burrell and Morgan in 1979. Burrell and Morgan based the paradigms on the dimensions of ontology and

epistemology in order to classify the different schools of thought in social and organisation studies. Ontology, the theory of the nature of entities (Bryman and Bell, 2003: 572, 19, 20), positions theorists on a sliding scale on which objectivism and constructionism form the opposing poles. Ontologically, objectivists are seen as realists who regard social reality as having an existence external to the understanding of the researcher. Opposed to this view, constructionists maintain that social reality is only created within the understanding of the observer. Epistemology, the theory of how to gain knowledge (Bryman and Bell, 2003: 569, 13-15), identifies positivists who maintain that knowledge is real and capable of being measured and tested within scientific and natural laws and rules, as opposed to subjectivists who believe that social knowledge is subjective and only valid at the moment of observation (Burrell and Morgan, 1979: 1-3).

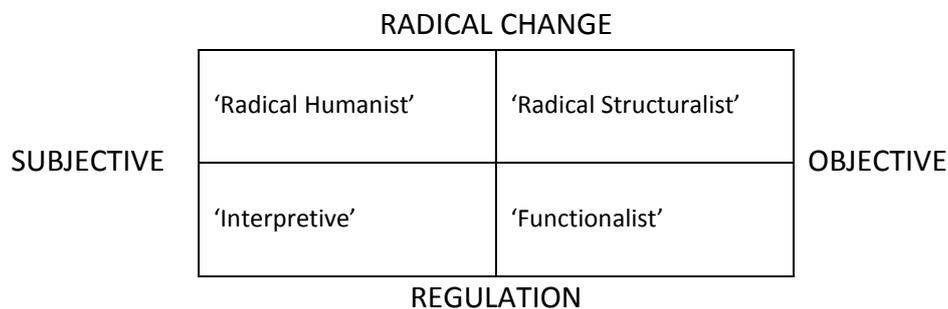


Figure 1.1 Burrell and Morgan's four paradigmatic quadrants (1979: 22)

Burrell and Morgan explored the history of social and organisational studies, and concluded that four paradigmatic movements can be identified, namely the radical structuralist, functionalist, interpretive and radical humanist movements (Burrell and Morgan, 1979: 22, 23). These four directions presented in Figure 1.1 were suggested to be mutually exclusive depending on the perspective of the theorist. Radical structuralism and functionalism, on the objectivist end of the ontological scale, offer an ontological objectivist and epistemologically positivist position, thus accepting that

society and organisations exist as separate entities which can be observed and objectively measured. The interpretive and radical humanist paradigms, on the opposite end of the scale, offer the ontological constructionist and epistemological subjective position in which “social phenomena and their meanings are continually being accomplished by social actors . . . they are in a constant state of revision” (Bryman and Bell, 2003: 20). In addition to the positioning on the ontological and epistemological scale, Burrell and Morgan added the dimension of regulation versus radical change to form the ‘order-conflict’ poles in the quadrant. Regulation refers to theorists supporting underlying unity, equilibrium and cohesion to explain society or organisations, while radical change theorists focus on continuous conflict and contradiction as characteristic of modern societies and organisations. They maintained that these quadrants form the matrix of the four paradigms (Burrell and Morgan, 1979: 16, 21-23). In their conclusion they recommended that the paradigms should be allowed to remain isolated by stating that “We firmly believe that each of the paradigms can only establish itself at the level of organisational analysis if it is true to itself. . . the paradigms need to provide a basis for their self-preservation by developing on their own account” (Burrell and Morgan, 1979: 397, 398).

The work by Burrell and Morgan presents a view of the past and future direction for the study, research and academic debate affecting social and organisation theories.

Positioning within the different quadrants of the paradigms continued, including inter- and intra- paradigmatic critique and debates among academics on the benefits of objectivism/positivism versus constructionism/subjectivism and the development of various theories within each of these paradigmatic streams. In addition, new paradigm

theories were developed and presented as alternatives to replace the four quadrant directions proposed by Burrell and Morgan. In an attempt to achieve some perspective on these plethora of emerging theories and paradigms, Hassard and Kelemen (2002) focused on the 'production and consumption' of knowledge of these theories and paradigms and identified the categories of non-consumers (unaware of debates); integrationists (a single paradigm is required); protectionists (stay with their preferred paradigm); pluralists (possible to communicate across paradigms); and postmodernists (try to find new paradigms) (Hassard and Kelemen, 2002: 342-347). They favoured the pluralist view of building a communication bridge to link the theoretical streams and Hassard demonstrated with a case study that it can be done (Hassard, 1995: 92-110). However, there is still a concern within the ongoing debates among academics that it is not enhancing the status and acceptance of social and organisation studies as a coherent field of theoretical study (Lewis and Kelemen, 2002: 252; Hassard and Kelemen, 2002: 339; Ritzer and Goodman, 2004b: A-21), although the need for allowing different perspectives is accepted.

Within academic circles the academic debates will continue, as they should, in search of reality and objectivity in knowledge. From the perspective of researchers as an audience for knowledge, the focus is not so much to favour one of the paradigms, but to use the best on offer to support the research objective: "they purposefully work with whatever conceptual resources are available. Their work is shaped by their own paradigmatic preferences, the prevailing *zeitgeist*, and the institutional frameworks and norms within which their work takes place" (Brown and Duguid cited in Tsoukas and Knudsen, 2003: 11). However, if the theories need to be scientifically tested for applicability and

translated for the consumption of managers as an audience, an argument can be made in favour of an objectivist/positivist view of organisations (Reed in Tsoukas and Knudsen, 2003: 39, 40) within the functionalist quadrant of Burrell and Morgan's matrix because the functionalist schools accept society and organisations as independent entities which are subject to regulation, though continually required to adapt and change (Burrell and Morgan, 1979: 220). This element of realism is more in line with the acceptance of managers about the reality of the organisations they work in, and their ability to understand and address current issues affecting organisations (Reed in Tsoukas and Knudsen, 2003: 299-304). For the purpose of this thesis, the functionalist paradigm will be pursued as it allows for a closing of the gap among the different audiences in the understanding and knowledge about organisations and societies. From an academic point of view, other paradigms will be acknowledged and referred to, especially the use of pluralism or a multiparadigm framework (Lewis and Kelemen, 2002: 253) to allow communication across the different paradigmatic streams.

However, theories still require adaptation and interpretation to be understandable and meaningful to management.

Metaphors, Methods and Tools

From the perspective of management and decision-makers as an increasingly important audience for academic research papers and theories, the interest is on practical applications of the theories developed by academics and offered as tools by management consultants. Within organisational research, the objectivist/positivist position plays a strong role in the development of organisation theories, however, when

practising managers attempt to apply proposed solutions and theories to organisational problems, the results are often without much success. Morgan (2006) proposed that organisation theories can be grouped and presented to management as metaphors or images, which, though effective as tools in the communication to management, can also be misleading:

“Our simple premise that *all theory is metaphor* has far-reaching consequences. We have to accept that any theory or perspective that we bring to the study of organization and management, while capable of creating valuable insights, is also incomplete, biased, and potentially misleading.” (Morgan, 2006: 5).

The danger, as explained by Morgan, is not in using a metaphor to elucidate theories, but in presenting a metaphor to managers as representative of the organisation as a whole instead of emphasising the partiality of its application. This difference between the development and proposition of theory by academics, and the application of knowledge by, and to, the practising manager has resulted in a financially lucrative sector of management gurus and consultants, creating their own theories and acting as translators of academic theories into practical solutions. Clark and Greatbatch explored the fashions and fads initiated by management consultants and gurus, as the self-declared experts in management and organisation theories, and found gurus to be involved in popularising new theories, often without peer reviews or even not based on factual information (Clark and Greatbatch, 2002: 10-18). This is a strong indictment against the exploitation of management by gurus and consultants, but also points to a gap between original and sometimes abstract knowledge pursued by academics to gain

theoretical insights, and the practical knowledge required by management in an effort to address the complexity of problems in their daily operations.

Morgan categorised the images or metaphors according to the underlying focus of the supporting theories. To demonstrate the partial image of organisations, four of the metaphors are discussed below, namely organisations as machines; organisations as organisms; organisations as brains; and organisations as psychic prisons. These four metaphors were selected out of the eight categories presented by Morgan, as representing the different and influential views about organisations.

Classical management theories, such as scientific or bureaucratic management theories, offered mechanistic solutions to improve production during the first half of the twentieth century (Morgan, 2006: 13). Key recommendations by theorists like Taylor, Fayol and Weber were to implement work specialisation; to separate management planning and control from task execution; and to apply stringent mechanistic methods such as 'time and motion' studies or 'management by objectives' to define and monitor the execution of tasks. While this metaphor accepted the necessity of the different functional departments identified in proposed hierarchical organisation charts, these hierarchical charts emphasised the specialisation of functions thus resulting in the growth of departmental empires and restricting cooperation and the ability of the organisation to address change (Morgan, 2006: 30). Rejected as rigid and dehumanising to workers by subsequent organisational theorists such as Maslow (Morgan, 2006: 36), the mechanistic approach to rationalise workflow is, however, still used in operational research in certain business sectors (Peaucelle, 2000: 452). An example of where this metaphor is still accepted is referred to as the 'McDonaldization' of organisations such

as fast food businesses. The service activities of the staff are clearly prescribed and closely monitored in order to promote productivity and a standard type and level of customer service (Ritzer and Goodman, 2004b: 423; Royle, 2006: 757-779; Morgan, 2006: 27, 28). Although rejected by many theorists such as Ritzer (2004b: 423) as dehumanising and favouring quantity over quality, this approach is still employed by organisations where the tasks are routine, the environment stable and precision and consistency is essential (Morgan, 2006: 27).

Morgan identified the metaphor of 'organisations as organisms' to include theories offered as a counter argument against 'organisations as machines' (Morgan, 2006: 33). These theories were built on the acceptance of the importance of cells and the relationships among cells within organisms, therefore addressing the 'dehumanising' effect of organisations as machines by recognising individual needs by theorists like Maslow (Morgan, 2006: 37). In addition, the need for the organisation to address and adapt its structure and strategy in order to persist within its environment was promoted by the contingency theorists such as Burns and Stalker, Woodward, and Lawrence and Lorsch (Morgan, 2006: 42-49). The recognition of the need for functions and processes to support the operation of organisation as proposed by the early classical theorists within the metaphor of organisations as machines was replaced by interpreting functions to address the biological needs to adapt to the organisation's environment and to influence organisational health and development (Morgan, 2006: 34). This metaphor does therefore not actually present an organisation as a biological whole, but provides a partial focus on specific elements of individual, structure and strategy. New theories were offered to management, including the focus on alternative organisation

structures such as matrix organisations or teamwork instead of functional identification (Morgan, 2006: 52, 101-106); strategy formulation to adapt to the environment (Morgan, 2006: 55); and theories to influence the environment, such as competencies and scenario planning (Hamel and Prahalad in Segal-Horn, 1998: 35-49; Moyer, 1996: 172-181). Organisations, however, require a balanced interrelationship among the all the functions in their organisations. For example, strategic planning to address external challenges and concerns is regarded as one of the essential functions of management, but has to be adapted based on information about product offering and the competitive environments of the organisation (Grant, 1998: 77; Cho and Hambrick, 2006: 453-469).

Within the study of societies the early theories comparable to the organisational metaphor of organisations as organisms were developed by social theorists from the school of structural functionalists such as Radcliffe-Brown and Parsons. Radcliffe-Brown argued the point that there should not be separate sciences such as law, economics, politics and management, but that these should all be studied as the functions performed within a single science of society (Radcliffe-Brown, 1957: 110-117) while Parsons promoted the societal subsystems and functions of the fiduciary system, societal community, economy and politics as part of his model (Ritzer and Goodman, 2004b: 101). These theories, similar to the theories of organisations as organisms, were criticised for being too prescriptive, too generic or difficult to apply and although functions of economics, politics, law and communications became and remained accepted specialist fields of study, the general theories lost ground during the latter parts of the twentieth century (Burrell and Morgan, 1979: 56, 57).

The metaphor of organisations as brains mainly addresses the information handling and decision-making processes in organisations (Morgan, 2006: 72). Although a very important function, the focus on information led to theories of power through information and the importance of politics within organisations. Organisations as political systems focus on the role of power within organisations, moving towards the constructionist end of the ontological scale and the power inherent in people and organisation (Morgan, 2006: 166), but also as a weakness if decisions are not based on relevant information. Pfeffer and Sutton addressed the impact of this partial perspective and knowledge on failed mergers, and identified some of the reasons for poor management decisions as casual benchmarking; relying on what seemed to have worked in the past; and acting according to beliefs of what might work (Pfeffer and Sutton, 2006: 6-12). They promoted the evidence-based approach currently followed in medicine in which information is collected from within and external to the organisations, and then considered in perspective before deciding on a path of action:

“Business decisions, as many of our colleagues in business and your own experience can attest, are frequently based on hope and fear, what others seem to be doing, and what senior leaders have done and believe has worked in the past, and their dearly held ideologies – in short, on lots of things other than the facts. Although evidence-based practice may be coming to the field of medicine and, with more difficulty and delay, the world of education, it has little impact on management or on how most companies operate. If doctors practiced medicine the way many companies practice management, there would be far more sick and dead patients, and many more doctors would be in jail” (Pfeffer and Sutton, 2006: 5).

The metaphor of 'organisations as psychic prisons' focuses entirely on the impact of organisational interrelationships on individuals (Morgan, 2006: 207), in other words the constructionist end of the ontological scale, and the importance of knowing the needs and aspirations of individuals regardless of their functions within the organisation. This metaphor, although promoted by consultants and theorists to assist employees individually, contained an inherent danger "that it raises the spectre of an Orwellian world where we attempt to manage each other's minds" (Morgan, 2006: 240). While Morgan accepted this method of management to try and manage organisational culture to the benefit of the organisation, he admitted that it is not likely to produce acceptable results and is therefore not an easy way to resolve problems within the organisation.

The four metaphors presented above are representative of the metaphors identified by Morgan (2006), although not complete. The partiality of metaphors can be detected in the metaphor of organisations as machines, mainly addressing how organisations produce and offer their products to market; the metaphor of organisations as brains focusing on how to obtain and interpret internal and external information for decision-making purposes; and the metaphor of psychic prisons in which the employees form the focus, regardless of their position or functioning within organisations. In my opinion, the one metaphor which has the potential to provide an integrated image of an organisation is the metaphor of organisations as organisms. Unfortunately this metaphor was linked to theorists who focused on strategy and structure over functions, and within the structure moved towards the importance of the structure of culture and language in the formation of organisations as the most important feature (Ritzer and Goodman, 2004b: 102). Theorists thus moved away from an integrated perspective on the functioning of

organisations (Burrell and Morgan, 1979: 57) to another partial metaphor of culture and language.

This discussion on the paradigms developed by academics showed that the knowledge gap between theorists and management is narrower in the functionalist quadrant of the paradigms, the perspective which managers would favour to provide an integrated image of the organisations as independent entities such as organisms. However, in this case the metaphor should cover organisations in full, and not present partial images as the full metaphor. This full framework of knowledge could be driven by the metaphor of organisations as organisms within the functional school of thought, but should then be comprehensive, testable and applicable to management, therefore, becoming scientific knowledge and not only theories.

Organisation and Social Studies as a Science

In addition to theories as paradigms and metaphors, the scientific approach to the study of organisations and societies attempts to bridge the gap between academia and management with a greater or lesser degree of success. However, as in the case of the different paradigms and metaphors, there are also different interpretations of what a science of society and organisation is or should be.

Social sciences cover a broad range of academic disciplines studied by using both qualitative and quantitative techniques to gain understanding and provide advice to society (Bryman and Bell, 2003: 280). These sciences are closely associated with the subjects of specialisation and cover diverse subjects such as anthropology, economics, education, law, politics and sociology (ESRC, 2011).

Organisational science “aims to create valid explanations that capture how the organizational world really operates, rather than to broadcast views that may better accord with values but which are not accurate characterizations of the world as it exists” (Donaldson in Tsoukas and Knudsen, 2003: 42). On the paradigmatic scale, organisational science is therefore taking a positivist stance, accepting organisations as independent entities. However, although organisational science attempts to learn from the natural sciences in the quest to gain knowledge about organisations and societies, the main focus is on developing theories of organisation, instead of offering a comprehensive and integrated base of the acquired knowledge.

Management science as a third interpretation of the sciences of organisations and societies is often associated with operational research, using empirical, mathematical or simulation modelling techniques to study organisations as natural entities within their environments (Bryman and Bell, 2003: 68; Wikipedia, 2011). Of the three types of science, this approach offers alternatives and potential solutions to management, and can be found within the individual subjects covered by social sciences, such as organisational simulation in qualitative social studies (Bryman and Bell, 2003: 188, 189), market and economic modelling, and empirical testing of theoretical concepts or solutions.

Using science as the preferred solution to close the gap in understanding among academics, students, managers and consultants is, therefore, not a straightforward solution due to the different interpretations and applications of the term. The *Oxford Dictionary and Thesaurus* defines science as “(1) the systematic study of the structure and behaviour of the physical and natural world through observation and experiment.

(2) An organized body of knowledge on any subject” (2007: 925). This definition accepts the topic for scientific study, including societies and organisations, as objectivist and able to be phenomenally observed, measured, evaluated and collected into a body of knowledge available to users. However, although this body of knowledge includes functions of accounting, marketing, human resources and production, the focus is on the management of culture, structure, power and control, in other words on the metaphors developed from past and current organisational theories (Linstead et al., 2009; Smith, 2007). Not all functions identified by early theorists and included in current organisational structures are covered, such as the legal function, and minimal emphasis is placed on the interrelationships among these functions. Different theories and pools of empirically tested knowledge have developed, still within the different fields of specialisation and the different paradigmatic streams of thought (Tsoukas and Knudsen, 2003). However, little information or research offers an integrated perspective or addresses the impact relationships among these specialised topics.

Summary and Selection

The three approaches to acquire knowledge, namely: paradigms to develop theories based on what is reality and the objectivity of knowledge; metaphors to present this information to managers as practical tools and knowledge; and science based on empirical testing of the theories, may explain why organisational theories are perceived to be overly complex as alluded to by Starbuck. However, they do not present an obvious solution to developing a knowledge base acceptable to all the different audiences.

A knowledge base acceptable to managers and decision-makers as an important audience seems to favour an objectivist/positivist position on the ontological and epistemological scale which accepts the reality of organisations as independent entities while providing as much information about the organisation as possible. A preferred stance for this research project is, therefore, the paradigmatic functionalist approach with a wider interpretation of the metaphor of organisations as organisms and requiring information to be validated and tested through scientific research methods. This base of knowledge should not offer a model for organisations to strive to, as in the case of metaphors, but should provide a framework of empirically tested information derived from the metaphor of organisations as organisms in which the audiences can find information about the functioning of organisations on which to base applications and problem-solving research. This approach will, however, sideline more abstract theoretical research in which knowledge is explored for its own sake (Parker in Dent and Whitehead, 2002: 138-156). In this respect it may be worth revisiting the theses and propositions put forward by the founders of early functionalism (Burrell and Morgan, 1979: 49), and specifically the comprehensive set of theses presented by Radcliffe-Brown during the first half of the twentieth century.

Radcliffe-Brown proposed that it is possible and advisable to work within a single branch of science for the study of human societies, focusing not only on natural scientific research and learning based on quantitative measurement and phenomenal observation (Bryman and Bell, 2003: 69), but on a comprehensive inclusion of all types of science. He included the abstract science of philosophy and mathematics based on logic; natural sciences building a knowledge pool based on phenomenal observation and empirical

validation; applied sciences offering potential solutions and tools to address problems; and the arts as a suitable method to present knowledge and research findings, for the study of societies and organisations (Radcliffe-Brown, 1957). Radcliffe-Brown argued that all four types of science must be integrated within this single branch of science and that a comprehensive natural science for the study of human society or organisations was still missing. He proposed that a science equivalent to physiology could form the basis for this natural science. This comprehensive proposal for the use of science may address the concerns which need to be overcome for the different audiences of academics, managers, consultants and students in their search for knowledge about societies and organisations. It may enable an integrated knowledge base to be developed which can be used by both academics and practitioner managers, thereby closing the gap between researchers, their objectives and audiences, while at the same time still acknowledging the role of the different types of science within the study of organisations and societies.

In his own discipline of anthropology Radcliffe-Brown was highly regarded, however, his reference to society as a living entity warranting a separate branch of science was criticised and ignored (Kuper, 1977: 1).

Is a Science of Human Societies Possible?

The concern identified at the beginning of the chapter was the complexity of social and organisational theories resulting in the difficulty for different audiences to understand and apply these theories in practice. By evaluating the way in which this information about organisations is developed by academics through paradigms; presented to

managers through metaphors; and evaluated, tested and applied through scientific research, resulted in a conclusion that it may be possible to cover all these requirements by critically evaluating Radcliffe-Brown's theses for a single branch of science for the study of human societies and specifically the feasibility of applying the physiology of organisations as a natural science in this branch of science. Physiology as the natural science should provide the functional organismic view of the functioning of organisations required by managers and researchers, while the single branch of science incorporates all the types, including abstract science of philosophy and theory. My research project is limited to test the feasibility of studying the physiology of organisations through a meta-analysis of current research publications and determine whether this approach can contribute to the current knowledge and debates around organisations and societies in academic circles as well as providing a knowledge repository for applied sciences and management to draw from.

Chapters 2 and 3 critically review the hypotheses of Radcliffe-Brown. Chapter 2 presents his theses and discusses the underlying concepts of science, process, function, structure and system as used by him in the integrated proposal. As one of the founder members of the structural functionalist movement, his theses on physiology as the preferred study for organisations as organisms will be compared to the theories put forward by the other members of this group such as Talcott Parsons, as well as subsequent theorists and the critics of this school of thought. The chapter concludes with the proposition that it is feasible to further explore the study of the physiology of organisations as one of the natural sciences within the comprehensive branch of organisation and social science. Since the criticism against his theories highlighted areas of concern in the practical

application of the theses, Chapter 3 focuses on the problems of addressing a natural science in the form of physiology for societies and organisations. It expands on Radcliffe-Brown's theses by addressing constraints in the practicality of studying the physiology of societies and organisations, and the context within which a research project can be conducted. Contexts of scale, relationships and identity are discussed, leading to a proposed delimitation of the scope for a feasible study and a research proposal for this project and thesis.

Concerns already identified in Chapter 1 include the debate around the feasibility of providing managers with a suitable comprehensive knowledge base to offer an integrated perspective of organisations. In a partial response, Chapter 4 explores the historical contribution made by physiology, the natural science for the study of the human body as a prerequisite in the preparation of medical practitioners, and proposes a framework used in the study of human physiology which can be tested for organisations. Physiology of the human body is used as a prototype analogy (Bowker and Leigh Star, 1999: 62) and presented with respect to the functioning of visceral or internal functions for survival and protection; motor functions to provide mobility and agility within the environment; and the cognitive functions, including the senses delivering information to plan and decide on strategic direction. The focus is on functionality and the interrelationships among the various functions.

Chapter 5 presents a conversion of the physiological framework into comparable organisational functions for validation and discusses the reasons behind the methods employed for the research approach and sample selection. In order to ensure the generalisability of findings (Bryman and Bell, 570), that is, addressing the potential

concern of research results being unable to produce acceptable conclusions that can be widely adopted, a modified meta-analysis of published research papers in accredited management and organisational journals was argued for and selected as the research approach. A detailed description is provided about the selection criteria used for applicable journals, publications within these journals, and the eventual interpretation, coding and capture of the findings for further analysis. To ensure that interrelationships can be observed, case studies and empirical research addressing change events in organisations have been identified as one of the selection criteria. Codification included the observed interrelationships during these change events, as well as relevant independent variables such as the country of research, the type of change and the result of the change process. Sample analysis validates the sample obtained from the research papers for scope, being wide and comprehensive enough to allow for further detailed analyses.

Chapters 6 to 8 present a critical interpretation of the research data analysed to identify the functions, roles and relationships observed within change events in organisations. In Chapter 6 the functions, roles and relationships of the identified internal functions of organisations, analogous to the visceral functions within organisms, are analysed and compared to the interrelationships identified in the physiology of the human body. Areas of inadequate observations or an inability to match with an acceptable level of confidence are identified and explored. Chapters 7 and 8 repeat the analysis process for operations functions analogous to skeletal muscle units, and the cognitive or management functions.

In Chapter 9 the research approach and findings are critically reviewed. The value of the study of the physiology of organisations is explored with respect to its usefulness to address the concerns raised against Radcliffe-Brown's theses and to address some of the issues facing modern organisations and society. The final conclusions identify further areas for research and suggest a suitable way forward to meet the needs of the different audiences of organisational knowledge.

Chapter 2 Radcliffe-Brown and the Science of Human Societies

“Indeed, structural functionalism as represented in the work of Radcliffe-Brown has proved a rare and transient phenomenon” (Burrell and Morgan, 1979: 57).

Introduction

Chapter 1 raised the concerns of the different audiences to understand and use theories and research findings of society and organisations. In order to develop a pool of knowledge that can be used by the different audiences as a framework of reference, the conclusion was that a compromised position on the ontological and epistemological scale will be objectivist/positivist, therefore accepting societies and organisations as independent entities that can be studied within scientific laws and means. This places the knowledge base within the functionalist quadrant of the paradigm schools of thought where it supports the metaphor of organisations as organisms and uses a natural scientific approach to organisational research. However, while functionalism will suit managers and decision-makers because it offers the view of organisations as independent entities which can be objectively observed and tested by means of scientific methods, it was also accepted that this position should not be offered as an exclusive alternative to subjectivism, especially within the interpretive paradigm quadrant (Burrell and Morgan, 1979: 22). The proposal was to revisit the theses of earlier functionalist theorists, and specifically the theories of Radcliffe-Brown for a single branch of science for the study of human society with the physiology of society or organisations as one of the natural sciences in this branch.

Radcliffe-Brown was recognised as one of the founder members of the structural functional movement, positioned in the functional paradigm quadrant. Other recognised members of the movement include theorists such as Spencer, Malinowski and Talcott Parsons. A discussion on the theories proposed by members within this functionalist quadrant is included before focusing on the specific theses of Radcliffe-Brown.

Functionalism

Functionalism, dating back to the philosophy of Comte during the early part of the nineteenth century, supports the positivist view of the world and society as a scientific reality and suggests that the scientific methods used in the natural sciences of astronomy, physics and biology should also apply to the study of society (Ritzer and Goodman, 2004a: 105). Comte used the biological model of the species to lay down his ground rules for a holistic study to understand social order and regulation. Although the positivist view of Comte influenced subsequent theorists, there were differences among the functionalist theorists during the nineteenth and early twentieth centuries.

Spencer (1820-1903) viewed society as a self-regulating organism “which could be understood through study of its various elements or organs and the manner in which they interrelate” (Burrell and Morgan, 1979: 43) and this laid the foundation for the concepts of function and structure. He maintained that self-regulation is part of the evolutionary process of societies towards increasing integration, heterogeneity, definitive structures and the coherence of the group. He regarded individualism as the driving force and proposed that the role of the state should be restricted to the protection of this individualism (Ritzer and Goodman, 2004a: 127).

The structural functionalist theories of the anthropologists Radcliffe-Brown and Malinowski built on the work of Comte and Spencer. Malinowski's (1884-1942) overriding contribution was to establish the importance of fieldwork in anthropology. He advocated a 'functionalist' explanation which argued that the characteristics of primitive social systems could be understood in terms of the biological functions that need to be fulfilled for the society to exist (Radcliffe-Brown in Kuper, 1977: 50; Burrell and Morgan, 1979: 50). He defined these functions as nutrition, reproduction, safety, relaxation, movement and growth (Langness, 1987: 80). Radcliffe-Brown (1881-1955), however, defined the concept of function as an analogy between social life and organic life, using Durkheim as his starting point. Unlike Comte and Malinowski, Radcliffe-Brown explained that it is not a set of inborn, or an imposed model of, functions that underlies society, but that the functions can be regarded as networks of interrelationships among the processual activities of the constituent parts to address conditions for continuation of the social structure (Burrell and Morgan, 1979: 51-53; Radcliffe-Brown, 1957: 26, 55). Unlike other functionalists who used the functions as prerequisites or models towards the maintenance of equilibrium or social order, Radcliffe-Brown's theories to place the interrelationships as underlying the formation of social structure did not exclude the acceptance of conflict or change within societies (Radcliffe-Brown, 1957: 152, 153).

Whereas Malinowski's theories of functionalism were based on biological needs for the continued existence of societies, and Radcliffe-Brown preferred to study the processual interrelationships among the units within a society as the basis for the formation of a continued structure of society, Talcott Parsons proposed models to meet functional needs. The American theorist Talcott Parsons (1902-1979), was interested in integrating

the diverse levels of social analyses, specifically the social and personality systems. His work was however marred by some confusion, specifically the uncomfortable mix of action theory and structural functionalism (Ritzer and Goodman, 2004a: 451, 452). Initially Parsons articulated a micro orientation in his action theory by emphasising the unit act and voluntarism in his early work, partially reflecting the ideas of Spencer on individualism. However these were replaced by his structural-functional theory in which actors are not acting in a voluntaristic manner but are constrained primarily by social structures and culture. The heart of Parson's theories lies in his sense of the major levels of social analysis, especially his AGIL (adaptation, goal attainment, integration and latency or pattern maintenance) scheme within the four identified action systems (social system, cultural system, behavioural organism, personality system). He regarded the most important to be the cultural system by controlling the other three systems (Ritzer and Goodman, 2004a: 429-452; Burrell and Morgan, 1979: 54-56).

Functionalism and the biological metaphor were, however, also pursued by later theorists such as the generic general systems theory developed by von Bertalanffy (1901-1972) and the proposition of autopoiesis by Maturana (1928-) and Varela (1946-2001). Von Bertalanffy as the founder of the systems theory of social and organisational research, based his generic theory on the principles which govern the behaviour of entities that are intrinsically widely different, but whose elements are interacting in a common way (Burrell and Morgan 58-68). These general principles include the necessity to be able to delimit the system or entity within a boundary. It also requires that the interaction within the system is essentially processual in nature and the processes can be described in terms of the input, throughput, output and feedback processes required

for homeostasis in the system (Burrell and Morgan, 1979: 68). Von Bertalanffy proposed that his general systems theory can be applied to all disciplines, including the study of “human groups or systems, from small groups like the family or working crew . . . to the largest units like nations, power blocks and international relations” (von Bertalanffy, 2006: 195). While he recognised the biological link to societies and social groups, the systems theory was not tied to any specific view of social reality, except being positivist and objectivist, thus forming direct parallels with functionalism.

Maturana and Varela suggested that living systems are organisationally autonomous systems of interaction that make reference only to themselves. They proposed the underlying principles to be autonomy, circularity (order), self-reference (specificity) and the ability to self-create or self-renew (constitution) (Maturana and Varela, 1980: 88; Morgan, 2006: 243-246). Although this theory focused on closed systems, the concepts of closed and autonomous do not mean that the systems are isolated, but the autonomy is organisational, responding to requirements for change, either from within or externally imposed (Maturana and Varela, 1980: 98). The concept of autopoiesis was pursued by Luhmann (1927-1998) and further developed as a generic theory applicable to all levels, from biological cells to the global society (Ritzer and Goodman, 2004b: 185-187). Luhmann, for instance, applied the principles of autopoiesis to explain and explore modern systems of economy or bureaucracy. Both the general systems theory and autopoiesis do not specifically focus on society and organisations and how they are functioning and structured, but offer a more generic approach to study and understand how biological and other group systems persist.

Key Elements of Early Functionalist Theories

Functionalism as discussed in the previous section followed the biological model for the theories and study of societies and organisations. The key elements of consensus among the theorists include the recognition of society or organisation as an objectivist/positivist independent entity with a strong element of self-regulation and self-maintenance to support its persistency. It is with respect to the identification and study of the functions required for and performed by the society towards its persistence, where the members of the movement differed among themselves, and received most of the criticism against their theories.

Malinowski and Parsons favoured prescriptive and essential models of functions which should be performed for effective and stable functioning of societies and organisations. Radcliffe-Brown, on the other hand, stated that it is the interrelationships among the processes performed by the individual units within societies and the resulting structures that are important, therefore, placing a greater emphasis on change than prescriptive and ideal models. In addition, the methodology developed within the general systems theory of von Bertalanffy and other related theorists offered the generic method of input, throughput, output and feedback to study the processes and functions within society and organisation. This clear objectivist/positivist stance taken by the functionalists, together with the different theories within the movement, resulted in functionalism being criticised and partially ignored during the latter part of the twentieth century.

Critics of Functionalism

Functionalism was one of the dominant schools of thought until the middle of the twentieth century, but became unpopular and unfashionable, though still dominant, during the 1970s. In his book *Modern Social Theory* (1970), Cohen grouped the critical concerns raised against functionalism into categories of logical, substantive and ideological concerns (Cohen, 1970: 47-64). The substantive and ideological concerns were mainly raised against the use of the organismic model as being rigid, leading to an ideal model instead of an expanding knowledge base. The logical concerns identified by Cohen questioned the ontological existence of society and organisation as an objective persistent system and the justification of a functional model for the maintenance of this system. The areas of criticism are discussed below.

Cohen contributed the substantive and ideological concerns to theorists within the functionalist school of thought. They accepted the organismic model for organisations or organised society (Kuper, 1977: 21) and the debate became targeted directly at changing and improving the basic assumptions underlying the concepts of an organismic model (Burrell and Morgan, 1979: 218). Burrell and Morgan, supported by Cohen saw the debates more as constructive and developmental in addressing the concerns about the harmonious nature of societies held by early functionalists, such as Malinowski and Parsons, who downplayed conflict and promoted ideal models for society or organisations (Cohen, 1970: 56-64). These concerns were addressed by subsequent theorists, especially in the field of organisational theories, such as open system and contingency theorists who included the environment as integral to the persistence of organisations (Morgan, 2006: 38-49). In the theories on competency versus adaptation

proposed by Hamel and Prahalad they also proposed that organisations could have flexible strategies that can influence their environments rather than the need to conform (Hamel and Prahalad in Segal-Horn, 1998: 35-49). The concerns were also addressed through various conflict theories in society and organisation, thus supporting the metaphors of organisations or societies as political systems (Morgan, 2006: 163-166). The view of organisations changed from rigid harmonious models to adaptive creative models, accepting conflict as part of the model. However, these improvements also tended to fragmentise the theories by focusing more on the reason for the improvement, such as environment; conflict; or change than on an integration of the functional theory of society and organisation.

Cohen's category of logical concerns included concerns, raised by subjectivists, of teleology, reification, generalisation and tautology. Teleological concerns addressed the justification of the existence and persistence of society or organisations by stating that the formation of functions and structure is both the cause and effect of the need for the 'life' functions required by the society (Cohen, 1970: 47-56). This could furthermore lead to the reification of functions within the organisational structure (Burrell and Morgan, 1979: 196) by applying a predetermined interpretation of activities to functions in order to fit the biological model, resulting in untestable hypotheses or naive empiricism (Burrell and Morgan, 1979: 218). It also addressed the danger of the inability to compare or generalise results as stated by Cohen: "if a social and cultural item is to be examined within the totality of a society, then it must be treated as unique; for the totality of one society is never the same as another" (Cohen, 1970: 53). The final criticism of tautology queries the value that can be added to existing knowledge, especially if the organismic

model of functions describes the same concepts by merely using different words and concepts. It is, therefore, not possible to conduct this research without addressing at least the concerns of teleology, reification, generalisability and tautology.

One of the functionalists, however, offered a wider and more comprehensive set of theses for the study of society and organisation, thus addressing some of the concerns raised against functionalism. Radcliffe-Brown's contribution is much wider and more sophisticated than his ideas about linking societies to a biological model (Burrell and Morgan, 1979: 51-53). In his presentation to faculty members of the University of Chicago in 1937, he hypothesised that social sciences could be developed as a separate branch of science for the study of human societies by stating that a "science of human society is possible; that there can be only one such science, although certain fields within the science may be capable of relatively separate treatment" (Radcliffe-Brown, 1957: 3). It is especially this integrated view of Radcliffe-Brown, incorporating all the sciences and not only focusing on either the philosophy or the natural science that provides counter arguments against teleology and reification. While he supported the objectivist/positivist view of organisations in functionalism, he accepted that this functionalist view is only one of the types of science that should be studied with respect to organisations. His adamant rejection of a fixed model to describe the functioning of societies and organisations allowed his theories to reduce the risk of reification, although he accepted the criticism that it may be difficult to determine the functioning of society through bottom-up observation research. In this respect he concluded that functioning can be observed within social processes by means of comparative research among societies towards the classification or morphology of the societies (Burrell and

Morgan, 1979: 52). He, however, accepted that this method is difficult and could still result in problems of generalisability.

The rest of this chapter explores Radcliffe-Brown's theses to determine whether it is possible to have a single science of human society, one of the types of science being the study of its physiology.

A Separate Branch of Science of Human Society

Radcliffe-Brown defended his hypotheses of a separate branch of science for the study of human societies by clarifying the concepts contained in the hypotheses and addressing the criticism and concerns raised by opposing theorists.

His hypotheses accept that the abstract science of philosophy already plays a major role in the study of societies, but what was still lacking at the time of his hypotheses, was a natural science, such as social physiology (Burrell and Morgan, 1979: 52). In order to explore whether Radcliffe-Brown's hypotheses can be realised, it is necessary to discuss his concepts of the science of society, followed by the concepts of function, process, structure, system and organisation as specifically applicable to his proposition for a theoretical natural science for the study of human societies.

Types of Science

To clarify his concept of a separate branch of science, Radcliffe-Brown emphasised the close link existing among the four types of science, identified as: abstract science, based on philosophy, logic and mathematical thinking; pure or natural science, based on phenomenal observation of natural laws; applied science, utilising the knowledge from

abstract and natural sciences; and the arts as the presentational medium of knowledge (Radcliffe-Brown, 1957: 9).

Abstract sciences are based on logical thinking, either within known natural laws, or by proposing natural laws and theories in fields where phenomenal observation is either not possible or not yet feasible. The abstract sciences include mathematics, mathematical forecasting, theoretical physics, theoretical psychology, and philosophy. Natural science, based on known natural laws, has as its objective the testing of theories and propositions developed by the abstract or theoretical sciences through observation, experimentation, measurement and validation, thereby allowing knowledge to be accepted as epistemologically real. Radcliffe-Brown included sciences such as mechanics, physiology, chemistry and psychology in this category.

Applied sciences, as implied in the title, build on the knowledge obtained from natural scientific studies to develop solutions to problems or to enhance the development of practical applications, and include engineering, medicine and psychiatry as examples.

Arts as the fourth proposed type of science, is concerned with the sensual representation of the knowledge derived from the other fields, thus allowing the knowledge to be spread, understood, and appreciated by a wider audience (Morgan, 2006: 174). In this category Radcliffe-Brown included psychotherapy and education, but it can be extended to other means of communication and representation of the arts.

Radcliffe-Brown maintained that a separate branch of science should contain all four types with the abstract philosophy, theoretical and logical sciences providing the propositions which, when linked to phenomenal reality, form a basis for measurement

and validation in the natural sciences, while the results and understanding derived from natural science can be used in applied science and arts (Radcliffe-Brown, 1957: 8-10). He acknowledged contributions to the philosophy of social science in the works of Montesquieu, Comte, Spencer, Boas and other theorists, but queried progress towards the existence of a natural science, thereby relegating the applied science of society to a 'common-sense practice' or empirical practice of trial and error (Radcliffe-Brown, 1957: 8). He proposed the study of the physiology of society as filling this gap between abstract reasoning and the application of the abstract theories in applied sciences (Radcliffe-Brown in Kuper, 1977: 32), and it is this study of the physiology of society as a natural science that forms the focus of evaluation in my research project and thesis.

Natural Science of Society

A natural science of human societies, according to Radcliffe-Brown, should comply with the natural laws of living persistent systems and encompass the systematic study and collection of knowledge of the systems, structure, functions and processes of society. He was especially adamant that his definitions are based on *relationships* among components and functions, identified in the Aristotelian requirements for knowledge, and not on aggregated knowledge of the components as the building blocks of the living society or organisation, or a top-down ideal model for society. To gain perspective in his theories, it is necessary to review the explanations used by Radcliffe-Brown with respect to a natural science of persistent systems, its component parts and their interrelationships, discussed below.

Natural Science of Persistent Systems

The Aristotelian requirements for knowledge of an object, on which Radcliffe-Brown based his proposal of a natural science, are:

“(1) Knowledge of its *form*, i.e., of the parts or elements of which it is composed and the relations of those parts within the whole.

(2) Knowledge of its *functioning*, i.e., what it does or how it works, and what is the function of each part of the system in relation to the functioning of the whole.

(3) Knowledge of its derivation, i.e., of the process by which it has come into existence.

(4) Knowledge of its potentialities for future development.” (Radcliffe-Brown, 1957: 153).

Knowledge of form should enable the identification of systems and the structural principles that are common in societies or organisations, and those that are unique to a specific society or type of organisation (Radcliffe-Brown, 1957: 129) thereby allowing societies or organisations to be classified by type. Radcliffe-Brown’s interpretation of the knowledge of functioning links directly to his theses that in a natural science of societies, the functions performed by the components provide the connection between the structure and activities required for the continued existence of the society (Radcliffe-Brown, 1957: 124). Knowledge of derivation asks the question of how societies form and change. Radcliffe-Brown identified two types of change: one from within through process changes, and another change imposed by the outside environment (Radcliffe-Brown, 1957: 87). Knowledge of potentialities for future development refers to

knowledge about the persistence and continued existence of society (Radcliffe-Brown, 1957: p.80).

However, a natural science is also subject to a set of immanent natural laws. In this respect, Radcliffe-Brown distinguished between different types of natural laws, such as laws of motion underpinning the study of mechanical systems as opposed to the laws required in the study of living persistent systems. He stated that “the characteristic of any persistent system is that it maintains through a certain lapse of time its structural continuity” (Radcliffe-Brown, 1957: 25). The functionalists ascribed this maintenance of the persistent system over time to the functions performed by the components in the system. Although supporting the biological model, similar to Malinowski and Parsons, Radcliffe-Brown’s explanation of how the components and functional systems maintain the integrity and continuity of the persistent entity focused on interrelationships instead of predetermined needs-based or ideal model functions.

A natural science such as physiology for the study of societies or organisations, as envisaged by Radcliffe-Brown is more than a study to identify, record or impose rigid structures and processes, but adds value by studying the interrelationships among, and mutual impact of, these functions.

Social Process

Radcliffe-Brown defined the process of social life as consisting of “an immense multitude of actions and interactions of human beings, acting as individuals or in combinations or groups . . . so that it is possible to give statements or descriptions of certain *general features* of the social life” (Radcliffe-Brown in Kuper, 1977: 14). The

analogous concept of process within the study of physiology of organisms refers to the operations performed by individual cells, in support of specialised functions performed by the organ to which they belong (Barrett et al., 2010: 1). An example is the process of metabolism to create and use energy for the contraction of muscle cells to facilitate movement. Radcliffe-Brown's interest was in the 'general features' of social life in which the individuals contribute to the underlying processes in society.

A process, therefore, refers to the actual task performed by individual components of a living organism or society as their contribution towards the continued persistence of the entity. However, whereas in anthropology during the earlier part of the twentieth century, grounded observation (Bryman and Bell, 2003: 570) was used to identify and categorise the processes in pre-modern societies, many processes such as accounting in business have already been analysed and accepted and can be learnt and applied to a professional level.

Social Function

With respect to the social function, Radcliffe-Brown stated that:

“The concept, as I use it, is one that enables us to study the interrelations of a structure and an associated process. An organism has a structure of organs and tissues and fluids. What we call the life of an organism is a process. The structure determines the process; life consists of the actions and interactions of organs. The process determines the structure, by renewing it and keeping it alive. This mutual relation between structure and process in an organism is what is referred to when we speak of function in physiology” (Radcliffe-Brown in Kuper, 1977: 51).

According to this concept, components of living organisations or organisms perform specific functions in support of the persistency of the entity and to maintain its identity. Physiology, defined in the *Oxford Concise Colour Medical Dictionary* as “the science of the functioning of living organisms and of their component parts” (2007: 556), studies the functioning of, and interrelationships among, the components of organisms (Barrett et al., 2010: 1). It could, therefore, provide an analogous framework for the evaluation of Radcliffe-Brown’s theses for physiology as a separate natural science of human societies. Radcliffe-Brown used justice as an example to demonstrate how the function can and does impact all aspects of social life. He argued that it is not the philosophical meaning of the term justice that is of interest in the social science, but “ what people have done in the past in the way of administering justice and in organizing the social relations in this respect” (Radcliffe-Brown, 1957: 132). He further discussed the implications that the principles and administrative application of justice as a function has on different sizes and types of society, as well as on other functions such as the economy of a society (Radcliffe-Brown, 1957: 131, 140). An analogous example which can be observed in living organisms is the function of security, equivalent to an immune system in organisms. This function interrelates with the external environment by blocking access to potentially dangerous components to enter the entity, as well as continuously scanning all parts of the entity to detect and act against foreign and unrecognised components and processes already within its boundaries, serving as access control and policing functions.

Social Structure

Social structure as defined by Radcliffe-Brown is:

“referring to some sort of ordered arrangement of parts or components. . . The components or units of social structure are *persons*, and a person is a human being considered not as an organism but as occupying position in a social structure. . . The social relationships, of which the continuing network constitute social structure, are not haphazard conjunctions of individuals, but are determined by the social process, and any relationship is one in which the conduct of persons in their interactions with each other is controlled by norms, rules or patterns” (Radcliffe-Brown in Kuper, 1977: 19, 20).

Radcliffe-Brown emphasised that while structure is formed as a result of the relationships based on, and impacted by, norms and rules required for persistency of the entity, it is not rigid and predefined, but adapts to processes and can only be observed through its functioning. In medicine, unlike Radcliffe-Brown’s focus on structure being intrinsically interlinked with function, the study of structure is more likely to be compared to the anatomy of the body, than to its functioning as in physiology. Anatomy identifies the organs and their positioning within the body, and, if studied in isolation, may not provide much information with respect to the functions being fulfilled by these organs except through their relative positioning and how they are connected to other organs within the body.

However, it was with respect to the concept of structure that theorists, especially in organisation sciences, moved away from Radcliffe-Brown’s theses that structure can only be observed in the functioning of organisations and societies (Burrell and Morgan, 1979: 52). Organisational theories as promoted by scientific management and contingency theorists and their supporters, focused on the hierarchical positioning of management and functions within organisations, analogous to the structuring of the

nervous system in organisms (Morgan, 2006: 20), or maintained that structures are formed through culture and the use of language within organisations (Morgan, 2006: 138). Although organisational structure charts are still widely used in organisations today, they provide a visual presentation of hierarchy rather than an explanation of functionality.

Social System

Radcliffe-Brown referred to work done by Comte and Montesquieu in his definition of the term system. Montesquieu, as the acknowledged founder of the concept of comparative sociology during the eighteenth century, defined a social system as a set of relations or interconnections and interdependence among features, events and activities within a system as the identifiable coherent whole (Kuper, 1977: 16). In his presentation in 1937, Radcliffe-Brown expanded on this concept of system by stating that:

“A natural system, then, is a conceptually isolated portion of phenomenal reality (the system separated from the rest of the universe which is then the total environment of the system), consisting of a set of entities in such relation to one another as to make a naturally cohering unity. The constituent entities may be events, or themselves systems of events. Such a system is the solar system, an element, an atom, a horse, a falling body” (Radcliffe-Brown, 1957: 20).

An isolated and identifiable set of entities and their interrelationships not only enables comparison of differences among societies, but shows the interconnectedness of the system to the society as a whole. System, however, also has a generic connotation as an independent unit of study which is widely used by organisational and social theorists

such as von Bertalanffy's general systems theory, applicable to systems within all the types of science (von Bertalanffy, 2006: 32). However, it is the definition of system in the study of the human body as "a group of organs and tissues associated with a particular physiological function, such as the nervous system or respiratory system" (Oxford Concise Colour Medical Dictionary, 2007: 699) that may be easier to understand and apply in a research project to evaluate the feasibility of studying the physiology of societies and organisations. In this case, the concept of system is analogous to either one or a set of functions or organs performing related functions within the study of physiology. Examples include the cardiovascular system, consisting of the heart as a pumping organ, as well as the blood vessels as the circulatory pathways. In business, an example would be the logistics system, incorporating the receipt of goods, warehousing and the distribution to the point of requirement.

Organisation

As an anthropologist, Radcliffe-Brown's interests were mainly with respect to the study of societies. In this he asserted his separation between society and organisation.

"The concept (of organisation) is clearly closely related to the concept of social structure, but it is desirable not to treat the two terms as synonymous. A convenient use, which does not depart from common usage in English, is to define social structure as an arrangement of persons in institutionally controlled or defined relationships, such as the relationship of king and subject, or that of husband and wife, and to use organisation as referring to an arrangement of activities. The organisation of a factory is the arrangement of the various activities of manager, foreman, workmen within the total activity of the factory. The structure of a family household of parents, children and

servants is institutionally controlled. The activities of the various members of the persons of the household will probably be subject to some regular arrangement, and the organisation of the life of the household in this sense may be different in different families in the same society. . . Within an organisation each person may be said to have a *role*. Thus we may say that when we are dealing with a structural system we are concerned with a system of social *positions*, while in an organisation we deal with a system of *roles*” (Radcliffe-Brown in Kuper, 1977: 21).

An analogy in business is the hierarchical structure still used in organisations to identify the position of seniority allocated to different departments, staff and managers in the organisation, compared to the actual function or role performed by each department such as recording and balancing the financial transactions, or operating production machinery. A position in the structure of the organisation does not necessarily explain the role that the individual or department fulfils within the organisation. However, the clarification of organisation offered by Radcliffe-Brown introduced the concepts of role and position as a criterion that can be used to link fields or systems for study to their sets of natural laws and is applied as such in Chapter 3.

	Definitions used in Research Project
Process	Processes are the actions and interactions of the components of a society or organisation in order to perform the tasks within a function.
Function	A function is the relationships between the processes performed by its components, the other functions and external environment towards the self-maintenance of the organism as a persistent entity.
Structure	Structure is an ordered arrangement of the components and the functions they represent in an organism.
System	A system is a set of related functions or processes within functions that can be used as a unit for study.
Organisation	An organisation is an organised set of components in relationships of role within functions and structures, operating as an independent persistent entity.

Table 2.1 Definitions of concepts proposed by Radcliffe-Brown for the study of physiology

Using Radcliffe-Brown's definitions as a starting point, it was possible to itemise a set of standard concepts, presented in Table 2.1, to be used within my research project. Radcliffe-Brown's interpretation is used for all the concepts, except in the case of 'system' where the definition moves from a generic identification of a topic to be studied, to the definition used within physiology.

The main focus is on function and interrelationships, while the concept of system is used as a group of related functions and structure, if inextricably interlinked. Processes are not analysed in detail in the research, but are implied in the activities performed by the functions. The use and identification of the concept organisation is addressed as part of the scope for research in Chapter 3.

Method for a Natural Science

The approach proposed by Radcliffe-Brown for the natural scientific study of societies is threefold. In the first instance it is important to understand the physiology, i.e. the form and functioning, and study the persistence of society (Burrell and Morgan, 1979: p. 52), thus building a knowledge repository for and from all four types of science. He accepted that this knowledge cannot be obtained through direct observation alone, but requires relational analysis between systems and functions in order to enable the identification and potential classification of different types of society (Radcliffe-Brown, 1957: 69-71). Radcliffe-Brown recommended a 'bottom-up' approach by starting with grounded observations of processes in order to be able to identify the functions and structure. Once a framework of the functions and their interrelationships to other functions has been defined, a structure to support these functions can be derived.

Secondly, his recommended approach was to develop an accepted classification system of societies (taxonomy), derived from the knowledge of form in which separate classes of society can be identified. Classification may be possible if common and unique functions and systems can be identified within the study of the physiology of societies. In the third instance he maintained that progress will be achieved if a suitable comparative research methodology can be developed to be used within and amongst societies (Radcliffe-Brown in Kuper, 1977: p.67). It is in the practical implementation of Radcliffe-Brown's theses that he admitted to major concerns and was subsequently criticised for being "a displaced naturalist, grubbing about for non-existent social species and reifying the 'anatomies' and 'physiologies' of societies" (Kuper, 1977: 1). It was found to be too complex a task to identify and achieve consensus about the functions of societies and organisation, especially through grounded observations. In addition, a comparative study of functions can only be meaningful if enough societies or organisations can be compared with respect to the functions they perform towards persistency. The problems of generalisability and to a certain extent, reification were still real in his theses.

My research project focuses on the requirement for the study of physiology as a prerequisite to be able to classify societies and organisations. I will address and explore the best approach to be employed for a comparative and generalisable research method and to reduce the risk of unnecessary reification. The practicality of a classification system will be addressed where applicable.

Conclusion

In Chapter 1 a concern was addressed about the complexity which developed within organisational and social theories; the difficulties experienced by the various audiences interested in social and organisational knowledge; and the ability to find a way in which information gathered by one of the audiences can be made useful to the other audiences. Three approaches to study and interpret knowledge were addressed, namely: the use of paradigms by academics to develop theories; metaphors used by consultants to translate the theories into tools for managers; and science to test and verify theories in practice. The conclusion was that a compromise position of knowledge accumulation and a knowledge base to meet the needs of managers as a growing audience, must regard organisations on the objectivist/ positivist end of the ontological and epistemological scale. This favours the functionalist paradigm within Burrell and Morgan's proposed quadrant (Burrell and Morgan, 1979: 22). This knowledge should be presented to managers as comprehensively as possible, favouring the metaphor of organisations as organisms, and be verifiable by means of a natural science.

While the conclusions in Chapter 1 pointed towards the classical theory of functionalism as the preferred paradigm, Chapter 2 explored their theories in more detail, including the reasons why they went out of fashion during the middle of the twentieth century. Most of the critics assisted to move the theories from the original rigid models proposed by Malinowski and Parsons, but the subjectivist concerns about teleology, reification, generalisability and tautology still required further attention. Radcliffe-Brown as one of the structural functionalists, however, offered a more comprehensive set of theses than just supporting the biological model for the study of societies and organisations. He

proposed that it is possible to have a single branch of science for the study of human society. Chapter 2 presented and discussed the concepts inherent in his theses. It was found that, by focusing on all types sciences within this branch of science, it is possible to embrace all the paradigmatic schools of thought for the study of society: academic theorising in all of the paradigmatic quadrants will be accommodated as an abstract science; while the testing of the theories and the application of solution to managers are covered in the natural science of the physiology of organisations or societies to satisfy the requirements of the functionalists and management.

However, there are still further practical concerns raised by Radcliffe-Brown and his critics to be addressed before Radcliffe-Brown's theses of a single branch of science for the study of human societies can effectively be evaluated, specifically with respect to the study of the physiology of organisations and societies as a natural science. These concerns include the problems of how to separate out a unit of society suitable for the study of its physiology, and the problem of how to study this unit of society to allow the results to be generalisable. Chapter 3 addresses the issues of identification as part of determining the context within which the research will be meaningful.

Chapter 3 and especially Chapter 5, explore the practicality of how to study the physiology of organisations, not from a grounded approach, but by starting with a prototype physiological framework (Bowker and Leigh Star, 1999: 62) developed from, and applicable to, the functioning of the human body as a complex living organism. Although this could be interpreted as reification, theorists promoting institutionalism, (DiMaggio and Powell, 1983: 148; Tsoukas and Knudsen, 2003: 362) have been

recognising the similarity of organisations by proposing an aggregation of information over many organisations in preference to the study of organisations in isolation.

This aspect to identify functions that are similar over a series of organisations, forms one of the arguments for the secondary data approach adopted in this research project as discussed in Chapter 5. This methodology was selected to ensure a large sample which can be used to test and adapt the prototype physiological framework and not only to accept the functions as a prescriptive model. Both concerns of reification and generalisation will, therefore, be addressed in Chapters 3 and 5 of the thesis.

Chapters 6 to 8 present the research analysis and findings which are summarised in the concluding Chapter 9. Chapter 9, in addition to providing a critical review of the research project and findings, also addresses the issue and concern of tautology by asking whether Radcliffe-Brown's theses of a single science for the study of human societies really offer a new or different approach to the study of societies and organisations, or whether they only state what is already occurring, only in different words and terminology.

Chapter 3 Physiology of Organisations: Context and Scope

“A living system is specified as an individual, as a unitary element of interaction, by its autopoietic organization which determines that any change in it should take place subordinated to its maintenance . . . all change must occur . . . without interference with its functioning as a unity in a history of structural change in which the autopoietic organization remains invariant”

(Maturana and Varela, 1980: 87).

Introduction

Radcliffe-Brown proposed that a branch of science is possible for human societies and organisations with people as the base components (Radcliffe-Brown in Kuper, 1977: 27).

His proposal is based on the Aristotelian approach of the systematic study of form, functioning, derivation and potentialities of a unit. The branch of science would also include all four types of sciences, namely, abstract science, natural science, applied science and the arts. He suggested the introduction of the natural science of physiology of organisations as a route to empirically evaluate theories developed by abstract sciences, thus creating a source of evidence-based knowledge to reduce the potential ‘trial and error’ solutions adopted in applied sciences.

There is a possibility that, seventy years after the propositions made by Radcliffe-Brown, empirical and phenomenally evaluated knowledge already exist, although scattered, to support his theses, especially with respect to the functioning of organisations and societies. There are also some logical and practical concerns which were raised in Chapter 2 and require attention before his hypotheses can be submitted to empirical

evaluation. These concerns include the delimiting of society into a suitable unit for study and the types of interrelationships to be studied. In Chapter 3 these concerns are addressed as part of determining the context within which a research project can feasibly be conducted, by addressing the context of scale, interrelationships and identity. Only after this clarification will it be possible to establish a research proposal.

Society in Perspective

It is important to determine the context within which a society or an organisation can be studied with respect to its physiology. Unlike organisms, enclosed and protected by external membranes and easily identifiable by shape, this is a challenge with respect to societies and organisations and it is, therefore, necessary to consider the contexts of scale, relationships and identity of the 'unit' of organised society or organisation to be studied.

Context of Scale

Radcliffe-Brown was conscious of the problems in defining or delimiting societies for the purpose of systematic study.

“I am suggesting that the most expedient abstraction we can make of a society is to take a territorially delimited group which seems to be not only clearly marked off from other groups, but which is also sufficiently homogeneous in most respects of the behaviour of its individuals, if not in all of them, so that the similarities can be discovered and constitute a material which can be adequately described” (Radcliffe-Brown, 1957: 60).

Similarities identified by Radcliffe-Brown in pre-modern societies, include the name they call themselves, their language, and their social usages or norms (Radcliffe-Brown,

1957: 61, 57). He accepted that this is not always easy and straightforward and that the identification of a 'unit' of society also depends on the scope of the material to be studied from the observer's perspective as well as the scale of the size and impact of the unit, by stating that:

“From certain points of view it would be convenient to take the whole of the United States as a unit – obviously so if you are dealing with certain political problems. On the other hand, in considering economic institutions, the whole world is the society now. Again, for certain other kinds of social problems, the United States is far too big, and therefore, what we have to do is to take as a unit a smaller community which we can separate out, define, and study as a system” (Radcliffe-Brown, 1957: 61).

Whereas this definition of a society as a 'homogeneous isolated system' was easier to accept at the time of Radcliffe-Brown's theses for a separate branch of social sciences and his interest in the study of isolated pre-modern societies, the definition needs to be revisited today in a more complex world. Independent social tribes studied by anthropologists have been replaced by multi-tribal nation states complete with the inherent differences still existing among the tribes, as perceived in Africa; federal nations allowing a large degree of independence to their member states, such as in the United States of America; or the European Union supporting a relationship of independent nations. Business organisations are not only able to be classified into sole traders, small and large single sector businesses, but form parts of conglomerates, not only consisting of multiple, often incompatible business units, but spanning the globe with their cross-national connections. The rapid advancements in technology which resulted in the World-Wide-Web opened the possibility of virtual organisations where

the need for humans, as the basic building blocks, has been reduced and replaced by technology and the technical presentation of websites. A single definition of society or organisations is not acceptable any more, and can benefit from the introduction of scale.

Radcliffe-Brown alluded to the concept of scale when he explained that separate branches of science can be identified according to the units to be studied and the interrelationships of their components as presented in Table 3.1.

Scale	Component	Unit
	-	-
	-	-
Scale level n+x	Earth	Universe
	-	-
	-	-
Scale level n+1	Societies, Organisations	Nations, Conglomerates
Scale level n	Individuals	Societies, Organisations
Scale level n-1	Cells	Individuals (organisms)
	-	-
	-	-
Scale level n-x	Atoms	Molecules
	-	-
	-	-

Table 3.1 Perspective of scale for persistent systems

He used the examples of atomic physics with components at the level of atoms; chemistry, focusing on molecules as their components; and the physiology of living organisms with cells as the components. Therefore, each branch addressed a different scale of focus to demonstrate his statement (Radcliffe-Brown in Kuper, 1977: 27). Scale introduces a perspective which allows a unit and its base components to be studied by adhering to the same set of natural laws which determine patterns at other levels of scale. A cell is studied with respect to the molecules within the cell as the components, while cosmology studies the universe with the earth as a component (Silver, 1998: 442).

A science of society fits between these scalar positions of, for instance, atoms and universe, with the individual as the component, but then also at a potentially next higher scalar level in which the organisation becomes a function within a nation state or business conglomerate.

Table 3.1 is an example of a possible set of scales based on the component and unit as the separator for the scientific study of organisations or organised societies. Radcliffe-Brown's theses of a separate branch of science for human societies will, therefore, be touching on the study of society at a level 'n' in Table 3.1, in which case the individual is the component part of a society or organisation, or at level 'n+1' where the organisation or the society becomes the component representing a function of a larger and more comprehensive nation state or organisational conglomerate. By identifying the scale of study, the science can focus on the relevant set of components and their interrelationships rather than to mix knowledge from the one scale to the next, even though the knowledge could be analogous as will be explored for the study of local societies versus organisms. Extensive comparative and systematic research is already being conducted, especially at scalar level 'n+1' by institutional theorists (Morgan, 2010). However, as identified in Chapter 1, the audiences that were identified to benefit most from a comprehensive approach to research and knowledge sharing, are the managers of organisations and self-maintaining institutions, therefore at scalar level 'n'. In this research project, the focus is therefore on the scalar level 'n', that is, individuals as components, and self-maintaining societies or organisations as the unit, referring to the immediate levels above and below, as and when required.

Context of Relationships

Identifying the level of scale at which an organisation is explored is, however, not enough. Radcliffe-Brown identified the four different types of sciences applicable to each level of scale as abstract science, natural science, applied science and the arts, with each type subdivided into relevant subsections, such as anatomy and physiology as natural sciences for the study of organisms. The sciences addressing the study of organisms support various types of relationships and structure in the research and presentation of knowledge. Radcliffe-Brown referred to the different relationships in the types of science when he clarified his understanding of the relationship of position versus the relationship of role in societies. Philosophy and theoretical psychology of individuals apply logic, based on the meaning and understanding of the behaviours of individuals which may not yet be verified through validation or not possible to validate, to their propositions. Statistics and mathematical simulation models of societies focus on the *position* of individuals in the logic of probabilities or group relationships for modelling purposes, while the natural science of physiology of organisms, explores individuals in their relationship of *role* in support of the laws of life for the study of their components (Radcliffe-Brown in Kuper, 1977: 21).

Within each level of scale, the study of a persistent living unit (Radcliffe-Brown, 1957: 25) can thus further be divided into separate types of study based on the interrelationships of the members of the unit. In order to explore Radcliffe-Brown's theses of a separate science for society, it is necessary to consider at least the interrelationships of role, position and individual understanding and behaviour of members within the society.

Relationships of Role

Radcliffe-Brown defined organised society or organisation as a system of roles (Radcliffe-Brown in Kuper, 1977: 21). This is equivalent to the guidelines in the study of the human physiology and of organisms where the cells are studied within their specialised roles, and the interrelationships of the components and functions are addressing these roles in support of the life requirements of the organism (Barrett et al., 2010: 31). However, Radcliffe-Brown was careful to distance himself from functionalists such as Malinowski, who used physiology as a rigid inborn model for organisation based primarily on biological needs. He preferred a more fluid role for the components in the continuous structuring, renewal and maintenance of the organism toward a sustainable life (Radcliffe-Brown in Kuper, 1977: 51).

This concept of interrelationships of role as a prerequisite to the definition of organisation and organised societies have been debated and accepted by theorists in organisational and social sciences. Maturana and Varela proposed the theory of autopoiesis, in which an organisation is defined as:

“a network of processes of production, transformation and destruction of components that produces the components which: (i) through their interactions and transformations regenerate and realize the network of processes (relations) that produced them; and (ii) constitute it as a concrete unity in the space in which they exist by specifying the topological domain of its realization as such a network” (Maturana and Varela, 1980: 135).

By comparing the interrelationships in organisations to that of living organisms they emphasised that the relationships in an autopoietic organisation only refer to the roles

and interrelationships of components with respect to constitution or function, and not to other relationships open to the components (Maturana and Varela, 1980: 91). This approach of components within roles also supports the natural laws of life underlying the study of multicellular organisms as stated by Silver who linked the functional roles of organisms to the essential need to “take in a source of energy to maintain the organism’s integrity, the ability to reproduce, the ability to respond to stimuli” (Silver, 1998: 322).

From the point of view of physiology as a science for the study of human societies, this refers to functions within structured societies or organisations performed by individuals in the functional roles they have committed themselves to for the self-maintenance of the organisation. This definition of interrelationship of role is used in the research project as the key relationship supporting the functional roles required for the self-maintenance of the organisation or organised society.

Relationships of Position

Within society, Radcliffe-Brown distinguished between individuals in various relationships to each other. He identified unrelated relationships, contributing mainly to the identification and classification of population characteristics in society; casual relationships of interconnectedness (Radcliffe-Brown, 1957: 21, 22); interrelationships of position; and interrelationships of role (Radcliffe-Brown in Kuper, 1977: 21). Of these, the first three can be considered within the unstructured or semi-structured relationships of the position of the individual.

Collecting and modelling the demographics of members of society does not require the individuals as the components of society to be related, or in any formal relationships to each other or the society as the unit, except that they are analysed and classified with respect to the similarity of characteristics (Radcliffe-Brown, 1957: 15). However, they can still be quantitatively studied with respect to their characteristics, habits, trends of movement and activity. An example of this science can be detected in quantitative demographics focusing on the statistical studies of population and various population groups, as a source of data provided by the Office of National Statistics for various quantitative studies. Whereas this quantitative and mathematical counting provide the data for forecasting and modelling, and is essential for applied sciences such as population forecasts, consumer research, or housing development planning, it does not add to the knowledge of society or organisations with respect to the roles and functions contained in the organised societies. Similarly, the science of microbiology, interested in the modelling of the movement of microbes, i.e. bacteria and viruses, in the spread of diseases, contributes to the applied sciences of epidemiology and public health, but not directly to the functioning of a human body.

The relationship of position, however, also considers individuals within an institutionally determined relationship of position or status, for instance as a member in a family, which Radcliffe-Brown defines as:

“Some sort of ordered arrangement of parts or components . . . determined by the social process, and any relationship is one in which the conduct of persons in their interactions with each other is controlled by norms, rules or patterns” (Radcliffe-Brown in Kuper, 1977: 19, 20).

This relationship is more structured and enduring than the spontaneous assembly of individuals and cover relationships of the organisation among peers, competitors, or partner organisations in its external environment.

In the research project the relationship of position is, therefore, limited to the relationships of position assumed by the organisation in relation to its peers, partners, sponsors or suppliers in its external environment.

Relationships of Individual Behaviour

The study of society based on the relationship of individual behaviour focuses on the individual comprehension, behavioural impact and rights. This field lies within abstract science of logic with respect to meaning and consciousness, including philosophy, theoretical psychology and humanities. In his argument regarding the difference between social science and psychology, Radcliffe-Brown stated that the social scientist studies the social acts of diverse individuals while the psychologist is interested in the different acts and behaviour of the same individual (Radcliffe-Brown, 1957: 45). He linked the study of psychology to the study of the mind, and, therefore, the study of meaning as perceived by the individual, whether this individual is the component of the unit of society to be studied, or the unit of society itself. The gap between psychology and physiology has narrowed with the use of scanners which can determine brain activities and resulted in a better understanding of the functioning of brain activities, including memory and reasoning. However, psychology still covers a wide spectrum concerned with the study of behaviour and its related mental processes both of the individuals as components of society or organisation, and that of the organisations.

This differentiation between the study of the relationships within the unit by its components at an individual level and the relationship of the unit to its external social and cultural environment, as described by Radcliffe-Brown, addresses the study of psychology at the two levels of scale, similar to the impact of scale on the study of interrelationship of role and position as discussed earlier. The psychology of the organisation, concerned with the meaning and consciousness within an organisation partially addresses the functional relationship of the role of the functions within the 'brain' of the society or organisation, and is, therefore, closely linked with its physiology. However, psychology, being interested in the behaviour of the organisation or society in relationships with other members, addresses the organisation as being the individual in a relationship of position among its peers rather than in a relationship of role.

The physiology of organisations as the study of the functioning of the organisation, therefore, limits the study of societies and organisations to the functions within roles rather than position, only touching on the relationship of position to identify organisational links and relationships within its environment. The psychology of organisational behaviour is relevant but does not form an integral part of the research project.

Scale and Relationship in Perspective

In order to determine whether a study of the physiology of organisations is possible, the research proposes to focus on organisations, such as an autopoietic or self-maintaining business unit on its own or as a member within a conglomerate; and on organised society or state in the form of institutes involved in functions and roles of government,

but operating as self-maintaining organisations within the government. The business unit or institute will be considered as a separate organisational unit, responsible for its own functioning, structure and maintenance, i.e. its autopoietic status (Maturana and Varela, 1980: 87), and, therefore, suitable for physiological analysis.

Table 3.2 presents a matrix of the scale and types of scientific study based on relationships, for persistent living systems.

Scale of science	Abstract science of meaning and behaviour	Abstract science of logic	Natural science of structure, function and process	Applied Sciences and the Arts
Examples	Philosophy, psychology	Mathematics, modelling	Anatomy, physiology, chemistry	Medicine, Pharmaceuticals, Education
Focus of study	<i>Behavioural relationship</i>	<i>Relationship of position</i>	<i>Relationship of role</i>	<i>Application and presentation</i>
		World economy	Nation states, Central governments,, Conglomerates	
Level n+1 Organisation to conglomerate	National psychology Organisational psychology	International economics World statistics	Function/Structure Language/Discourse Politics	Global issues Diplomacy Global education
		Market economy, Partnerships	Organisations, Autonomous institutions within structured society	
Level n Human to organisation	Organisational psychology Sociology Individual psychology	Economics Simulation modelling Demographics	Function/Structure Language/Discourse Processes	Consultancy Sector specialisation General, professional education
			Human (organism)	
Level n-1 Cell to organism	Cellular biology	Microbiology Bacteriology, virology	Physiology Anatomy Chemistry	Medicine Pharmaceuticals Health education
			Cell	

Table 3.2 Scale/relationship perspective of the study of human societies

The shaded portion highlights the focus of the research in this project. Conglomerates or national governments at level 'n+1', not included in this particular research, are more likely to follow the rules of social positioning analogous to families, with the head-office of the conglomerate or the central government also as an independent unit, but with an added positional relationship of sponsor or partner to the other members of the family. However, at the level 'n+1', it could be possible to study a conglomerate or a central government as the physiological entity, this time if the businesses or institutes forming part of the conglomerate or nation fulfil the functions required for the autopoietic self-maintenance of the conglomerate or nation.

From the perspective of the structure and functioning of human societies, examples of the types of sciences that can be identified within a separate branch of science of human societies, include the study of loosely structured societies such as informal groups within the logical sciences of mathematics; philosophy or psychology with respect to the behavioural patterns of the individuals or groups; and the natural science of physiology, applicable only to organisations and organised units of society based on the roles played by the individuals towards the persistence of the unit. Studies of individuals in unstructured or informally grouped societies such as event-driven crowds will not be covered as the groups do not display an enduring physiology of roles.

Context of Identity

Living organisms are observable through their external appearance and boundaries, an attribute used in the classification of species, rather than in the functioning of the organisms, i.e. their physiology (Silver, 1998: 257, 258). However, without being able to

identify the unit for study, functionalism in the nature of a study of the physiology of organised society and organisations, tends to remain at a theoretical level and difficult to conduct. Various theories on the delimitation and identity of the unit of society or organisation have been addressed, including the 'closed system' approach of the classical organisational theorists focusing mainly on stand-alone manufacturing and retailing organisations (Morgan, 2006: 39); the contingency theorists who study the organisation as responding to the environment external to its own boundaries (Morgan, 2006: 55); and the subjectivists who discard the notion of accepting organisations as independent units. In his discussion of the logical criticisms raised against functionalism, Cohen argued the difficulties of studying societies in context:

“Of course, the notion that any society or culture is ever really studied 'as a whole' is a misconception, if not a myth. It would be logically impossible to do this, for there is no way of knowing when one has included every single item; there may always be another. Contextual analysis is necessary of *identifying* social phenomena; but these can then be removed from their contexts and compared. Much functional inquiry consists in relating a small number of processes which are manageable for purposes of comparison and generalization” (Cohen, 1970: 56).

This is true if the reference is only to one type of science used for study and one research project to cover all. We have already recognised the different types of science required to study different aspects of society, and that even for the study of physiology as a natural science, it is necessary to clearly define and delimit the unit for study. However, it may be possible to study an autopoietic unit of organisation or organised

society 'as a whole' if the organisation can also be identified within a definable boundary, separating it from its environment.

Boundary of Organisation

The theory of autopoiesis proposed by Maturana and Varela provides a method for identifying the concept of boundary to delimit a unit of study by stating:

“In fact, a living system is specified as an individual, as a unitary element of interactions, by its autopoietic organization which determines that any change in it should take place subordinated to its maintenance, and thus sets the boundary conditions that specify what pertains to it and what does not pertain to it in the concreteness of its realization. . . . As a consequence, all change must occur in each living system without interference with its functioning as a unity in a history of structural change in which the autopoietic organization remains invariant” (Maturana and Varela, 1980: 87).

According to the theory of autopoiesis, a unit, or unity as referred to by Maturana and Varela, has to be in control of its own change and internal maintenance, although the change and maintenance may be in response to external pressure or stimuli. A relatively easy, although not indisputable, boundary for organisations and organised societies can be regarded as physical national borders; the physical existence of an office block, shop or factory of an organisation; or the living boundary of an organised social tribe (Radcliffe-Brown, 1957: 61). A single organised society or unit, however, cannot only be defined by its physical or observable boundaries, especially not in the complex global environment. We could query whether everyone within this boundary is included in the society, or whether factors such as citizenship, residential status or domiciled status should be the determinant factors for member status both within and external to its

physical border; and which employees are covered, namely full time, part time, local, remote and temporary, within an organisation (Morgan, 2006: 39).

An additional criterion for boundary delimitation comes from the perspective of 'self' and 'non-self' used in the study of immunology of living organisms. In this respect the term 'non-self' is described as:

“covering everything which is detectably different from an animal’s own constituents. Infectious microorganisms, together with cells, organs or other materials from another animal, are the most important non-self substances from an immunological viewpoint” (Playfair and Chain, 2005: 9).

Using this analogy from the study of the physiology of living organisms, the boundary of an organisation or organised society can, therefore, also be determined according to the 'self' and 'non-self' of its components or constituents. Employees, whether temporary or fulltime, and active citizens (i.e. taxpayers), not residing within physical boundaries of the organisation are still 'self', while visitors can be excluded as external or 'non-self' to the unit. However, while food and material from other animals may start off as 'non-self' when introduced into a living organism, they may be incorporated into the unit through the digestive process or as transplants and then become 'self' within an organism and similarly within the unit of society or organisation in the case of the acquisition of supplies, or take-over of other organisations.

There is one type of 'self' component that requires further clarification, and that is the role performed by equipment such as manufacturing machinery, or electronic systems and tools. Latour (2007) addressed this issue of 'objects as actors' in his Actor-Network-

Theory as a proposed methodology for scientific study, including the study of societies and organisations. In addition to recognising individuals in their roles as mediators to familiarise observers with the functions they fulfil and the interrelationships they conduct with other components and units, he stated that objects are also actors exercising power in organisations and society (Latour, 2007: 72). This concept of machines and electronic equipment playing a role within the organisation even forms part of the study of the physiology of living organisms in the roles of skeletal bones and joints, acting as levers in conjunction with the muscle cells to perform tasks of mobility. By including equipment as part of the organisation, the main requirements for the study of the physiology of organisations, however, moves one step further from the proposition by Radcliffe-Brown of a society with the human as the sole or main component (Radcliffe-Brown, 1957: 65). This can even be regarded as a stepwise change in the evolutionary development of organisations, initiated by the industrial revolution and more recently by an explosion in the use of technology. The boundary of a unit of society or organisation is both wider and narrower than focusing on individuals as components and needs to include the equipment and technology directly involved and being regarded as part of the 'self' of the organisation, whether local or global.

The delimited boundary of an organisation or organised society is, therefore, more than just its physical boundary. It includes organisations and observers to be able to identify the 'self' and 'non-self' components of the organisation, whether human or equipment, and the physiological functions performed within and for the organisation by the components as an integral part of the self-maintenance of the organisation.

External Environment of Organisations

However, an aspect to clarify the context for the unit of study for the physiology of organisations, also affects the environment of the organisation. The reciprocal impact of the organisation on its environment will be discussed in greater detail in the exploration of the functions within the physiology of organisation in Chapters 6 to 8, but a few concerns can be considered at this stage, such as the relationships impacted by mergers versus acquisitions, insourcing versus outsourcing, sponsors, shareholders, regulatory bodies, markets and economy. Working on the concept of 'self' and 'non-self' and the requirement for the unit of organisation to be responsible for its own maintenance, positions sponsors, shareholders, regulatory bodies, partners such as suppliers, customer and economic markets in the category of 'non-self' and, therefore, external to the organisation. However, as discussed with respect to its boundary, the material obtained from suppliers and the funds provided by the customers, shareholders and sponsors, may start off as 'non-self' to the organisation, but then be accepted and processed as 'self' components by the organisation.

Mergers can be regarded as the establishment of positional relationships analogous to families, in which case each unit is still independent, although in a relationship of position with its partner or sponsor organisation (Radcliffe-Brown in Kuper, 1977: 21). Acquisitions, on the other hand, may potentially be compared to cannibalism or killing in the food chain by living organisms, or as a transplant of selected organs into the bidding organisation. The organisation taken over during acquisition loses its identity and is assimilated as an integral part of the bidder. The acquiring organisation, however, gains benefits from the acquisition by integrating its functional strengths as part of an

assimilation process, such as the vertical integration of expertise or supplies in the manufacturing of products (Morgan, 2006: 63).

A reversal of this process also applies to the acts of decentralisation, devolution and outsourcing. The concept of spin-off or radical decentralisation addresses the construction of a separate business unit within the conglomerate family of businesses. All the functions, including the essential survival and self-maintenance functions are being decentralised to an independent new unit within the family (Mintzberg in Segal-Horn, 1998: 249-251), similar to the birth of a child. In the case of outsourcing the equivalent depends on the function being outsourced. If it is one of the internal functions, important to the self-maintenance of the organisation, such as the cleaning functions (kidneys), the equivalent in living organisms could be the removal of a key function in favour of submitting the organism to regular sessions of kidney dialysis to perform this essential function. It ties the organisation to the outsourced service organisation as the 'machine', as an alternative to improve a non-functioning activity in the organisation, or to acquire a working function through acquisitions (transplants). Interrelationships within the organisational functions form an important part, but so are the interrelationships of the unit or its functions to players in its external environment.

Research Problem and Proposal

By exploring the context and scope within which the physiology of an organisation or organised society can be researched and potentially acknowledged, it becomes clear that, as stated by Radcliffe-Brown, the study of the physiology of society and organisations can only be one of the natural sciences underpinning a single branch of

science for the study of human societies, and does not provide a comprehensive and all inclusive knowledge base for society.

However, physiology as a natural science to study organisations and organised societies does provide a framework for the study of individuals performing their allocated roles and functions within the organisation; the domain or immediate environment (whether internal or external to the organisation) within which the roles are conducted; the interrelationships among the roles; and impact of the roles on other functions and their environments. While it is not feasible in this research project to fully explore the validity of the theses raised by Radcliffe-Brown during the 1930s, that a single branch of science for human society is possible and desirable, the project can contribute by focusing on the evaluation of the physiology of organisations as one of the natural sciences within this branch.

Within context, physiology as the study of the functioning of a structured society or organisation can, however, only be acknowledged and meaningfully conducted when it is possible to identify the organised society or organisation as an autopoietic unit, responsible for its own self-maintenance (Maturana and Varela, 1980: 135). This unit of organisation must also be able to determine its boundaries by separating 'self' from 'non-self' with respect to its members and possessions (Playfair and Chain, 2005: 8, 9), thereby able to define its impacting environments. Meaningful research was, therefore, restricted to identifiable units of organisation or organised societies as one of the selection criteria for the selection of suitable sample material.

A further consideration in the study of the physiology of organised societies and organisations is the relationship of role that the individual conducts on behalf of the function, not only within the organisation, but also in relation to the other functions in the organisation, and its environmental domain. A method proposed by Radcliffe-Brown, has been to identify unique and common functions within organisations or organised societies through observation (Radcliffe-Brown, 1957: 71), a lengthy and potentially subjective approach. The proposition for this research is to learn from knowledge already gained with respect to living organisms at the 'n-1' scalar level, in other words, the functions identified in the study of the human body which are required for the persistence of the individual. A prototype framework based on these main functions identifiable in human physiology is developed in Chapter 4 to form the basis for identifying functions, and their roles and interrelationships within and external to organisations (Bowker and Leigh Star, 1999: 62). The prototype framework only provides a structured starting point for the study of the physiological functions in organisations and will inevitably have to be modified and updated as more empirical evidence-based information becomes available, thus reducing the danger of reification or the proposal of rigid models for organisations.

The final consideration impacting the research project is the question of generalisability of results from the research. Even by starting out with an analogous model of functions which could apply to organisations, it will be necessary to work with more than one organisation. In order to ensure a generalisable sample for analysis, the research approach is to conduct a meta-analysis of academically acclaimed research papers and analyse the results. The sample for analysis will comprise of published research papers

from which it is possible to identify an organisational autopoietic unit, specific functions within the unit, and clear interrelationships among the functions, or between functions and entities within their environment. It is expected that most of the units will be organisations, although they may contain institutions operating as self-maintaining entities in organised societies, such as local authorities or autonomous health institutes. Chapter 5 discusses the research approach, sample collection and validation. Within the context and identified research constraints, the analysis and evaluation of the viability of Radcliffe-Brown's theses for physiology as one of the natural sciences for the study of organised societies and organisations can be conducted by exploring the following research questions:

- Is it possible to identify functions analogous to those observed in persistent living organisms, in organisations and organised societies?
- Can the interrelationships of roles be observed among functions and their environments as part of the autopoietic maintenance of the individual organisation, similar to the interrelationships in living organisms?
- If similarities can be observed, do they add to the knowledge we already have about the functioning of organisations and organised societies?

In the next chapter a framework used in the study of the physiology of the human body will be explored as a possible prototype framework to apply to the study of the physiology of organisations and organised societies. The history of physiology provides an insight into the value contributed by the knowledge of the physiology of the body to other sciences, and especially the applied sciences such as medicine. The framework is

proposed in a format that supports the natural laws of persistent systems, potentially also applicable to persistent organisations and organised societies (Silver, 1998: 321, 322).

Chapter 4 The Study of Human Physiology

“Physiology – the study of the functioning of living organisms and of their component parts”

(Oxford Concise Colour Medical Dictionary, 2007: 556)

Introduction

The necessity of a bridging knowledge base between the theories and research conducted by academics and the need for solutions and decision tools by management was identified in Chapter 1 and led to the recognition of Radcliffe-Brown’s theses for a separate branch of science for the study of societies as a potential solution to be explored and evaluated. As discussed in Chapters 2 and 3, Radcliffe-Brown acknowledged that while most of the types of sciences within a separate branch of science for human societies already existed, a natural science could provide this bridging knowledge-base link, and could be obtained through the systematic study and collection of knowledge of the functions and their interrelationships within societies (Radcliffe-Brown, 1957: 8). The objective of this research project and thesis is to focus on the feasibility of, and the contributions made by the study of physiology as the natural science to study the functions and their interrelationships of organisations and societies.

In his approach to the study of the physiology of society, Radcliffe-Brown suggested that the functions should be identified through grounded observations and then further refined, classified and submitted to a comparative analysis with other societies. In Chapter 3 this approach was found to be difficult to scope, prone to subjective interpretation of functions, too slow, and not generalisable within a single research project. The suggestion for the research project was to start with an analogous

prototype framework of the study of the physiology of the human body (Bowker and Leigh Star, 1999: 62, 63) instead of inductive grounded observations in organisations. Human physiology was selected as representing the functioning of a complex multicellular organism already extensively researched, studied and understood.

The objectives of this chapter are twofold. The first objective is to evaluate Radcliffe-Brown's assertion that the knowledge and pursuit of the study of physiology is key to the understanding of society by following the development of a knowledge base on the physiology of the human body over the centuries. The second objective is to identify and construct a framework of the functions and their interrelationships in the study of the physiology of the human body which can be used to be validated as an acceptable framework for the study of organisations.

Contribution of Human Physiology as a Natural Science

In order to determine whether the knowledge gained from the systematic study of the functioning of a persistent entity could add value to the study of organisations, it is worthwhile to trace the history of the study of human physiology in the field of medicine and the benefits gained from its acceptance as a natural science. The study of the human body, as the most complex of living organisms, followed a phased approach over the centuries, driven by the quest for knowledge, the need for medical solutions to health problems, and guided by discoveries.

A brief chronological summary of events and periods of focus in this quest for knowledge (Loudon, 1997: 316-323) is provided in Table 4.1 and discussed below.

Period	Key events and impact
5 th century BC	Alcmaeon and Hippocrates break away from mythology and ancient religion towards a rational study of the bodily functions.
1 st to 13 th century	Anatomy studies are based on phenomenal observations of dissection. Physiology as the functioning of the body is based on the philosophy of the four humours of blood, phlegm, yellow bile and black bile, supported by Galen's teachings.
13 th to 17 th century	Physicians are afforded professional status. University learning is based on the philosophical teaching of Galen's theories, and practical anatomy.
17 th century	Harvey published a treatise on the circulating motion of blood through the heart and body. Physiology teaching moved from philosophical theories to evidence-based research and teaching. Production of microscopes led to research in microbiology.
18 th to 20 th century	Linnaeus, Darwin, Mendel, and Watson and Crick researched and addressed classification, species, heredity through genes and DNA. Significant advances in applied sciences of pharmacology and public health based on the phenomenological based knowledge from research in natural sciences.

Table 4.1 Chronology of events and trends in the study and research of medicine in the western world

During the ancient Egyptian and Babylonian period and the Heroic age in Greece, local customs, mythology, religion and philosophy dominated the learning of healers. Disease was regarded as an infliction, and health as a gift from the gods, with people often giving sacrificial offers for this gift (Longrigg in Loudon, 1997: 26). Alcmaeon, in the fifth century BC, with his interest in the physiological questions and phenomenal study of the senses and other bodily functions, and Hippocrates (c. 450-377 BC) through his Hippocratic *Corpus*, are generally recognised as major contributors for breaking away from mythology and ancient religion towards a rational study of the human body. They favoured anatomy and philosophical propositions of deductive logic, based on the four *humours* of blood, phlegm, yellow bile and black bile in balance, as the cornerstone of knowledge (Longrigg in Loudon, 1997: 30).

Events that moved medical studies away from philosophy and abstract logic towards evidence-based science include the writings of Galen (c. 130-200). Galen was among the first to dissect bodies as empirical proof for anatomy and his complete system of the

study of the human body and medicine dominated the Middle Ages and beyond. However, understanding the functioning of the human body was still based on the philosophical propositions of the *humoral* model (McVaugh in Loudon, 1997: 59). In 1628 Harvey (1578-1657) published his treatise on the circulating motion of the blood through the heart, lungs and blood vessels in animals, leading to the eventual recognition of physiology as a natural science in universities as opposed to the previously held philosophical or mechanical theories of Galen, Paracelsus and their supporters (Cook in Loudon, 1997: 85). Knowledge and research in all the systems, functions and structure of the human body accelerated, not only based on the empirical research, but on additional scientific and mechanical discoveries and inventions that enabled academics and researchers to explore the body in more detail and within its environment.

Another branch of research and development influencing the understanding of multicellular organisms and their function and structure, came from the classification of plants and later animals into kingdom, class, order, genus, species and varieties by Linnaeus (1707-1778) (Silver, 1998: 257-258). Linnaeus's classification is mainly based on his interpretation of external appearance or structure, and the observable functioning of each group, subdivided into the different types of sexual organs of plants, or the structure and use of limbs in mammals. Although strongly debated for its rigidity in which evolution is ignored, Linnaeus's method still forms the basis for the scientific classification of organisms at a macro level. Mendel's (1822-1884) discovery of heredity via chromosomes (Silver, 1998: 262-267), started the move from the debated macro level classification system to additional classification at a micro molecular level within

cells (Silver, 1998: 259), and eventually, in the twentieth century, the structure of DNA was deciphered by Watson and Crick (1953), leading to a new field of study of DNA decoding and related scientific applications (Silver, 1998: 292-306). Classification systems based on the concepts proposed by Linnaeus are still used, but only as one of a selection of systems. Within DNA, as the blueprint for the structure and functioning of an organism, it is possible to determine how many genes are common to all living organisms; to certain species or organism; or which are unique to individuals (Silver, 1998: 295). Unlike Radcliffe-Brown's thesis of one classification system for the taxonomy of societies (Radcliffe-Brown, 1957: 33, 34), the classification systems of organisms turned out to be many, depending on the understanding and view of the observer using these systems.

At present a natural science of physiology is not yet able to fully replace the study of the functioning of the mind. Psychology is recognised as a separate branch of science, basing its knowledge both on the phenomenal functioning of the nervous system as researched and taught in physiology, but adding the abstract philosophy, theories and logic of meaning before using the knowledge and understanding in applied sciences such as occupational psychology or psychiatry (Neve in Loudon, 1997: 247).

Radcliffe-Brown proposed a single branch of science for the study of society with the human being as the building block. In this section we followed the evolution of a single science for the study of the human body as a living organism based upon the cell as the building block. It still uses the comprehensive Aristotelian framework for study as proposed by Radcliffe-Brown (Radcliffe-Brown, 1957: 153) and discussed in Chapter 2 and Table 3.2, but with a shift in focus from abstract to natural sciences as the

underlying resource for epistemological knowledge. Anatomy, physiology, cell biology and chemistry now form the scientific foundation for understanding the structure, functioning, building blocks and interrelationships within the body. Psychology, while based on the scientific understanding of the functioning and structure of the brain, addresses the philosophical and logical questions of meaning and understanding. Applied sciences, benefitting from the evidence-based knowledge in the natural sciences, include medicine, pharmacology, epidemiology, public health, specialised sport medicine, and DNA fingerprinting. Education and arts through the media and exhibitions are able to spread knowledge and appreciation of living organisms and the mutual interdependence of life based on rational scientific understanding. The field is much wider and complex, but the four types of science – abstract, natural, applied science and arts – have been combined, though always expanding, to provide an integrated pool of scientific knowledge of structure, functioning, composition, interrelationships and control of the human body as an entity.

By understanding the framework within which this scientific knowledge of the physiology of organisms is studied and researched, it may be possible to determine whether a similar framework can benefit the study and research of organisations or organised societies.

Human Physiology as a Framework

The objective of a prototype framework is to provide a broad picture of a classification system that can be applied to the selected field of study. The development of a framework used in the study of the human body as a prototype framework for

evaluation in organisations is, however, also prone to subjective reification by selecting the preferred functions of the researcher. It is, therefore, necessary to ensure that the classification system within this framework complies with basic standard requirements of consistency, mutual exclusivity and completeness in order to reduce the danger of reification (Bowker and Leigh Star, 1999: 62, 10, 11).

To be consistent and complete, the approach followed in the research has been to select the major systems offered to physiology students in acknowledged study guides and to follow through on the functions contained within these systems. Ganong in Barrett et al. (2010), as one of the main sources of study, for instance, identified the following systems as important to the study of physiology:

“In unicellular organisms, all vital processes occur in a single cell. As the evolution of multicellular organisms has progressed, various cell groups organized into tissues and organs have taken over particular functions. In humans and other vertebrate animals, the specialized cell groups include a gastrointestinal system to digest and absorb food; a respiratory system to take up O₂ and eliminate CO₂; a urinary system to remove wastes; a cardiovascular system to distribute nutrients, O₂, and the products of metabolism; a reproductive system to perpetuate the species; and nervous and endocrine systems to coordinate and integrate the functions of other systems” (Barrett et al., 2010: 1).

In addition to these systems, other systems have been identified as important in the functioning of the body either within the contents list of Barrett et al. or in separate guides in the *At a Glance* series presented to students, such as cellular physiology on the common functions within cells (Barrett et al. 2010: 31-59), the immune system to defend the integrity of the organism (Playfair and Chain, 2005; Barrett et al. 2010: 63-

77), and the musculoskeletal system to enable the individual to move within the environment (Barrett et al. 2010: 93-112).

The study of the systems and functions in physiology is presented to students in various sequences and frameworks. Radcliffe-Brown's proposal for physiology as the natural science for organisations is, however, also based on organisations or organised societies being recognised as living persistent entities, therefore subject to the natural laws of life (Radcliffe-Brown, 1957: 25). Instead of selecting an arbitrary framework of physiological systems and functions and to ensure mutual exclusivity, the research proposes to arrange the systems and functions in a format that supports the main laws of life. These were identified by Silver as the ability to create energy and maintain the integrity of the organism; the utilisation of this energy to respond to external stimuli through movement; and the ability to perceive, interpret and plan for persistence and procreation (Silver, 1998: 322). The study of human physiology as a prototype framework will, therefore, be explored in this chapter under the headings of:

- Visceral internally focused functions involved in obtaining, processing and distributing sources of energy and the self-maintenance and protection of the body to maintain its integrity.
- Motor musculoskeletal systems which allow the body to move and respond to stimuli in its environment.
- Cognitive functions of the central nervous system involved in the control of the body's functions, interpretation of sensory perceptions, planning and decisions.

Each of the systems will be explored with respect to the overall function it fulfils within the body; the main organs or functions within the system; their interrelationships to other functions within the body; and the means by which the activities of the functions are controlled. The potential contribution of the knowledge about the functions and some pathological conditions will be alluded to, although not as a formal part of the prototype framework.

The study of the systems and functions within the human body is important, but so is the study and understanding of the functioning of the cell as the building block within the living human body. The following section addresses this essential part in the understanding of the functioning of the body by exploring the common functionality, structures, requirements, controls, and the contribution made by the information in the study of the cells as the building blocks of the human body.

Cells as the Building Blocks of the Human Body

The key function of cells is metabolism, that is, to generate and use energy in order to perform various functions in maintaining the integrity of the body (Silver, 1998: 322).

Metabolism consists of two steps, namely catabolism in which energy is produced by the oxidation of nutrients, and anabolism in which the generated energy is used to perform cell-specific operations (Barrett et al., 2010: 459).

Common features within cells have been identified as the active parts or organelles (small organs); the cytoplasm or water-based medium within the cell; and the cell membrane. Two key organelles are the nucleus, containing the DNA which provides a complete blueprint for the organism, although only the cell specific section of DNA is

activated for the cell; and the mitochondrion, using generated subsets of the active DNA in the form of RNA messengers to generate and utilise energy (Barrett et al., 2010: 34, 40). The cytoplasm within the cell and the intercellular fluid outside, provides the cell with a balanced or homeostatic environment of chemicals, water and temperature to operate. The maintenance of this homeostatic balance is the focus of some of the internal functions in the body (Barrett et al. 2010: 58, 59) as discussed in the next section. The cell membrane is permeable, i.e. stable enough to form a boundary for the cell, but flexible and accessible to allow the transfer of nutrients and chemical, electrical or mechanical messages required for the functioning of the cell (Silver, 1998: 325-326).

In order to function, cells require a regular provision of nutrients such as protein, carbohydrates, fats, oxygen, minerals and water. Protein is required to build and renew the nucleus and mitochondria and to produce stimulants such as enzymes and hormones (Barrett et al., 2010: 15-18, 454). Carbohydrates and fats provide the cell with its source of energy (Barrett et al., 2010: 19-27, 457) through the process of oxidation in which oxygen is a major enabler (Barrett et al., 2010: 459). Minerals and other nutrients are cell specific requirements necessary in the products developed by the cells (Barrett et al., 2010: 458) while water and minerals are required to maintain a balance within the cytoplasm as the operating medium of the cell (Barrett et al., 2010: 2). Different types of cells require different nutrients and different levels of energy. Muscle cells, for instance, require more energy in order to contract (Barrett et al., 2010: 104), while bone cells will require calcium as a nutrient to ensure the maintenance and development of skeletal bones (Barrett et al., 2010: 371).

Cells communicate as part of the control process. Attached to the membranes of the cell, the nucleus and the mitochondrion are receptors through which cells communicate by means of chemical, mechanical or electrical impulses (Barrett et al., 2010: 33). Direct cell to cell communication takes place by means of chemical transfers between neighbouring cells (Barrett et al., 2010: 38); nerve cells communicate by means of electrical impulses to and from the receptor of the cell (Barrett et al., 2010: 83); and enzymes and hormones are picked up by the receptors, or created within the cell (Barrett et al., 2010: 33).

A summary of the function, structure and control of cells in general is presented in table 4.2. The functional roles of the different cells will be discussed in more detail in their respective sections.

Function/Role	Structure	Control	Types of Cells, e.g.
Metabolise – generate and use energy	Nucleus Mitochondrion Functional organelles Cytoplasm Membrane	Local and remote communication: -Electrical -Mechanical -Chemical	Muscle Endocrine Nerve Bone

Table 4.2 Cells as the building blocks of the human body

Knowledge about the functioning of cells highlights the importance of a balanced diet to ensure that all cells receive the essential nutrients they require to function, but also of the means of communication required to stimulate and control the processes within the cell. With respect to the nucleus and mitochondrion as the key organelles in the cell, an example of a pathological concern is the fact that the ongoing creation and recreation of the RNA messages from the DNA by the mitochondrion can lead to mutations as stated by Ganong: “Mitochondria have an ineffective DNA repair system, and the mutation rate for mitochondrial DNA is over 10 times the rate for the nuclear DNA . . . (resulting in) for

the most part disorders of tissues with high metabolic rates in which energy production is defective as a result of abnormalities” (Barrett et al., 2010: 34).

Cells are grouped into functions and systems discussed in the following sections. The objective is to present existing knowledge at an understandable level, as accurately and objectively as possible, in order to be able to develop the framework of functions, interrelationships and control which can be adapted for evaluation in organisations.

Visceral Functions

Visceral systems and functions support the body in its ability to generate and utilise energy through metabolism; to maintain the homeostatic balance of the inter- and intra-cellular environments; and to protect the body against foreign material.

System	Main Function/ Role	Relationship: Reactive to:	Relationship: Impact on:	Control
Gastrointestinal	- Ingestion and digestion of nutrients - Waste excretion	- External input - Central nervous system	- All cells via cardiovascular system - External environment	- Local and external stimulants
Respiratory	- Inhale and absorb oxygen - Exhale carbon dioxide	- External input - All cells via cardiovascular system	- All cells via cardiovascular system - External environment	- Local stimulation - Voluntary override
Cardiovascular	- Pump and distribute blood through the body	- All cells - Respiratory system	- All Cells - Respiratory system	- Local pacemaker for heart
Renal	- Eliminate waste - Maintain homeostatic balance	- Blood and intercellular fluids	- Cell environment - External environment	- Continuous process - Voluntary for elimination
Immune	- Protect against foreign organisms and material	- External environment - ‘Non-self’ material	- ‘Non-self’ material	- Innate and adaptive action
Endocrine	- Hormonal messengers affecting a variety of functions in the body	- Central nervous system	- All cells	- Hormonal feedback loop

Table 4.3 Visceral systems, functions, interrelationships and controls

The identified visceral systems are listed in Table 4.3 as the gastrointestinal, respiratory, cardiovascular, renal, immune and endocrine systems. The summary presents the system, the major function or role identified for the system, its interrelationships and means of control. The individual functions and structures identified within the systems are not included in the table, but are used in the construction of the full functional framework to be converted for the use in organisations. This transformation of the functional framework is addressed in Chapter 5 and Appendix 1.

Gastrointestinal System

The main function of the gastrointestinal system is to ingest, digest and absorb nutrients to be used for the generation of energy within the cells. An additional function is to process, collect and expel digestive waste material.

Structurally, the system consists of a continuous tract through the body, thus open to the external environment. It can be divided into different parts, each with specific dominant functions, such as the mouth and teeth for initial breakdown of food into manageable pieces; the stomach for the breakdown of proteins and fats; the small intestines for the breakdown of carbohydrates and absorption into the bloodstream; and the colon in which waste material is collected for subsequent excretion. The gastrointestinal system works in close cooperation with other organs, such as the taste and smell sensory receptors in the mouth, the liver to extract toxins, and the pancreas for the production of essential hormones to assist in the digestion of carbohydrates. The digestive system is also one of the systems in the body which tolerates and utilises the assistance of bacteria in the breakdown of food (Barrett et al., 2010: 429-486).

Cells most common and active in the gastrointestinal system are smooth muscle cells which operate within the digestive tract to move the food forward along the digestive tract, and glandular cells secreting digestive enzymes used in the breakdown process. The regular contraction of the smooth muscle cells and secretion of enzymes are triggered by a local nervous system, the enteric nervous system, which responds to mechanical, thermal and chemical stimuli within the tract from the food ingested (Barrett et al., 2010: 269-270).

Examples of pathological conditions of the gastrointestinal system include problems with the absorption of nutrients or difficulty to excrete waste material, such as lactose intolerance or the inability to effectively metabolise carbohydrates and sugars in diabetes.

Respiratory System

The respiratory system is responsible for the inhalation and absorption of oxygen, and the exhalation of carbon dioxide as the spent oxygen (Barrett et al., 2010: 587).

The system consists of different features such as the airways (including the nose, mouth and throat) and the lungs. The mouth and airways optimise the inhaled air for the lungs by humidifying and warming the air and identifying potentially harmful gases through smell. The various parts of the lungs absorb oxygen and transfer it into the haemoglobin of the red blood cells for distribution via the cardiovascular circulatory system to all cells, and to expel carbon dioxide.

The skeletal chest muscle enables the lungs to inflate and deflate in order to inhale oxygen-filled air and expel carbon dioxide by means of regular contraction and

relaxation. The respiratory system has its own automatic pacemaker system, independent of impulses from the cognitive brain. It is situated in the medulla part of the midbrain, and thus maintains a regular breathing rhythm (Barrett et al., 2010: 625). The cells in the medulla also receive stimuli from the cognitive brain through which the depth, frequency and duration of respiration can be voluntarily altered though not wilfully stopped.

As a key participant in all the metabolic processes, oxygen is essential for life, and a lack thereof can result in death within minutes, even if the rest of the organism is in a healthy state (Barrett et al., 2010: 587-637). A pathological example is the damage that can be introduced through smoking where the lungs are damaged and can therefore reduce the effectiveness of the person to absorb oxygen and reduce carbon dioxide.

Cardiovascular System

The main function of the cardiovascular system is to circulate blood around the body. The system is structured into the heart as the central pumping station, the circulatory arteries, veins and capillaries as the pathways for the distribution, and the blood being distributed.

The heart has local pacemaker cells that regulate the pace and strength of the heartbeat. This pace and strength can be adjusted from the midbrain by means of chemical messages especially if additional effort is required because of exercise or fright (Barrett et al., 2010: 518).

Circulatory blood vessels consist of arteries to transport blood from the heart; veins to transport blood from the various organs and cells back to the heart; and minute

capillaries in the tissue to ensure that all cells have access to the contents of the blood. Pressure in the circulatory system is kept within an acceptable range in the blood vessels by means of self-pacing smooth muscle cells surrounding the walls of the vessels, and since they are volume and chemical sensitive, the tension is adjusted according to the amount of blood being pumped by the heart (Barrett et al., 2010: 536).

Blood is the medium in which the various requirements for the cells are being transported. Although the components carried in blood are discussed together with the systems that produce and distribute them, they are varied and include dissolved nutrients, red blood cells transporting oxygen, white blood cells as part of the immune system, blood platelets to clot and stop blood loss, hormones and enzymes as chemical messengers, but also intruder cells or organisms which have managed to bypass the initial immune filters in the digestive and respiratory systems (Barrett et al., 2010: 521-527).

Heart failure occurs when the heart is unable to sufficiently pump blood around the circulatory system, leading to the ineffective distribution of nutrients, and could be fatal to the organism within minutes (Barrett et al., 2010: 508). Benefits to applied sciences lie in knowledge about the importance of heart disease and the use of transplants or chemicals to assist any defective operation of the cardio-vascular system. It is also possible to apply artificial pacemaking directly to the heart in case of defective action (Barrett et al., 2010: 93, 511).

Renal System

The function of the renal system is to maintain the internal balance (homeostasis) of intracellular, intercellular and blood plasma.

The renal system consists of the kidneys and the bladder. The kidneys filter the blood against excess water and waste material to ensure the correct water and mineral balance required by the plasma. The bladder acts as the receptacle of water and chemicals expelled from the kidneys and stored until released externally as urine.

The kidneys function in an automatic continuous process, triggered and dependent on the chemical composition of the blood it filters (Barrett et al., 2010: 639-662). The bladder is however under voluntary control of the central nervous system to excrete urine.

Kidney failure can lead to an imbalance of the composition of blood and body fluids and could lead to death due to retained toxins. Artificial dialysis providing external filtering of the blood or a kidney transplant would be required for survival.

Immune System

The functions of the immune system can be split into two main features: namely protection against, and prevention of, foreign and potentially harmful material from entering the body; and the action against any foreign intervention within the body. Blood cells also include platelets as a repair mechanism.

The skin and the membranes in the various systems, such as the gastrointestinal and respiratory systems, function as the initial protective shield against foreign material. External skin forms a non-permeable shield which becomes more permeable in the

membranes to allow foreign bodies to be filtered by the lymphatic nodes, such as the tonsils in the throat (Barrett et al., 2010: 605). The immune system includes lymph nodes, the spleen and free-floating white blood cells or lymphocytes in the blood. The lymph nodes and cells in the throat detect the presence of external harmful material. The white blood cells in the bloodstream detect and react to foreign, or 'non-self' material in the body (Playfair and Chain, 2005: 9) often responsible for infection, or introduced as grafts or transplants. They respond to these foreign pathogens through destruction and by building up antibodies as a memory of the intruding organism for future detection. The defence mechanisms also include blood platelets which will form a mesh to facilitate blood clotting in the case of damage leading to the loss of blood and its contents.

White blood cells and other lymphocytes operate as free floating cells in blood, located in the lymph nodes and circulating through the spleen by means of a lymphatic distribution system, independent of the blood circulation system. Although the control is independent from the central nervous controls, the immune reaction in the body can be enhanced by voluntary action of immunisation or desensitisation.

Adaptive immunity can, however, result in hypersensitivity and allergies or, in extreme cases result in the immune cells attacking the normal cells, such as in autoimmune diseases like rheumatoid arthritis.

Endocrine System

Endocrine hormones act as messengers, produced by various endocrine glands and with actions at distant sites. The role of the glands is to produce messages to stimulate cells

into increasing or decreasing activity (Greenstein and Wood, 2006). Other hormonal production also occurs in central nerve cells, mainly for direct impact on other nerve cells. This will be discussed in more detail in the section on the central nervous system, but examples of these include the production of serotonin, a mood-stimulating hormone, and histamine impacting sexual behaviour, blood pressure, pain thresholds, and the regulation of the secretion of other hormones (Barrett et al., 2010: 136, 137).

Individual glands within the endocrine system are discussed in more detail below. The control mechanism of hormonal production is most commonly through a feedback loop from the hypothalamus in the midbrain to the pituitary gland and from there stimulating different hormonal glands. Balance of the effect of the messengers on the cells is through the feedback loop back to the hypothalamus. Not all glands are affected by this feedback control loop as will be discussed for each type of hormone separately.

The thyroid (Barrett et al., 2010: 301) produces hormones to optimise metabolism.

Standard production includes the stimulation by the pituitary gland and hypothalamus as part of the standard control loop, and the hormones affect all metabolising cells.

Hormones secreted by the thyroid gland, for instance, play a role in the effectiveness of cell operations by maintaining an optimal level of metabolism in tissues through the stimulation of oxygen consumption in cells, regulating fat and carbohydrate metabolism and being essential for normal growth and maturation (Barrett et al., 2010: 301-313).

Pathological functioning either result in hypo-production leading to the slowdown of metabolic rate and lethargy, or to hyper-production resulting in hyperactivity.

The pancreas produces insulin and glucagon to regulate the storage or mobilisation of glucose for energy. Production of the hormone is under local continuous feedback control to maintain optimal glucose levels in the blood (Barrett et al., 2010: 327). The pancreas produces insulin which regulates efficiency through the intermediary metabolism of fat and carbohydrates (Barrett et al., 2010: 315-335), an absence of which can lead to diabetes and the resulting symptoms of inadequate energy production for normal cell operation.

The adrenal cortex in the kidneys produces adrenalin (also known as epinephrine). Adrenalin prepares the body for a fight or flight situation (Greenstein and Wood, 2006:37) by mobilising the availability of nutrients through increased metabolic and heart rates. Adrenalin is released in response to sympathetic nerve stimulation from spinal cord and affects all cells. (Barrett et al., 2010: 267). Examples of the impact of adrenalin include changes in the strength and contraction of the heart rate, changes in the diameter of airways, and a reduction in intestinal mobility.

The pituitary gland produces growth hormones. The hormones stimulate growth, especially young growing bones, and muscle and skeletal bone growth in adults. The production of growth hormones is regulated by the hypothalamus and form part of the standard feedback loop. Excess production of growth hormone could result in gigantism in young adults or the development of enlarged body parts e.g. hands or heart (acromegaly), in adults (Greenstein and Wood, 2006: 28).

Reproductive or sex hormones prepare the body for reproduction. Estrogen is regarded as a feminising hormone and progesterone prepares the uterus for pregnancy. They are

produced by ovaries. Testosterone as a masculinising hormone is produced by testes. These hormones result in the maturation of the sex organs in adolescence and enable reproduction in adults. Hormonal production is controlled as part of the standard feedback loop of control. Inadequate hormonal production can lead to infertility (Barrett et al., 2010: 421).

The parathyroid gland is responsible for the production of calcium regulating hormones. Calcium is an essential cellular element and the hormones controlling the calcium homeostasis is regulated in bones and kidneys (Barrett et al., 2010: 366). Calcium regulating hormones are released due to imbalance of calcium detected in the blood. Malfunction can lead to vitamin D deficiency and bone ailments such as rickets or osteomalacia (Barrett et al., 2010: 367) resulting in weak and deformed bone structures.

In conclusion, with respect to the visceral functions, the knowledge of their functioning emphasises the independent method of operation of these functions in support of all the parts of the organism. The respiratory, cardiovascular, gastrointestinal and renal systems have been identified as vital systems for the survival of the body, and malfunction can lead to death. The immune system, skin and skeleton play important roles in the protection of the body against foreign material, while the role of the endocrine system is to stimulate cells through remote communication messengers.

Motor Functions

The focus in the next section is on the motor functions of the body, as observed in the functioning of the skeletal muscle units in conjunction with the skeletal bones and joints

2010: 93). Muscle cells contract in muscle unit groups, controlled by nerve cells which provide the electrical stimulus for contraction. Figure 4.1 demonstrates the relative attention that each of these groups receive from the brain.

Each group of muscle fibres and their controlling nerve cell is referred to as a motor unit and, based on “the duration of their twitch contraction, motor units are divided into S (slow), FR (fast, resistant to fatigue), and FF (fast, fatigable) units” (Barrett et al., 2010: 105). It is this subdivision into the different types of muscle units that will be discussed in more detail in the subsections.

The control loop for the stimulation of the muscle units is from the motor cortex area in the brain for voluntary control to the cerebellum for continuous subconscious control, to the skeletal motor units (Barker et al., 2008: 76, 87). The feedback part of the loop is from receptors within the motor units or other parts of the body to the cerebellum for reflexive response, or to the motor cortex.

System	Main Function/ Role	Relationship: Reactive to:	Relationship: Impact on:	Control
Skeletal muscle – slow muscle (S)	- Slow muscle action for longer periods and strength, e.g. legs for walking	- Motor cortex - Cerebellum - Proprioception - Energy providing nutrients	- External mobility - Nervous system	- Motor cortex, - Cerebellum - Senses as feedback
Skeletal muscle – fast, resistant to fatigue muscle (FR)	- Fast muscle action for fine graded and precise movements, e.g. fine movement of fingers	- Motor cortex - Cerebellum - Senses, especially touch - Nutrients	- External agility - Nervous system	- Motor cortex, - Cerebellum - Senses as feedback
Skeletal muscle – fast, fatigable muscle (FF)	- Fast muscle for fine graded and brief demanding tasks, e.g. facial muscles in smiling	- Motor cortex - Cerebellum - Senses, especially vision and hearing - Nutrients	- External expression - Nervous system	- Motor cortex, - Cerebellum - Senses as feedback

Table 4.4 Motor systems, functions, interrelationships and controls

The motor cortical areas responsible for the stimulation of the motor units, as presented in Figure 4.1, provide an indication of the distorted focus on the stimulation of the different types of motor units within the voluntary brain. The cerebellum acts by initiating and storing motor information as part of non-declarative memory in the brain and using this memory of action as a comparator or timing device in regulating smooth muscle action (Barker et al., 87). Of the different muscle units, the fast muscle units in the fingers, face and tongue have greater representation in the motor cortex than the slow muscle units of the arms, legs and back. Differences in the functioning, interrelationships and controls of these three types of muscle units are summarised in Table 4.4 and discussed in more detail below.

Slow muscle unit

The slow muscle unit fibres contract in the strong and sustained movement required for posture, standing, continuous movement and heavy lifting.

The muscle units are situated in the back, neck, legs and arms. Each nerve cell can stimulate up to 600 muscle fibres within one motor unit and the units have a longer continuous period of contraction. The muscle units are subject to the standard control feedback loop for skeletal muscle, however, the voluntary impact from the motor cortex is lower than for the fast muscle units. Slow muscle in the arms and legs, such as the hamstring muscle extend over one or more joints to allow for maximal motion with minimal muscular effort (Barrett et al., 2010: 105, 106). For effective long term utilisation of these muscle units the cells, however, require energy in the form of oxygen, carbohydrates and fats.

During excessive exercise, there is a possibility that the stored energy is exhausted and the cell compensates through a breakdown of the glucose to lactose. In these cases the muscle can develop an oxygen debt resulting in muscle cramp and inability to operate (Barrett et al., 2010: 104).

Fast muscle unit

Fast muscle fibres have a fast and short contracting period and are involved in “fine, rapid, precise movement” such as that executed in the fingers and hand movements (Barrett et al., 2010: 105).

The feedback loop control is the same as for the slow muscle units, however, the feedback cycle initiated by the touch senses, especially in the skin of the finger tips, is much stronger than for the other motor units (Barker et al., 2008: 53). Figure 4.1 also highlights the larger representation in the motor cortex of the brain for the fast muscle units in the fingers, especially the thumb (Barker et al., 2008: 84, 85). Similar to the slow muscle, the fast muscle fibres in the fingers are attached by tendons to the smaller bones in the hands and feet, and operate over joints to enable the precise movements required.

Pathological conditions mainly refer to inflammation in the joints leading to arthritis.

Fast fatigable muscle unit

Fast muscle fibres prone to fatigue have a fast and short contracting period, are involved in rapid and precise movement, and can tire easily, such as facial muscle and the movements of the eye (Barrett et al., 2010: 105).

Figure 4.1 highlights the larger representation of facial muscle over the slow muscle units (Barker et al., 2008: 84, 85) in the motor cortex. The higher representation in the motor cortex indicates the importance of the direct control especially over the mouth and tongue used for vocalisation and facial expression. The fast response may be less durable than for the slow muscle units, but can be more intense and targeted.

Loss of the use of these muscle units result in the inability to vocalise or change facial expressions. The body contains all the different types of muscle units. Individuals can, however develop one muscle type through training such as athletes or singers in preference to the other types.

Central Nervous System

This section discusses the central nervous system. Parts have already been referred to in the functions already covered due to their integrated relationships in the control of these functions. Duplication will be limited to essential information not yet covered.

The nervous system operates at cell level to provide electrical and mechanical stimuli to the various parts of the body and to detect changes through the nerve cell receptors.

The system is broadly divided into three major parts namely the autonomic, peripheral and central nervous systems. The autonomic nervous system is concerned with the stimulation of internal functions and therefore the homeostatic balance within the body. The peripheral nervous system perceives changes and transmits impulses mainly from and to the muscle cells, while the central nervous system refers to the areas in the brain involved in the reception of the impulses from the various part of the muscle and sensory functions, interpret and react on these impulses, including the higher functions

of the brain. Because of the integrated relationships of control and impact the roles of the autonomic and the peripheral nervous systems have already been covered in the previous sections of this chapter. This section will therefore focus on the senses and the cognitive brain or central nervous system.

Table 4.5 provides a list and brief summary of the major systems of the central nervous system discussed in this section. Each of the systems and functions explores the function, structure, relationships and control mechanisms.

System	Function/ Role	Relationship: Reactive to:	Relationship: Impact on:	Control
Senses				
Somatosensory perception	- Touch, pain, temperature changes and pressure in cells	- External environment - Internal muscle cells	- Central nervous system (CNS)	- Direct stimulation of nerve receptors
Proprioception	- Continuous monitoring of motor units to maintain balance	- Skeletal muscle cells - External gravity	- Motor control of central nervous system	- Continuous monitoring and correction
Special senses	- Smell, sight,, hearing, and taste.	- External environment	- Central nervous system	- Directed control
Cognition and higher functions				
Association cortices	- Information interpretation and planning	- All parts of nervous system	- Various nervous systems such as hypothalamus	- Voluntary action
Learning and memory	- Memory banks, understanding and learning.	- Senses - Central nervous system	- Other parts of nervous system	- Voluntary retrieval
Emotion, sleep, consciousness	- Various cortical areas involved in emotion, sleep.	- Senses - Central nervous system	- Hypothalamus	- Cyclical and emotional action
Language and planning	- Language perception and initiation	- Senses - Central nervous system	- Fast facial muscle - External environment	- Voluntary control

Table 4.5 Central nervous systems, functions, interrelationships and controls

Senses

The general function of the senses is to observe and detect stimuli from the external and internal environment.

Different senses are covered in more detail as the somatosensory system, receiving impulses mainly from internal functions, but also external through receptors in the skin; proprioception focusing on muscle fibres for mobility, agility and posture; and the special senses receiving stimuli from the external environment.

Somatosensory System

The somatosensory system (Barker et al., 2008: 52, 53) detects and reacts to changes in touch, pressure, pain, and temperature internal and external to the body.

Somatosensory perception acts through nerve ending receptors in the skin and muscle cells. The relative numbers of touch receptors are much higher in certain areas of the skin, such as the fingertips, thus allowing for greater sensitivity through the fingertips. Temperature perception, and pain (Barrett et al., 2010: 167-171) is associated with actual or potential tissue damage.

Interpretation and response to the somatosensory stimuli from the body takes place mainly in the associated somatosensory areas in the brain which then project to the hypothalamus for thermoregulation and response to pain.

Pathological conditions can lead to numbness and inability to detect pressure, pain and differences in temperature, or to chronic pain.

Proprioception

Proprioception is involved in the control and maintenance of balance and posture of the body.

Receptor cells situated in the middle ear monitor and regulate balance, postural reflexes and eye movements (Barker et al., 2008: 69). The perception area in the brain receives and consolidates stimuli on pressure or touch from the joints, balance of the positioning of the body in its environment from the inner ear, and the visual perception of the environment from the eye. From here it transfers information to the cerebellum and the eye muscle nerve cells.

Important applications for the body include the maintenance of balance during walking and standing, and reflex eye movements to enable focusing on one point while moving the head.

Special Senses

The special senses of sight, hearing, smell and taste are involved in the perception of stimuli from the environment around the body.

The standard control pathway is from the receptor cells in the sense organs to the association areas in the brain for interpretation and then to the relevant parts of the higher functional areas in the brain. Reaction from the higher centres to other parts of the brain such as the hypothalamus or cerebellum controls the endocrine and muscle reaction to the perception in order to close the control loop (Barker et al., 2008: 48).

The function of the visual sensory system (Barker et al., 2008: 58-63; Barrett et al., 2010: 181-199) is to observe through sight. The receptor cells in the retina of the eye are responsible for converting light energy into electrical impulses and to transmit the impulses to the visual areas in the brain where the stimuli are analysed and combined into composite pictures. This knowledge is, for instance, important for diagnostic

purposes to establish whether an inability to see is related to damage in the eye, such as with cataracts, or as a result of nerve or brain damage in transmitting and interpreting the light image, such as in persons with blindsight who are capable of receiving the light impulses, but unable to interpret them in the brain.

Hearing (Barker et al., 2008: 64-67; Barrett et al., 2010: 203-216) is responsible for sound perception from the receptors in the ear where sound waves are detected, converted into electrical signals and transmitted to the associated auditory areas in the brain. These auditory areas interpret sound as well as more complex interpretation of music and language and eventually transmit to the frontal lobe, responsible for the expression of speech. Hearing disabilities could lead to complications in speech and verbal communication in individuals.

Smell and taste senses (Barker et al., 2008: 70,71; Barrett et al., 2010: 219-226) are mainly involved in the perception of different chemical stimuli in the form of odours or taste through receptors in the nose and on the tongue, before transmission to the associated sensory areas in the brain. Although subject to the standard sensory control loop, inhibitory cells in the pathways to the sensory areas for smell and taste can change by being replaced and changed throughout life. Taste and smell play an important role in the mouth and nose in detecting food and inhaled air that may stimulate or be detrimental to the body.

Higher functions of the brain

The higher functions of the brain include the interpretation and understanding (cognition) of sensory impulse information, learning, memory, consciousness, sleep and

language. Impulses are received by the association areas or cortices in the brain from the various senses for interpretation and further transmission to other areas in the brain for storage such as in memory, or to initiate and stimulate action such as the hypothalamus or the motor cortex and cerebellum.

The higher functions covered in this section are the association cortices, and the areas involved in learning and memory, emotion, sleep, consciousness and language.

Association Cortices

Association cortices “are those parts of the cerebral cortex that do not have a primary motor or sensory role, but instead are involved in higher order processing of sensory information necessary for perception and movement initiation” (Barker et al., 2008: 72).

These areas include the areas of the cortex connected to the senses and the motor cortical areas with respect to perception interpretation, and the initiation and control of muscle action. The motor and sensory areas have already been covered as part of the control functions in these functional categories. However, the brain does not only support a one-to-one link between senses and association areas, but contains more areas as part of the control loop such as the posterior and prefrontal cortical areas. The posterior cortex “is related to specific forms of human behaviour, such as the extensive use of tools, collaborative strategic planning and the development of language” (Barker et al., 2008: 72). The prefrontal cortex is best developed in humans and involved in the purposive behaviour of the individual through the planning of responses to stimuli that include a motor component, i.e. movement (Barker et al., 2008: 73). These two cortical areas are, therefore, intimately involved in the planning and initiating of motor activity,

to be transferred to the motor cortex areas for implementation, as well as external means of communication through verbal interpretation and speech. Damage can lead to a change in motor activity, the emotional responsiveness to external input and even the ability to talk, thus damaging the means of external communication and response (Barker et al., 2008: 73).

Learning and Memory

Memory can be split into non-declarative and declarative memories (Barker et al., 2008: 102-103; Barrett et al., 2010: 290). Non-declarative memories have already been discussed as part of the operation of motor functions and typically involve the cerebellum and motor cortical areas of the brain for routine control of action through learning. Non-motor or declarative forms of memory are involved with the taking in, manipulating and storing of information for problem solving, and the recall of events and factual knowledge (Barker et al., 2008: 102, 103). This type of memory can be subdivided into working memory and long term memory. Working memory is short term and small, usually only involving a small sample of around seven items at a time, and can be lost once the attention in the brain is diverted to a different direction. On the other hand, the long-term memory is defined as a store of practically unlimited memories stored over a lifetime. Damage to these areas of the brain can lead to a loss of either short or long term memory as in stroke patients or persons suffering from dementia.

Emotion, Sleep and Consciousness

The awareness of self-consciousness and the control of emotion are higher functions of the brain identified in higher primates and studied in humans.

The system involved is the limbic system, a group of areas in the brain receiving sensory information from various parts in the brain, and transmitting impulses to the prefrontal cortex and hypothalamus as well as to cortical areas involved with the planning of behaviour, including motor response (Barker et al., 2008: 100-101). Reaction to the emotional state reached within the limbic system affects the stimulation of glandular or neuronal secretion of hormones to guide the motor or other visceral activities in the body and should, therefore, be considered in conjunction with the chemical messages in hormones coordinated by the hypothalamus and its controlling endocrine glands.

Damage to the limbic structure include blunted emotional reactions to normally arousing stimuli; the inability to recognize facial expression of fear; potential motor neglect; reduced pain perception; or reduced aggressiveness. Also important is the impact of drugs and external stimuli on the decision-making and initiating of action by the cognitive part of the brain (Barker et al., 2008: 104- 105).

Sleep “is defined behaviourally as a reduced responsiveness to environmental stimuli” (Barker et al., 2008: 96). This reduced state of responsiveness differs among species and can change into hibernation for species living in colder climates during the winter period, pointing to seasonal periods of high and low motor activity, depending on environmental factors. Sleep disorders such as insomnia can lead to the inability of the body to function normally during the day (Barker et al., 2008: 97).

Consciousness, on the other hand, includes both physiological and psychological knowledge by differentiating between the level and the content of conscious experience. While the level of consciousness can be measured by monitoring the level of

arousal through electrical impulses in the brain, the content of consciousness refers to the objects and events of which we are aware, and can only be described subjectively by the individual being tested. Barker et al. state that:

“As humans, we may be unique in being conscious of our consciousness. This thinking about thinking has been referred to as ‘meta-representation’ and it is perhaps the ability to represent our own mental states and those of others that facilitates and shapes our most complex social interactions. To be able to represent the mental states of others has been referred to as having a ‘theory of mind’. We must use this theory of mind to interpret, explain and predict many of the actions and utterances of other people. If someone is being sarcastic or deceitful, they say and do precisely the opposite of what they feel. By understanding these possibilities their behaviour may become more logical and predictable to us” (Barker et al., 2008: 99).

Barker et al. classify neural disorders according to chemical (anxiety, depression, schizophrenia), physiological (epilepsy), immunological (encephalitis), genetic or degenerative malfunctioning of parts of the cognitive brain (Barker et al., 2008: 116-129).

Language

Language functions include the understanding of the spoken and printed word, as well as the ability to express ideas in speech and writing (Barrett et al., 2010: 297).

Ganong discusses the functions of the brain responsible for language processing as follows: “Memory and learning are functions of large parts of the brain, but the centers controlling some of the other ‘higher functions of the nervous system,’ particularly the

mechanisms related to language, are more or less localized to the neocortex. Speech and other intellectual functions are especially well developed in humans” (Barrett et al., 2010: 295). Similar to the other higher functions in the brain, the language area therefore links closely with other areas of memory, learning, sensory perception and interpretation, and the stimulation of the fast motor units for speech and writing.

Summary and Conclusions

The focus in Chapter 4 was on the development of a prototype framework to be used to evaluate Radcliffe-Brown’s theses of the study of physiology as a natural science for the study of organisations and organised societies (Radcliffe-Brown, 1957: 8-10). Major systems and functions were identified from known textbooks in human physiology and explored with respect to their main functions, structures, interrelationships, control mechanisms, and contributions made from the knowledge of their functioning or pathological conditions.

Whereas the major systems reflect the grouping of functions as presented in various textbooks, the systems and functions discussed and presented in tables 4.3 to 4.5 were arranged in a sequence to enable a closer match to the main functions of living entities as identified by Silver, namely, the generation and use of energy, ability to respond to stimulation, and the ability to persist as an independent entity and procreate as a species (Silver, 1998: 322). Table 4.6 presents an overview summary of the functions and their interrelationships discussed in this chapter.

The functions performed by the visceral systems interrelate to ensure that cells are provided with nutrients required to generate and use energy to perform their tasks, and

for the protection of the cells in the body. The functioning of the motor systems enable the body to move and obtain the nutrients from its environment, and the senses and cognitive functions allow the brain to interpret internal and external stimuli and respond accordingly. It was also possible to show that the components and functions in the body are not static and in balance, but complex and their interrelationships continuously changing in response to stimuli.

	<i>Visceral functions</i>	<i>Motor functions or limbs</i>	<i>Central Nervous System</i>
Functionality	<ul style="list-style-type: none"> - <i>Gastrointestinal system</i> - <i>Respiratory system</i> - <i>Cardiovascular system</i> - <i>Renal system</i> - <i>Immune system</i> - <i>Endocrine system</i> 	<ul style="list-style-type: none"> - <i>Musculoskeletal system – combined muscle and bone:</i> - <i>Slow muscle units</i> - <i>Fast muscle units</i> - <i>Fast fatigable muscle units</i> 	<ul style="list-style-type: none"> - <i>Somatosensory perception</i> - <i>Proprioception</i> - <i>Special sensory perception</i> - <i>Association cortices for interpretation and control</i> - <i>Memory, language, speech</i> - <i>Consciousness, emotion and sleep</i>
Domain of operation – reactive to:	<ul style="list-style-type: none"> - <i>Selective input from external for nutrients and air.</i> - <i>Homeostasis</i> - <i>Volume of throughput.</i> 	<ul style="list-style-type: none"> - <i>Motor cortex for voluntary stimulation.</i> - <i>Cerebellum for subconscious stimulation.</i> 	<ul style="list-style-type: none"> - <i>Senses for external and internal perception.</i> - <i>Related areas in cortex.</i>
Domain of operation – influence on:	<ul style="list-style-type: none"> - <i>Cells and organs.</i> - <i>Selective to external for carbon dioxide and waste material.</i> 	<ul style="list-style-type: none"> - <i>Association cortices.</i> - <i>Immediate external environment, through movement, speech and expression.</i> 	<ul style="list-style-type: none"> - <i>Muscle cells in limbs, direct or via cerebellum.</i> - <i>Visceral functions – partial and through intermediaries.</i> - <i>Expression to external environment.</i>
Mode of operation – Nervous system control	<ul style="list-style-type: none"> - <i>Local pacemakers, except</i> - <i>Endocrine – integrated feedback control loop.</i> 	<ul style="list-style-type: none"> - <i>Feedback loop from muscle through senses to cerebellum and motor cortex and back to muscle units.</i> 	<ul style="list-style-type: none"> - <i>Networked interconnections in the brain centre.</i>

Table 4.6 Summary of functions and interrelationships of living organisms

The transfer of the prototype set of systems and functions as studied in the physiology of the human body to a framework which can be used to evaluate the feasibility of the study of the physiology of organisations as one of the natural sciences, is addressed in Appendix 1 and Chapter 5. Guidelines and criteria for the transformation of the

classification framework for organisations were applied to reduce the element of subjectivity and these guidelines are presented in Appendix 1.

Chapter 5 presents and discusses the analogous framework for organisations, the research approach adopted for the research project to evaluate this framework, and a sample evaluation of the data obtained during the research process.

The research data is analysed and interpreted in Chapters 6 to 8 with respect to the ability to observe the analogous functions in organisations and the interrelationships which can be observed during change events among these functions. Chapter 6 explores the analogous visceral functions, while the motor and cognitive functions are explored respectively in Chapters 7 and 8.

Chapter 5 Research Method, Data and Sample Validation

“Research design . . . refers to a framework for the collection and analysis of data. A choice of research design reflects decisions about the priority being given to a range of dimensions of the research process” (Bryman and Bell, 2003: 573)

Introduction

The objective of my research project is to show how I set about studying the physiology of societies and organisations as a natural science within the single branch of science proposed by Radcliffe-Brown (Radcliffe-Brown, 1957: 3). Various conceptual and practical concerns were raised and addressed in Chapters 2 and 3 with respect of the scope, scale, reification and generalisability of the research approach, data and findings.

In Chapter 3 it was necessary to delimit the scope of the study to organisations and organised societies in which the individuals are components in functional relationships and roles towards maintaining the persistence of the organised society or organisation as an autopoietic entity (Maturana and Varela, 1980: 87). The scale for the research was limited to the level of independent business units or independently operating government institutions and organisations, in preference to a higher scale level of conglomerate businesses or nation states. The practicalities of identifying the functions performed within the organised societies and organisations included the danger of reification which was addressed in Chapter 3 (Cohen, 1970: 47).

The rest of this chapter discusses the approach and method selected and followed for the research project and evaluates the sample for acceptability before conducting the analysis of the findings in Chapters 6 to 8.

Research Approach

Two major concerns that required attention in deciding the research approach for the project are the method to be used to identify and observe the functions in organisations, analogous to physiological functions as discussed in Chapter 4, and the need to ensure that the findings and conclusions can be generalisable to different types of organisations. The research approach favoured by Radcliffe-Brown was grounded observations to identify functions common or unique to societies. Criticism against the qualitative approach of grounded observations and research are that, as identified in Chapter 4, the research can be subjective, difficult to replicate, and result in the inability to generalise (Bryman and Bell: 2003: 298-301). It is also time consuming and restricted to what the organisations allow to be included in the research. The decision was to conduct a modified meta-analysis of academic research literature to support generalisability of results and a prototype framework of functions to limit subjectivity and allow replication of research. These choices are discussed below.

Secondary Literature Analysis

In order to address the constraint of a sample which could be too small to be generalisable, the options of secondary data analysis, meta-analysis and content analysis of previous research projects were considered. All of these methods would allow for a large enough sample, but each method had its own advantages and disadvantages.

Bryman and Bell defined secondary analysis as “the analysis of data by researchers who will probably not have been involved in the collection of those data for purposes that may not have been envisaged by those responsible for the data collection” (Bryman and Bell, 2003: 574). The disadvantage of a secondary analysis is that it requires a database or datasets which have already been compiled and in which it will be possible to identify functions and their interrelationships within organisations such as data provided by the Department of National Statistics, or by other researchers who conducted similar function-related projects (Bryman and Bell, 2003: 212). Since usable datasets were not readily available, this sample selection method was rejected as unsuitable.

Meta-analysis is defined by Bryman and Bell as a method “by drawing together the findings from more than one . . . research studies” (Bryman and Bell, 2003: 571). Similar to following a secondary analysis approach for the research, a meta-analysis approach is also fraught with disadvantages and limitations. Meta-analysis as the re-interpretation of the work performed by other researchers, is subject to the personal interpretations and opinions developed by their authors. Sample selection is bound to be subjective as it will be necessary to focus only on research papers which clearly address functions and their interrelationships within organisations and the interpretations of functions would be subjective as interpreted by the authors and may not include all the relevant functions within organisations.

A content analysis is defined as “an approach to the analysis of documents and texts that seeks to quantify content in terms of predetermined categories and in a systematic and replicable manner” (Bryman and Bell, 2003: 568). It would have been possible to identify some of the functions within organisations by performing a content analysis of

the annual company reports in which functional departments can be identified from the published organisational structure, or from the fund allocation to these functions as shown in the financial statements of the organisations. This approach could also have provided a large enough sample to be generalisable. However, the concerns were with respect to the potential subjectivity inherent in selecting the company reports to be studied; the fact that organisations are not obliged to name all their departments or functions; and the absence of independent public organisations such as local authorities. While most of these concerns could have been addressed by setting out rules for selection, research and interpretation, the major disadvantage was the absence of information on the interrelationships among the identified functions (Bryman and Bell, 2003: 220), one of the key variables required for the research.

To limit the constraints and limitations of these approaches, the data method adopted for the research and thesis was a modified content and meta-analysis approach. The research used recently published organisational research papers presented in accredited academic journals (Bryman and Bell, 2003: 213-218) as the main source of data. The data was, however, not the findings and interpretations of the authors of the research papers, but an identification of functions and interrelationships referred to in the research papers as separate and project-independent data which can then be further analysed. While this approach reduced the concerns about subjectivity of the author opinions, the subjectivity was transferred to the identification and interpretation of functions and interrelationships for this research project. To limit this concern, detailed guidelines on how to identify functions and interrelationships; and how to code and

record the findings were compiled and these guidelines are discussed in the section on coding later in this chapter.

Why Study Change?

An adapted meta-analysis approach is unlikely to be the best generic approach for the study of organisations, but was regarded as the optimal approach to provide a wide sample for the research analysis. There was however one further concern about the use of meta-data and that was the potential inability to identify interrelationships within a normal working environment by identifying the functions in the research papers.

Research papers in the field of organisation studies tend to focus either on abstract research into theories around organisational paradigms, metaphors or methods for research, or alternatively address practical problems and potential solutions to management concerns (Whitley cited in Tsoukas and Knudsen, 2003: 2). A meta-analysis of research papers will have to choose between the two main trends in research if a wide and objective sample has to be found. Since theoretical research is more subjective than problem solving research, the choice was made to focus on problem solving change research as a limiting criterion in the selection of research papers.

Selecting to study change, whether to address health concerns or to impose change, is not new in the study of the physiology of organisms. Pathology has always been closely linked to the study of physiology of the human body, and this combination has been used since the eighteenth century to classify diseases (Cook in Loudon, 1997: 92) and develop cures. An analysis of the changes in these disease classification systems provides us with an insight in how the knowledge about the functioning of the body and

the understanding of diseases has progressed and the subsequent impact on effective targeting and development of cures for diseases. This link of the functioning of the body to diseases and the understanding of the differences between normal and pathological interrelationships was promoted by Canguilhem by stating: "It is in pathology . . . that we can unravel the teachings of health" (Canguilhem, 2007: 43) and also forms a part in the current medical study of human physiology, such as the changes that occur in the human brain which leads to the onset of Alzheimer disease (Barrett et al., 2010: 294). Chapter 4 alludes to some of these abnormal processes of functions within the body and their impact on other functions to provide a better understanding of the interrelationships among functions. Pathology to provide a focus on the functioning of the body does not, however, imply that equilibrium is always the end result of healing and changes, as identified by Canguilhem (2007) in his discussion on disease, cure and health. Canguilhem regarded the process of change on the body as twofold, namely changes to promote healing, or deliberate change to attempt to modify the functioning or processes within the body. He maintained that pathology should be studied in conditions as observed by the individual and subsequent changes in interrelationships among normal functions within the body; and that the healing process does not bring the body back to the previous state, but to a new acceptable state. "The healthy man does not flee before the problems posed by sometimes sudden disruptions of his habits, even physiologically speaking; he measures his health in terms of his capacity to overcome organic crises in order to establish a new code" (Canguilhem, 2007: 200).

Change in the study of organisations also features strongly in organisational theories, metaphors and research projects. Again two types of change are addressed. Deliberate

change to the processes of the organisation, usually in response to external market or environmental pressures as promoted by the contingency theorists (Morgan, 2006: 88, 89); and internal changes such as changes to the culture of the organisation (Morgan, 2006: 60-61, 137-147) or to improve operational processes. Analogous to the linking of pathology to physiology in the study of the human body, not all changes or cures are successful, or the interrelated impact of some minor changes could be significant on other functions or external to the organisation (Morgan, 2006: 261-262).

The introduction of a selection criterion of change projects within the research papers to be included in the sample, therefore allows for the interrelationship among functions to be observed and studied within situations of change, while at the same time allowing for additional information to be collected and included in the research. Interrelationships in a position of change also provide an understanding of normal interrelationships. The additional information includes the types of change programmes, the different roles performed by functions within the process of change, impact analysis of change activities including whether a change activity could fail, and why.

The choice for the research was therefore to focus on change projects within academic research journals as the main source for an adapted content and meta-data for the research into the testing of the feasibility of the study of physiology of organisations as promoted by Radcliffe-Brown.

Research Method

The research method in support of the meta-analysis of change projects addressed practical concerns in the selection, codification and evaluation of a sample of data, in

order to enable the analysis of findings to result into acceptable and generalisable conclusions. The methodology covers the analogous translation of the physiological functional framework for organisations and organised societies; the selection of suitable published research papers to form the data source; and the codification of the sample of data for subsequent evaluation.

It has already been acknowledged that a grounded approach to identify functions in organisations would have been slow and potentially incomplete. Radcliffe-Brown identified functions of language; culture or social usages; justice, including law and criminology; and economics to be included in his proposed single science for the study of society (Radcliffe-Brown, 1957: 8, 129-140). The focus on selected functional areas was also promoted by Parsons as the societal community, the fiduciary system, economy and politics (Ritzer and Goodman, 2004a: 100-104). This selective focus on functions has continued in the study of organisation and national institutions resulting in the well-established functions such as economics, law, central politics etc. to be recognised and studied in the institutional sciences today (Morgan et al., 2010).

Whereas this approach had success at national level, the focus of my research is on independent business units as organisations, and the concern about the ability to observe functions within organisations at first hand due to reasons of privacy and security. The proposal for the research project is therefore to start with a prototype framework of functions already identified in the human body as a persistent living entity at the scalar level below the study of societies, and to explore whether similar functions can be observed within organisations. This prototype framework was developed in Chapter 4 and presented in Tables 4.3 to 4.6. The practical approach in how to change

the prototype framework into a framework which can apply to organisations and be used in the research is discussed below and in the section on research coding.

Prototype Table of Functions

The initial research step discussed in this section concerns the transposition of the functions as proposed in a framework for the human body in Chapter 4 into identifiable functions in organisations. A prototype framework is regarded as a 'best example' of an analogous picture of a similar framework, and in order to support objective evaluation, the framework must comply with the underlying properties of a classification system of consistency, mutual exclusivity and completeness (Bowker and Leigh Star, 1999: 62, 10, 11). It was therefore important to ensure that the prototype framework proposed in Chapter 4 complies with these requirements. Appendix 1 contains the final prototype and converted table of functions identified for organisms, adapted for organisations and used in the research project.

Silver identified three categories of energy generation; the ability to respond to stimuli; and the persistence of the organism as some of the major functions of living entities (Silver, 1998: 322) and these categories were used in Chapter 4 to classify the functions into the categories of visceral, motor and cognitive functions (Barrett et al., 2010: 1, 63-77 and 93-112). Within each category the framework follows the major systems and functions as identified in the study of human physiology, such as the digestive and respiratory system for energy provision, muscle type for response to stimuli and the central nervous system to plan and act for persistence. All attempts have been made to ensure that the structure of category, system and function is consistent.

In order to address exclusivity of functions, thereby preventing duplication in understanding and the identification of individual systems, some of the physiological functions required special attention in this prototype framework. The integrative nature of the central nervous system, and especially the peripheral nervous system, could, for instance, result in functions being allocated to more than one category and/or system. To prevent duplication, the controlling roles of the peripheral system equivalents were grouped together with the relevant internal and operations functions. Similar to the management functions, the sensory perception functions were allocated to the main category of systems affected by the perception: somatosensory perception from the internal systems and functions was allocated to visceral/internal systems; proprioception to motor/operational systems, and the special senses to the cognitive/executive functions. The third requirement for a prototype framework which can be used in research, is to ensure that the components, in this case functions, contained in the framework are as complete as possible. In Chapter 4 attempts were made to ensure that the identified systems and functions in the prototype framework are complete at a high level.

In the process of 'translating' the physiological framework into a framework of functions which could be applied to organisations, five categories of functions were identified.

'All' as the first group, refers to the general processes observed within individual cells and, therefore, also the components within organisations, whether people or equipment. In the research project this category was identified and coded as such only if it was not possible to identify the function represented by the individual and analysis of this data was limited. Internal functions in organisations were used as analogous to the

visceral functions within the physiology of the human body. Operations, analogous to motor functions, identify the functions responsible for the mobility and agility of organisations. The cognitive functions, translated as executive management functions are responsible for interpretation of various input information from within and external to the organisation, and to plan, decide and communicate on longer term persistence of the organisations. However, since the organisation operates within its external environment, influences from parties or actors external to the organisation were also identified.

Sources for information on equivalent functions in organisations included acknowledged study handbooks on organisational and management studies, acknowledged professional and trade institutes and published company reports. The following adjustments were found to be necessary in transforming the prototype framework from human physiology to a physiology of organisations:

- Supply and distribution in organisations does not follow a single common path such as in the gastrointestinal and cardiovascular systems. The framework therefore split the supply functions into the different types of supply, i.e. people, supplies, material, systems and equipment.
- It was not possible to find a direct match between the organisational function of human resource management and the analogous functions in the human physiology. For this reason the framework split the functions generally attributed to human resources into supply and communication functions.

- It was not possible to detect organisational functions and activities dedicated to sex and procreation hormones. Many examples could be detected of change programmes involved in mergers, acquisitions and divestment, but not in functions only focused on these activities. Recording of mergers, etc. was restricted to types of changes and not to specifically dedicated systems.

Table 5.1 presents a high level framework discussed for the study of the human body in Chapter 4 and converted to be used as a prototype framework that can be evaluated for its suitability for the study of organisations.

Physiology of Organisms	Area of Control	Area of Impact	Physiology of Organisations
Cell biology			All incumbents
Visceral Survival Functions: <ul style="list-style-type: none"> • Respiration • Digestion • Cardiovascular • Renal and Colon 	Local Local Local Continuous	External and internal Internal Internal and external	Internal Functions: <ul style="list-style-type: none"> • Accounting, fund allocation • Logistics • Workplace management
Visceral Protection and Health <ul style="list-style-type: none"> • Skin and Immune • White blood cells 	Continuous	External Internal	<ul style="list-style-type: none"> • Protection and security • Health and safety
Visceral Communications <ul style="list-style-type: none"> • Hormonal system 	Networked feedback loop	Internal	Internal communication
Motor functions <ul style="list-style-type: none"> • Different muscle units 	Cortex: stimulation Cerebellum: routine	External mobility, agility	Operations functions <ul style="list-style-type: none"> • Operations sectors and units
Senses <ul style="list-style-type: none"> • Somatosenses • Proprioception • Major senses 	Central nervous system	External Internal	Information <ul style="list-style-type: none"> • Internal information • Target monitoring • External information
Cognitive <ul style="list-style-type: none"> • Cortices for interpretation • Higher functions of plan and decisions • Language • Limbic system, emotions 	Central nervous system	Internal External	Executive/ Management <ul style="list-style-type: none"> • Information interpretation • Planning and strategy • External communication • Meaning – not covered

Table 5.1 Categories of Physiological and Organisational Functions

The full set of systems and functions together with the guidelines followed in developing this framework is presented in Appendix 1. The high level functional categories presented in Table 5.1, based on the framework developed in Chapter 4 and converted to analogous functions in organisations as described in this section and Appendix 1, have been used in this research project to evaluate the suitability of this functional framework for the study of the physiology of organisations. It has to be accepted that the translation of the functions are personal and therefore subjective, although extensive attempts were made to substantiate the reasons for the selections and the use of guidelines to minimise reification and ensure consistency. This framework was subsequently used in the coding exercise of the meta-data as discussed in the section on coding of the data.

Journal selection

The decision to conduct a modified meta-analysis of academic research papers instead of qualitative research in organisations, was based on the expectation that a meta-analysis would provide a large enough and academically acceptable sample to allow a meaningful exploration of the viability of Radcliffe-Brown's thesis of accepting the study of physiology as a natural science for organisations. Concerns about subjectivity in interpreting published papers as potentially biased opinions of the researchers and authors (Bryman and Bell, 2003: 219) were addressed by applying a standardised method. Publications were selected and only the functional information and interrelationships were coded and recorded. Appendix 2 contains the guidelines followed for the selection of suitable research papers, and Appendix 3 describes the

guidelines and rules followed in the identification and codification of the functions, relationships and roles from these papers.

The list of thirty journals from which the papers were selected is presented in Appendix 2 and was compiled from recommended lists used by the Leicester School of Management, according to various selection criteria for identifying world ranked journals. Recommended lists included lists prepared by Bristol Business School (BBS; 2004), the ERIM Journal list (2004), a list compiled for the British Journal of Management by Geary et al. (2004), a list of quality journals compiled for the University of Melbourne by Harzing (2004) and a rankings list of Economic Journals (2004). Journals were then prioritised by their ranking in multiple groups as indicated in the Select column of Appendix 2.

From the list prepared by Bristol Business School (2004), world elite journals were selected as determined by the common consent of researchers and editors. The list compiled for the British Journal of Management (BJM) by Geary et al. (2004) ranked journals based on most frequently cited, and from the ERIM Journal List (2004) the primary set of ERIM journals were selected based on judgement by peers and the highest ranks were selected. Journals from the University of Melbourne Journal Quality List (JQL; Harzing, 2004), were selected when ranked with 3B or higher grade ratings and from the Journal Rankings of Economic Journals, journals with ratings of five or higher were selected.

While this list was compiled at the start of the research and could, therefore, be criticised as being outdated and not incorporating the most recent trends in

organisational research, this was not regarded as detrimental, as it was not the topics of research that were analysed but the functions involved in the research projects. For additional confidence, the extracted journals were compared to journals recommended in the 2010 ABS journal list compiled by Harvey et al. in the final column of Appendix 2. According to this comparison, 21 out of the 30 selected journals were classed as 4, being in the top 25 percent, and eight as a 3, being in the top 50 percent of the most cited journals. Only one, which was selected because of its specific focus on change management, was rated in the bottom 25 percent as it has only been on offer for seven years.

From each of the identified journals, all published papers were selected for the latest accessible full year between 2005 and 2008. The range of years was necessary as either paper or electronic sources were used and electronic versions for some of the journals had a delay period before becoming available. Journal selection was regarded essential to ensure that quota sampling would be restricted to the journal selection which provided academic acceptability, rather than potentially biased content targeting (Bryman and Bell, 2003: 107).

Number of Journals selected	30
Total number of papers published in the journals for the selected year (latest available full year 2005-2008)	± 1200
Number of papers passing first selection test i.e. can identify case study or hypothesis testing for organisations	658
Number of selected papers (can identify and code functions and interrelationships)	327
Number of identified cases in the papers	364

Table 5.2 Research papers and case studies selected during meta-analysis of journals

Each paper was screened for suitability based on the ability to identify independent business units, organisations or government institutions suitable for the study of their

physiology. A second selection criterion was the ability to identify change events, roles and relationships affecting the functions within the organisations. The results of the numbers of papers evaluated and selected are presented in Table 5.2.

All empirical and case study research papers, as well as meta research papers containing hypotheses or proposition testing, were accepted during the first round of the selection process. Discussion papers and theoretical or simulation modelling research papers were rejected as unsuitable if it was not possible to identify specific organisation types, functions and relationships. 658 or approximately 50 percent of the published papers passed this first selection round and brief summaries were made of these papers.

To ensure that the sample retains a degree of objectivity, the summaries did not focus on the objectives and findings of the research in the papers, but concentrated on the identification of event-based case studies and empirical research in which functions and their interrelationships could be identified regardless of eventual interpretation by researchers. In the case of empirical hypotheses testing, however, only functions and activities identifiable in positive hypothesis testing were selected. Unsubstantiated hypotheses were regarded as not valid or applicable.

During the second round which also formed the codification stage, the functions and roles were identified from the summaries and coded according to a predetermined set of rules discussed in the next section of this chapter. At this stage papers which could not be coded because it was not possible to identify specific functions, roles or interrelationships, were rejected, reducing the number of selected papers to 327. For some of these papers it was possible to identify more than one case study of separate

independent change programmes, and the eventual sample covered 364 suitable case studies.

Whereas journal and publication selection was aimed at academically accredited research papers to form the data source for my research, a spread analysis indicated that 41 percent of the countries in which the selected research projects were conducted, addressed research in Europe and 40 percent in North America with the remainder in the rest of the world. This shows a strong bias towards western research practices, potentially not generalisable to other regions, countries or cultures. The reason for the bias can be ascribed to the recommended lists used in selecting the academically accredited journals, and further research will be necessary before accepting interpreted findings of the results as generalisable to the study of all organised societies or organisations.

Coding of Data

In order to be able to analyse the change activities, interrelationships and impact of functions within these processes, functions were identified as per the definition table in Appendix 1 and the impact roles of functions were identified as the requestor for change, the driver or champion of the change process, and the function predominantly impacted on by the change programme. These roles could be used to determine the relationships of the functions and the impact exerted by each function within its domain of operation. In addition, it was necessary to isolate the functions involved as participants in the supporting change activities without being subjected to the change process, and also the functions as the recipients of the change process. On average, 3.4

change activities were identified for each of the 364 case studies selected, resulting in a total of 1227 change actions and a total identification of 3543 functional actors within the sample.

Each individual research paper identified in the journals passed a final selection test if it was possible to isolate functions for each change case study, and identify the roles played by these functions in their interrelationships during a process of change. The guidelines for the identification and coding rules which were developed and accepted for this research are presented in Appendix 3 and demonstrated in the example below.

Karra, N., Phillips, N., Tracey, P. (2008). Building the Born Global Firm: Developing Entrepreneurial Capabilities for International New Venture Success. <i>Long Range Planning</i> . Vol. 41, pp. 440-458
Summary Notes
<p>Case Study: Jenni & Neroli: a case of successful international entrepreneurship 1992-1994: Jenni</p> <ul style="list-style-type: none"> • Founder (Karov) during travels from Turkey to Russia and Eastern Europe, found limited availability of women’s leather accessories and planned to exploit the Russian market. • Contacted acquaintance with leather factory to <ul style="list-style-type: none"> ○ Produce leather accessories ○ Supply these to budding entrepreneurs from Russia and Eastern Europe • Karov was only a minor stakeholder – factory owner did most of the financing • Popular product and Karov expanded by selling not only to agents but through main Eastern European stores <ul style="list-style-type: none"> ○ Built and established brand in Russia ○ Provided control over distribution <p>1994 onwards: Neroli</p> <ul style="list-style-type: none"> • Karov and partner disagreed about the company’s future (Jenni) • Karov left Jenni and created another leather accessories company, Neroli <ul style="list-style-type: none"> ○ Production in Turkey, material from Italy ○ Launched internationally ○ Used existing Russian links to compete with Jenni • Developed large international network and company <ul style="list-style-type: none"> ○ 750 staff involved in design, production, distribution and retail ○ Products available in 77 stores in 9 countries in Eastern Europe and Russia • Outpaced Jenni <p>Paper continued with further discussion on competences leading to the success story.</p>

Table 5.3 Summary of Case Study in Research Paper

One of the selection steps was to prepare summaries of potential suitable research papers as demonstrated in Table 5.3. The summary identified the paper, author, journal and year of publication, but then focused only on the case studies for subsequent coding.

General	Paper number and type of research	1632 / Case E M
	Sector/ Size of Organisation	Retail / Small L
	Change type	Innovative (start market for leather products)
	Country of research	Russia
Change Programme	Requestor or initiator of symptom	Executive Manager
	Reason for request or symptom	Identify niche in market for leather products
	Driver/champion of change / decider	Executive Manager
	Change process applied	Set up business to market leather products
	Impacted functions	Marketing
	Overall success /failure / stopped	Successful
Change activity 1	Participant 1 in change process	External Research
	Function impacted by participant involvement	Executive Manager
	Involvement process	Identify market opportunity for products
	Result & effect of impact on function	Positive - take action
Change activity 2	Participant 2 in change process	Executive Manager
	Function impacted by participant involvement	External Partner
	Involvement process	Develop partnership with production company
	Result & effect of impact on function	Positive – supply of products to market
Change activity 3	Participant 3 in change process	Marketing
	Function impacted by participant involvement	External Customer
	Involvement process	Build customer network as outlets
	Result & effect of impact on function	Positive – network of outlets for products
Change activity 4	Participant4 in change process	Executive Manager
	Function impacted by participant involvement	External Partner
	Involvement process	Disagree on future of product
	Result & effect of impact on function	Negative – manager exits

Table 5.4 Coding of the Summary Case Study in Table 5.3

Only the first case of Jenni is discussed in the coding exercise presented in Table 5.4. A full coding of the case studies in this paper is presented in Appendix 3. Coding of the summary information was performed on a pre-formatted coding sheet under three headings of general information, change programme information and change activity information. The first part of general information identified the summary as a **Case Study** (as opposed to an empirical study or business model) in the **Retail** Sector. The size of the company was recognised as **Small** (entrepreneurial) and the type of change programme as **Innovative** (starting a new business).

The second part of the coding sheet describes the functions in their overall change programme roles as requestor for change, driver of change and the main impacted function. In the example Karov as the entrepreneur, and therefore **Executive Manager** was regarded as the requestor and driver in the change programme. The dominant impacted function was identified as **Marketing** of the leather products in Russia.

Additional free format information was captured and coded on the motive or reason for the change, the type of change programme and whether the overall programme was regarded as successful or a failure by the driver.

The third part of the coding process focused on the individual change activities which could be identified in the change programme. This part enabled functional interrelationships to be observed and coded. However, to reduce the possibility of reification by 'creating' functions in order to visualise a complete flow of functional activities, the coding was restricted to functions which could be observed in the papers and not all functions could therefore be included in the change processes. The emphasis was also on the function being performed and not necessarily the individuals performing

the functions. In the example the entrepreneur as an individual performed more than one function.

In the first change activity, Karov in his capacity of **Market Researcher** influenced his decision as **Executive Manager** about the potential market opportunities for leather goods, and as he acted on this information, the activity was regarded as successful. The next two change activities identified Karov as the **Executive Manager** negotiating with an **External Partner** for financial and production support; and Karov on his own or with his supporting **Marketing** team (not clear) promoting and marketing the new products to **External Customers** throughout Russia. Both of these activities were also regarded as successful by the recipient of the functional activities. In the fourth and final identifiable change activity in this case study, Karov as the **Executive Manager** disagreed with his **External Partner** on the strategic future of Jenni, the entrepreneurial organisation, and he left to start a new competitive business (the second case study in the paper). The outcome of this activity was regarded as negative from the point of view of the both the recipient and participant, although the overall change programme of Jenni was still a success.

The functions were identified and coded according to the framework developed for physiology and presented in detail in Appendix 1 while the change activities, reasons and results were recorded in free format for subsequent interpretation during the analysis phase. Functions, although presented in the example in acceptable business terminology, was also captured as codes, listed in the table in Appendix 1 for ease of electronic analysis and presentation. The full dataset is available and a summary version is included in Appendix 4.

It has to be recognised that change processes in this methodology are not recorded as a complete process flow. In the example there was for instance not enough information on the role and interrelationships of the production facility of the external partner, and this could not be coded and recorded. For consistency, and to reduce the risk of reifying functions and processes normally involved in change processes, one of the coding rules was only to code functions and roles which were clearly observable in the change process. The size of the sample allowed for the averaging and smoothing of identified functions and their involvement in change.

Sample Validation

The main information identified, coded and recorded during the selection and recording stage of the research project were the functions, roles and types of interrelationships of the change programmes and activities within organisations. In order to determine the feasibility of using the data as a generalisable sample for further exploration on whether physiology could form a suitable framework for a comparative study of organisations (Radcliffe-Brown, 1957: 153), additional information was also collected. This information includes the type of change as either incremental change or a stepwise innovative change; the country in which the research was conducted; the business sector in which the organisations operate; and the size of organisations as demonstrated in the example discussed in the previous section.

Canguilhem distinguished between physiological activities aimed at corrective or healing action and deliberate decisions to change the operations of the functions (Canguilhem, 2007: 175). This same concept of differences in change within society or organisations

was also supported by Radcliffe-Brown, by distinguishing between process change and imposed change (Radcliffe-Brown, 1957: 87), and Maturana and Varela (Maturana and Varela, 1980: 98). It was, therefore, regarded as appropriate to add information which differentiates between incremental and innovative change programmes in organisations. An incremental change was defined as a process already in existence, such as existing procedures, services or products, which required improvement or changes without changing the base processes. Innovative change, on the other hand, refers to change projects involving step-wise changes to existing processes, or the introduction of new or different processes. Examples are the introduction of a new range of products, or mergers of organisations as innovative change, as opposed to motivational change to improve productivity as incremental change. In separating the types of change into incremental and innovative, it was possible to explore the functions influencing, participating and being impacted on by these types of change.

Recording the country in which the research was conducted was considered part of evaluating the sample for bias. This was already discussed as part of the journal selection earlier in this chapter in which the sample showed a bias towards western research. The variable was included in this part of the sample evaluation in order to establish that no additional data bias can be detected in the sample.

The business sector was introduced to identify the different business sectors in which the organisations operate. This information will not only provide a means of validating the spread of the sample, but can provide a means of testing Radcliffe-Brown's theses on taxonomy by exploring the functions common or unique to different types of organisation (Radcliffe-Brown, 1957: 71). Organisations were categorised according to

their major area of operation, similar to that used in stock market sector classifications.

Main sectors identified are government services; manufacturing; production; retail; services; and mixed sectors. The latter was used when the case study covered more than one sector and no dominant sector could be isolated.

Recording the size of organisations proved to be problematic except for isolating small and entrepreneurial businesses in the research papers. Approximately five percent of the case studies applied to small businesses and it was not possible to isolate medium sized businesses with an acceptable degree of confidence. Further analysis was not possible with respect to any finer split in the size of organisations, and small businesses could only be analysed with a limited scope.

Variables	Percentage Spread of Functions per Independent Variable				Number of Observations
	Executive	Operations	Internal	External	
Total Observations	591	1762	727	464	3543
Incremental	13.0	51.3	24.2	11.5	1877
Innovative	20.6	47.5	16.7	15.2	1666
Europe	16.8	50.4	20.4	12.4	1497
North America	16.9	48.3	20.4	14.5	1326
Rest	15.4	50.0	21.9	12.6	720
Gvt Services	14.6	52.6	20.1	12.7	527
Manufacturing	14.5	57.5	14.8	13.2	988
Mixed	25.5	32.1	30.3	12.2	664
Production	14.4	48.4	20.6	16.6	223
Retail	13.3	53.3	20.1	13.3	338
Services	15.1	50.8	19.7	13.5	803
Average percentage spread	16.6	49.5	20.7	13.2	3543

Table 5.5 Spread of observations representing functions for each of the independent variables

The most representative perspective of acceptable spread of the sample, was to compare the percentage spread of the observations of each of the types of additional information identified above by functional category. The average percentage spread of

observations over the functional categories is presented in the final row of Table 5.5 and demonstrated in Figure 5.1.

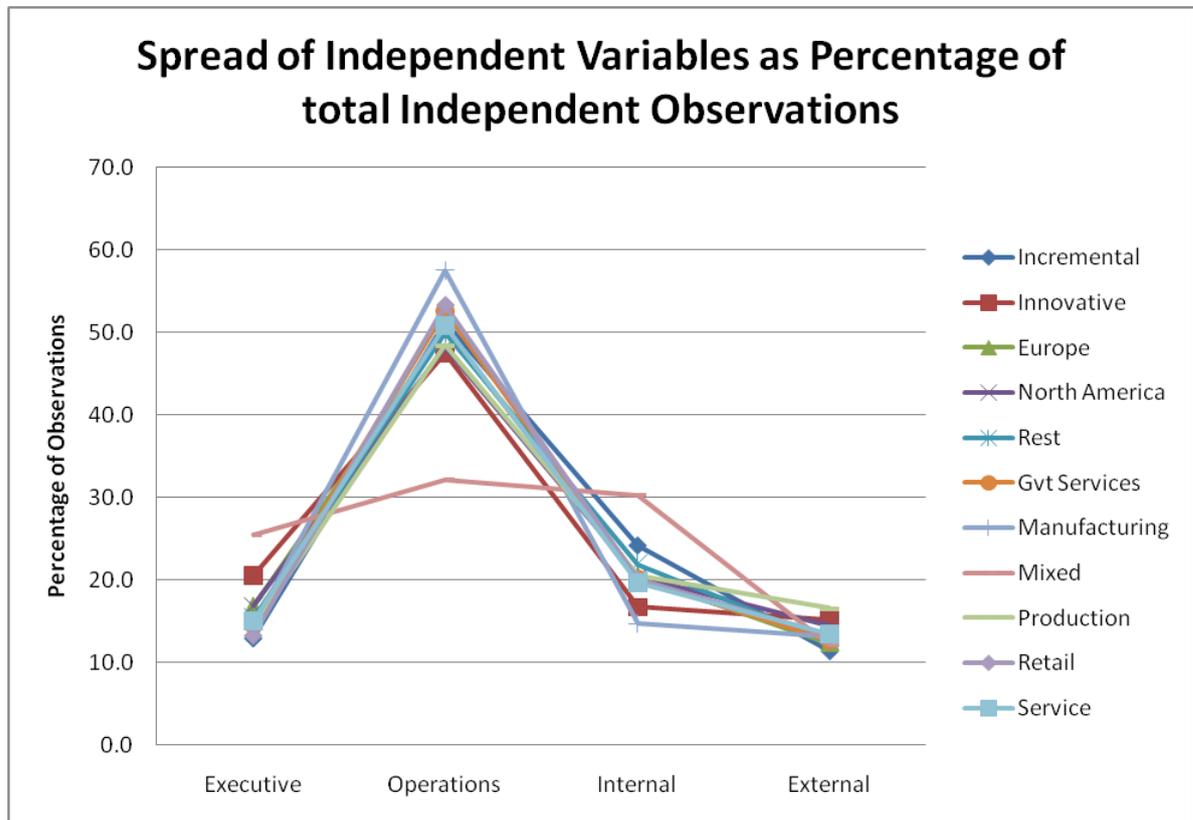


Figure 5.1 Percentage spread of independent variables over functional categories

Except for the mixed organisation sector, implying that the research paper analysed was applicable to multiple sectors, the percentage spread of the observations by functional category is within range of acceptable deviation from the average spread and, therefore, acceptable for use in more detailed analysis within each of the independent variables. In the case of the mixed sector, the 32 percent of observations identified within operations functions is significantly lower than the 50 percent average, with more functional actors identified in the internal (30 percent versus 21 percent average) and executive functions (25 percent versus 17 percent average). A more detailed analysis of this category showed a strong link to papers focusing on research in staffing and human resources

issues. The spread was regarded as representative enough for the sample to be used in interpretive analyses.

Sample validation of the functional spread within each of the independent variables showed an acceptable representative sample for use in comparative analysis during the analysis phase of the project discussed in Chapters 6 to 8.

Conclusion

The main objective of the research sample validation was to ensure that the sample which will be used in the interpretation of the findings in the subsequent chapters of the thesis is acceptable to add confidence to the analysis, interpretation and conclusions.

In the section on the selection of the research approach, concerns about the size of the sample and the ability to observe functional interrelationships were discussed. A combined approach was adopted comprising the selection of academically accredited papers, but instead of interpreting the papers as part of a meta-analysis of their findings, the contents of the papers were used as the actual source of data by identifying functions and their interrelationships as described in the papers. It was further decided to focus on change activities within these papers in order to show the functions in their interrelationship roles in a change process. Strict guidelines with respect to the identification and coding of these functions and interrelationships were followed to limit subjectivity and reification in the construction of the dataset. Table 5.3 presents the functional categories identified for the study of the human body as developed in Chapter 4, and the analogous prototype framework proposed for the research in this programme for the study of the physiology of organisations. The

rationale used in generating the prototype organisational framework; in selecting the published papers to form the research data source; and in coding the information that could be observed in these selected papers was discussed in the research method section.

The objectives of a wide enough sample, evidence of identification of the equivalent of physiological functions within the organisational sample, and evidence of the different relationships within the three functional categories and their domains, were all supported, with a few concerns, therefore enabling the analysis results to offer generalisable conclusions.

The sample was found to be biased towards research papers within western countries and, therefore, not necessarily applicable to all countries or cultures in other parts of the world. However, within the three sets of Europe, North America and the rest of the world, the sample was spread evenly over the information variables collected for each of the functional categories with two exceptions. The areas of concern were the inability to identify different sizes of organisations and the spread of observations in mixed sectors. The impact on the analysis will be the inability to confidently compare findings over different sizes of organisations. Mixed sector analysis will also have to be excluded if sector analysis is relevant. This may not be too much of an issue since this group of case studies refers to research work crossing sector boundaries, and should, therefore, not be analysed as a specific sector operation of the organisations.

Chapters 6 to 8 present and discuss the analysis results of the research for each of the three functional categories of internal, operations and executive functions, analogous to

the visceral, motor and cognitive functions identified in the framework for the study of the physiology of the human body. Each of the chapters will address the following questions as part of the analysis objective:

Can the functions be observed in the sample data? It will be necessary to explore whether it is possible to observe the functions in the sample analogous to the functions identified within the prototype framework used for the study of the physiology of organisms. In Table 5.5 the numbers of observation of functional actors in change processes were found to be high in the category of operations functions compared to the internal and executive functions. It will be necessary to determine reasons behind this imbalance even though the sample was found to be large enough to support further detailed analyses in all three the categories.

Why are some functions under-represented? Functions which are found to be poorly represented in the research sample will require further analysis in order to determine reasons for this finding. Potential reasons could be ascribed to the prototype framework used in the research, or may be explained through case study examples within the sample data.

What are the key-interrelationships identified for the functions? This is important, as it will give an indication of the impact interrelationships identified by the physiological functions in their domain of operation. Interrelationship roles of requestor, driver, participant and recipients of the change activities will be explored, as well as the types of change in which functions are involved. Examples of interrelationships will be explored as part of the evaluation of the functional framework, but also to determine

the value of studying and viewing organisations in a balanced perspective of functions and interrelationships as promoted by Radcliffe-Brown.

In conclusion each chapter will highlight the areas of value and concern and identify areas for future research to assist in knowledge accumulation about organisations.

Chapter 6 focuses on the findings of internal functions in organisations, by comparing the functions in more detail, as well as their interrelationships with other functions and the environment external to the organisation or organised society. Chapter 7 presents similar analyses with respect to the operations functions of organisations. In addition to analysing separate functions observable in the operations category of functions, a further analysis compares the results obtained for the different sector types of operations. Chapter 8 analyses the findings for the executive functions. It also includes a summary of all management functions in organisations and the link to the external environment through the 'senses' of the organisations. The final conclusion of the thesis is presented in Chapter 9, including evaluation of the contribution that can be made by the study of the physiology of organisations and scope for further research.

Chapter 6 Internal or Visceral Functions

“Health is life lived in the silence of the organs” (Leriche cited in Canguilhem, 2007: 91)

Introduction

The objective of the research project is to explore whether organisations or organised societies can be studied within a framework of their physiology as a natural science. The first part of the thesis presented and discussed the hypotheses of Radcliffe-Brown during the 1930s in which he proposed that there should only be one branch of science for the study of human societies and that an evidence-based natural science, preferably the study of the physiology of societies was, at that stage, not available.

By critically evaluating the thesis of physiology as a natural science for societies in Chapters 2 and 3, it became clear that there are practical prerequisites to be resolved before a study can be conducted. It was necessary to narrow the definition of a society to an organised society or organisation which can be identified as a persistent entity, or ‘autopoietic unity’ (Maturana and Varela, 1980: 97), responsible for its own self-maintenance within its environment. It was also necessary to establish a practical scale for organisations to be studied at the level of independent business units, organisations, independent government institutions or independent local authorities as opposed to nation states or conglomerates. From a research point of view, the decision was taken to divert from Radcliffe-Brown’s recommendation for a grounded study to identify functions common and unique to specific societies, in favour of starting with a prototype framework derived from the functions accepted for the study of human physiology. The framework, developed in Chapter 4 focuses on the functions required to support the

persistence of the entity within its environment, and the relationships of each of the functions within this process of self-maintenance towards survival and growth.

Defining organisations or organised societies as suitable entities for the study of their physiology still presented the practical concern of acquiring a sample of evidence large enough to allow for analysis and for the results to be generalisable. The choice was to conduct a meta-analysis of acclaimed published academic research papers addressing activities of change within organisations. This decision made it possible to acquire a large sample which was evaluated in Chapter 5 with respect to size, spread and objectivity. Although found to be biased towards organisational research in the western world, and low in observations with respect to some of the internal functions in the sample, it was found to be acceptable for continued analysis of the findings. One other concern was related to the decision of selecting and studying the research of change activities instead of the normal functioning of the systems within the organisations. This decision was influenced by the interlinking of pathology, or change, within physiology in the study of the human body (Canguilhem, 2007: 285, 286). By studying the impact and interrelationships that come into play when changes occur, whether to modify existing processes through incremental change, or by introducing innovative changes, it is possible to determine and learn about the normal functioning of organisations.

Chapters 6 to 8 of the thesis present and discuss the analyses and findings of the research data. To find evidence of physiological functions in organisations, the research project focuses on the functions and only refers to individuals as representatives of their functions (Latour, 2007: 31). It was, therefore, not possible to substantiate any comparison between the individual components in organisations analogous to the cells

within complex multicellular living organisms, as presented in Chapter 4. To provide the necessary perspective within which physiological functions of organisations can be studied, it is, however, necessary to presuppose that the base component for an organisation is not the individual, but the individual within his or her functional role (Maturana and Varela, 1980: 88; Radcliffe-Brown in Kuper, 1977: 21), in other words, the job incumbent. In order to be effective as discussed in Chapter 4, the cell requires a powerhouse to generate the energy for the task to be performed (mitochondrion); a set of instructions relating to the tasks (DNA in the nucleus); various task specific tools (organelles) to assist in the execution of the task; a balanced and ambient work environment (intracellular fluid); all the required oxygen and nutrients to generate the energy and fulfil the required task; and the means to communicate with other cells, directly, remotely or via the nervous system. While functions within organisations are involved in enabling the organisation to compete and survive within its environment, the organisation can only succeed if every job incumbent is provided with requirements necessary to ensure successful operation of the allocated functional task.

Physiology, the study of the functioning of organisations covers three categories of functions: internal (visceral) functions to ensure that each individual job incumbent is able to execute his or her task, comparable to ensuring that energy can be generated and applied (Silver, 1998: 322); operations (motor) functions that enable the organisation as a whole to be mobile or agile in order to compete and operate within its environment in order to ensure the persistency of the organisation (Barrett et al., 2010: 105); and executive (cognitive) functions that can give meaning to perceptions from both internal and external to the organisation, and can provide guidance to long term

sustainability and growth of the organisation similar to the nervous system and higher functions of the mind (Barker et al., 2008: 72, 73). The results of the research project are, therefore, presented and discussed in three chapters, each addressing one of the categories of functions.

This chapter presents and discusses the findings and analysis results of the meta-analysis of academic research papers on change activities within organisations, focusing specifically on the roles and relationships of internal functions identified within the framework for human physiology in Chapter 4 and translated for organisations in Chapter 5 and Appendix 1. These functions were evaluated with respect to their presence within organisations and the observable interrelationships of their role and impact within or external to the organisation. The sample collected and evaluated in Chapter 5 and tabulated in Appendix 4, forms the source of data used in the analysis.

The chapter is divided into a section in which evidence of observations of the internal functions and their roles is discussed, followed by a section identifying and discussing poorly represented functions in the research and a section in which findings about the key interrelationships among functions and with the environment external to the organisation are further explored. In the concluding section the findings are evaluated against the framework developed for physiology, the impact these findings can have on organisational science, and concerns and proposals for further research.

Evidence of Functions and Roles

Silver (1998) regarded the most important functions of life as being energy generation to perform tasks, the ability to respond to stimuli, and the ability to reproduce. He

commented that the most important of these is the ability to generate and use energy (Silver, 1998: 322).

Codes used in Research		Total and % Observations	Percentage of Observations per Role				
System	Function		Requestor	Driver	Impacted	Participant	Recipient
All	All	40(5.5)	7.5		40.0	2.5	50.0
Acquisition	Equipment	8(1.1)	12.5		12.5	37.5	37.5
	People	84(11.6)		6.0		85.7	8.3
	Supplies	56(7.7)			8.9	75.0	16.1
	E-systems	23(3.2)			4.3	69.6	26.1
Total		171(23.5)	0.6	2.9	4.1	77.8	14.6
Distribution	Dist-centre	0					
	Dist-channels	11(1.5)				72.7	27.3
Total		11(1.5)				72.7	27.3
Accounting	Fund allocation	60(8.3)			1.7	76.6	21.7
	Income	24(3.3)				62.5	37.5
	Expenditure	18(2.5)			5.6	61.1	33.3
Total		102(14.0)			2.0	70.6	27.4
Maintenance	Waste management	0					
	Workplace maintenance	19(2.6)				100.0	
	Equipment maintenance	0					
Total		19(2.6)				100.0	
Security	Protection	0					
	Audits	57(7.8)	3.5		12.3	52.6	31.6
	Policing	21(2.9)			4.8	71.4	23.8
	Health & Safety	9(1.2)				88.9	11.1
Total		87(11.9)	2.5		10.3	57.7	29.5
Internal communication	Development	40(5.5)				92.5	7.5
	Motivational	124(17.1)		0.8		96.0	3.2
	Productivity	40(5.5)				92.5	7.5
	Resource management	60(8.3)				93.3	6.7
	Total		264(36.3)		0.4		94.3
Information	Internal information	8(1.1)		25.0		75.0	
Decision	Internal management	25(3.4)		100.0			
Total Internal Functions		727	1.1	4.3	4.5	74.4	15.7

Table 6.1 Numbers and percentages of observations of internal functions and their change roles

Table 6.1 lists the internal systems and functions observed for organisations, focusing specifically on the functions involved in the process of providing, producing and using

energy in the autopoietic maintenance of the organisation (Maturana and Varela, 1980: 87); the protection for its survival; its internal communication functions; and the management and control of these internal functions. The table is a summary of the research findings also provided in Appendices 1 and 4 and is structured in four columns around the functions within the research project. The number of observations of the internal functions in the sample is presented in column three, both as a number and a percentage of all the observations of internal functions. In column four, roles have been identified within the context of change and, therefore, split into the role of functions as the requestor, driver, or impacted function of a change programme, or being a participant or the recipient of a specific change activity.

The identification of the organisational functions was based on the functions identified within living organisms, and especially the human body. For this reason there may not be a one-to-one comparison with the commonly accepted organisational functions. Functions identified in the case study analysis, therefore, refer to their roles instead of their organisational position. The observation of the functions in the sample and the relevance of the findings are discussed below for each functional system separately in the same sequence as presented in Table 6.1.

Internal Functions to Support Working Environment

The first group of functions are the internal functions which, if analogous to the physiological functions of living organisms, are the functions vital for the survival and self-maintenance of the organisation as a persistent entity. These include the functions grouped as systems, responsible to receive and distribute all the necessary material,

people and equipment required for task execution; the functions involved in the accounting and fund distribution to assist in the execution of tasks; and the functions to maintain a balanced and ambient working environment for the incumbents to perform their tasks. Table 6.1 provides a breakdown of the functions observed in the meta-analysis, in total and in their roles as requestor, driver, participator or recipient of change.

Acquisition and distribution as the first two systems in Table 6.1 refer to the functions involved in the acquisition and distribution of various nutrients within the body. In the sample these functions are well represented in total at 24 percent of the observations of internal systems. However, whereas in the human body these functions are separated, organisations are more likely to combine acquisition and distribution as a single logistics function, but then split into separate logistics functions for the combined acquisition and distribution of supplies and equipment versus the recruitment and selection of new personnel. Similarly, the cardiovascular or distribution function in the body provides a single distribution centre and channel through which nutrients, oxygen, enzymes and various blood components are transported, whereas various separate distribution centres and channels may exist in organisations to distribute messages, information, people, and material. Of the 171 observations for acquisition, 77.8 percent of the observations showed these functions active as participants in change activities.

Acquisition was mainly involved with the recruitment, selection and placement of new personnel at 11.6 percent of all internal function observations; 7.7 percent in the acquisition of material and supplies; and 3.2 percent in obtaining equipment or supporting electronic systems. However, only eight observations, or 1.1 percent of

internal function observations could be made with respect to the acquisition of equipment. Although 1.5 percent of observations were made with respect to a separate distribution function, none was observable in the sample to address the functioning and roles of a distribution centre. These low observations are discussed in more details in the next section of the chapter.

The accounting functions are compared to the functions observed in the respiratory system of organisms, concerned with inhaling oxygen required to generate energy in the organism; exhaling carbon dioxide as the spent oxygen back into the environment; and the subdivision and parcelling of the oxygen within the red blood cells in order to provide oxygen to all cells in the body. The three equivalent functions of accounting are income, expenditure and the internal allocation of funds, and they have been used in the meta-analysis to explore the interrelationships with respect to change. As a group, the accounting functions were found to operate as participants in change activities for 70.6 percent, but also as recipients in change activities for 27.4 percent of the observations. Observations in the sample identified the fund allocation function as the best represented at 8.3 percent of the observations of all internal functions, followed by income generating action at 3.3 percent, and finally the creditor function at 2.5 percent of the observations. The finance and accounting set of functions is one of the internal functions of organisations that is well represented in universities and through their own professional institutes.

Although combined into a single function, referred to as 'workplace maintenance' for the convenience of coding the meta-analysis research results, the colon, kidneys and other organs such as the liver, perform essential functions required to ensure a

conducive environment for the cells in an organism (Barrett et al., 2010: 475, 639, 523).

The equivalent functions in organisations, as stated in Table 6.1, include the maintenance of an ambient work environment such as air quality, lighting and temperature; equipment and building maintenance; and the cleaning and waste management within the organisation. In the meta-analysis of current published research papers, the maintenance function was only observed in 2.6 percent of the activities in the internal functions and in these observations the functions acted for 100 percent as participants in change. No observations could be made with respect to waste management or equipment maintenance as part of the maintenance function.

Internal Functions for Protection, Security and Health

In addition to the vital functions enabling the individuals to operate towards the autopoiesis of the organisation, organisations also require protection against external 'non-self' intrusion as demonstrated by the presence of the skin, skeleton and senses; internal security against unacceptable influences internal to the organisation, analogous to the immune system of an organism; and damage control and addressing ongoing health concerns internal to the organisation. These functions are grouped in Table 6.1 under the system of security and health functions.

The role of the internal function of protection, equivalent to the skin or exoskeleton of organisms is to offer a first line of defence against the intrusion of 'non-self' elements within the organisation (Oxford Concise Colour Medical Dictionary, 2006: 658). By offering a defined border to the external environment, and working closely with the sense of pain, pressure and temperature, the organism can defend against potential

danger by reflexively reacting to these sensations. This function can be observed in organised societies as border control, external and access security, but may be less clearly defined within organisations. The research sample collected for the meta-analysis from recently published research papers could not identify research or even participatory actors within this category.

Whereas the first line of organisational defence – the function of ‘border’ protection – did not receive attention in the sample of research papers, there was evidence of the second line of defence, the immune system, translated as access and internal security, safety and health functions within organisations. The roles of the various functions of the immune system in living organisms are to act as a filter in which ‘non-self’ elements or actions within the organisation can be detected and dealt with, either by their removal so that they do not endanger the rest of the organisation; or by developing a tolerance within the organisation through which these original ‘non-self’ elements become accepted as ‘self’ elements; and to allow healing of impacted functional areas (Playfair and Chain, 2005: 8). Within societies this can be compared to internal security, the policing function and the health and welfare of the society. Within organisations the equivalents have been identified as various audit and security controls, the processes to deal with ‘non-self’ elements or incidents detected within the organisation and to facilitate general safety, health and wellbeing within the organisation.

Table 6.1 presents the observations of the security function within organisations as 11.9 percent of the internal activities observed. Only nine actors, or 1.2 percent, were observed as being involved in healing activities in organisations. Audit controls as security filter activities were observed in 7.8 percent, and 2.9 percent of the participants

and were observed in dealing with the identified security issues (policing). Security was strongly observed as a participant in change at 57.7 percent of its activities, but also 29.5 percent as the recipient of change activities from other functions.

Internal Communication Functions

The internal communications functions have been identified in the physiology of living organisms as the hormones produced within the endocrine system, defined as “chemical messengers, released and having their actions at distant sites” (Greenstein and Wood, 2006: 8). The endocrine system is responsible for the regular production of different types of hormones as stimulants to cell operation, and in cases of need, the selective increased production of hormones. Hormones in the body are produced by different specialised glands and regulated by the hypothalamus as its integrated control centre within the nervous system.

While the equivalent functions in society and nation states can be identified as the education system and media which provide necessary messages to all members of society, the equivalent functions within organisations are less well defined. Most large organisations do have training and development departments performing the functions of a growth hormone, but even in these cases the internal communication is often associated with managers as a means to motivate, instil and develop organisational values. The analysis of the research findings explores the role of communications within situations of change, thereby focusing on the use of internal communication during periods of change. In the research the equivalent types of hormonal production and distribution have been coded as motivational or encouraging messages, effective

resource management, greater productivity and efficiency in the execution of operations, and general development of new and existing members of the organisation or society.

In total as shown in Table 6.1, the communications functions were involved in 264, or 36.3 percent, of all the internal functional activities, of which 17.1 percent were motivational communication, 8.3 percent addressing the effective use of resources, and 5.5 percent each to improve productivity and the development training of staff. Of the 264 observations, 94.3 percent identified the communications function as participants in change. Communication functions have been observed as one of the most proliferate functions active during periods of change within organisations.

Internal Management Functions

Although not strictly part of the internal functions of an organisation, it is important to consider the role of management (the autonomous nervous system) in the ongoing and changing operations of internal functions. In line with the nervous system, connecting to the internal functions of organisms, management has been subdivided into two separate concepts. The first is the observational and information gathering role of supervisory management as presented by the somatosensory receptors linked to the nerve endings through which the local nervous system can perceive changes in temperature, pain and pressure within the skin and walls of the intestinal tract (Barker et al., 2008: 53). This activity can be compared to the close proximity in organisations between employees and the supervisors in a functional department which enables the supervisors to monitor and observe the morale and wellbeing of their staff, and react

when required. The second function in nerve cells has been identified by the electrical and chemical impulses through which they communicate not only as a stimulant to all operational cells, but also to other nerve cells at the synaptic joints in order to pass on exception messages for action by other functions or to higher cognitive levels (Barker et al., 2008: 22, 23). This part was compared to the various hierarchical and network management structures of internal management, developed and proposed for organisations.

Table 6.1 presents the number and percentage of observations with respect to internal management functions. Especially low are observations about the supervisory role of gathering information on morale and the wellbeing of operators, at only eight observations or one percent of the internal observations. In the relationship roles observed for the internal management functions, 75 percent of the observations for the internal information function were in the role of participant in change, whereas all the 25 observations of the internal manager were in the role of driver of change.

In summary, functions that could not easily be detected, at less than five percent of all the visceral functions observed, include the internal information function, involved in ongoing observation and perception of internal morale and status at 1.1 percent; health, involved in internal damage recovery and healing at 1.2 percent; acquisition of equipment at 1.1 percent; internal distribution as separated from the function of obtaining supplies at 1.5 percent; and maintenance, responsible for the maintenance of the workplace at 2.6 percent of all the visceral functions. No representative actors were observed for the function of the protection and safety of organisations analogous to

skin; for equipment maintenance analogous to bone maintenance in organisms; or for waste management. These functions are discussed in more detail in the next section.

Functional areas where it was difficult to observe a one-to-one comparison between the physiology of organisms and organisations, are the digestive and cardio-vascular systems, translated as the receiving bay and initial warehousing of various resources, and the internal distribution of the resources throughout the organisation. It is easier to detect similarity between organisms and national societies as there is a clear separation between the production or acquisition of supplies, for example adequate food for the citizens, and the means and channels available to distribute the supplies throughout society. In organisations, over time, the supply and distribution functions tended to be regarded as the single function of logistics, and distinctions were made, not so much on the functionality of receipt and distribution, but on the content of what is being received and transported.

Functions Requiring Further Attention

Functions for which relatively high levels of observation could be recorded in the sample, provide an indication of functions already being well addressed in the academic community and therefore offering information which could be included in a knowledge-based framework of physiological knowledge as envisaged by Radcliffe-Brown.

Functions with low observations or not directly translatable for organisations, however, require further attention. This may be because of the bias identified in the sample, or due to the lack of academic research in these functions. Even though not well represented in the sample, individual case studies forming part of the sample, or

external to the sample could be used to explore the reason for low observations and the impact of studying these functions through the framework of physiology. Functions identified as warranting further attention are workplace maintenance; equipment maintenance and the role of electronic processing; and protection, security and healing. Examples of case studies in these functional areas, and potential impact of the study of the physiology of organisations on the knowledge accumulation within these areas are covered below.

Workplace Maintenance

In a research project investigating the reasons for a high level of absenteeism and sickness in a call centre environment, Taylor et al. (2003) investigated the impact of the three categories they regarded as the components of a work system, namely the “social environment (work organization, job design, managerial control systems, industrial relations context); the proximate environment (work technology, workstation design) and the ambient environment (work building, lighting, temperature, air quality, acoustics)” (Taylor et al., 2003: 438). This widening of the factors impacting the operations of the employees is in line with the common requirements identified within the physiology of living organisms to include the immediate work environment within which the individual cell is operating. Taylor et al.’s conclusions regarding the reasons for ill-health were “that occupational ill-health in call centres should be seen as a composite outcome of the way in which identified sub-optimal factors interact with each other. It is not *either* the work environment for this employee, *or* work organization for their colleague, but rather the result of performing a task which can, in itself, be stressful (difficult customers), while trying to meet demanding performance

levels (targets), and doing this in an unsupportive working environment” (Taylor et al., 2003: 454). Their recommendation for improved temperature regulation within the ambient environment was accepted and rolled out to the other parts of the organisation, although their recommendations with respect to target-related stress were not implemented. The level of absenteeism and illness was reduced.

Another research project into the changes within the workplace environment is of interest for more than one reason. These are the changes that have been initiated from executive management, not necessarily to improve an unsatisfactory working environment, but as a motivational tool to increase productivity, the sharing of ideas, and especially creativity. Warren (2008) explored the impact of the ‘aestheticization’ of the workplace environment for a design team responsible for developing graphic design software, in which “paint and lighting effects were combined to give an appearance that the office had been transformed into a ‘funky’ and ‘futuristic’ space. The office was also newly equipped with toys, games and large sculptures – the existence and use of which were intended to impart a sense of ‘fun’ to the workplace and their use was actively encouraged during the working day” (Warren, 2008: 566). Although Warren’s research was exploring the use of aesthetics methodology in research, it revealed that in this particular case, the imposed changes to the working environment were not accepted by all members of the department. While some accepted the toys as a reminder of a positive childhood, others regarded them as inappropriate in a work environment, and annoying (Warren, 2008: 570). This enforces a point that although internal functions support other functions in the organisation, changes to the work environment should meet the needs of the individual functions. Physiology regards the maintenance of the

work (cell) environment as an important internal function. Little attention is yet paid to the ambient work environment, except for the purpose of motivation, as demonstrated in the case study by Warren. In the meta-analysis of recent research papers published in the leading management and organisational journals, very few research studies actually addressed the importance of the work environment.

No cases were identified which addressed the functions of waste management or cleaning as essential internal functions, another area that warrants further research. Examples do exist of cases where these functions have been regarded as 'non-core' to the operation of organisations, such as in hospitals, resulting in the functions being outsourced (Augurzky and Scheuer, 2007: 263-277). Augurzky and Scheuer concluded that in the German hospital sector, functions like IT services, catering and cleaning are generally targeted for outsourcing to reduce costs, although not always with satisfactory results. Hospitals with adequate funding preferred to reverse the outsourcing action in order to reduce patient complaints and incompatibility concerns between the organisation and the outsourced company. It can, therefore, be argued that, as part of the essential life functions of organisations, more attention could be afforded to the maintenance functions within organisations and their essential roles in the self-maintenance of the organisation. Research into the real cost of outsourcing these internal functions and the consequent reliance on external organisations could show that, analogous to the physiology of the human body, it may be better to address shortcomings in these internal functions, or replace them rather than to be tied to outsourced companies analogous to healing equipment such as dialysis machines to compensate for kidney failure.

Equipment Maintenance and Role of Electronic Processing

No observations were made with respect to the functional role of equipment maintenance analogous to bone cell maintenance. Whereas this function is well covered in trade and professional journals in manufacturing, mining, transportation and other organisations relying on equipment as an integral part of their processing, it does not feature strongly in general management research and publications. Latour maintained that objects should also be regarded as actors (Latour, 2007:72) and the importance of this concept can be demonstrated by research into the factors leading to the Piper Alpha oil platform disaster in 1976. Paté-Cornell (1993: 226) identified the four categories of design, production, management and maintenance shortcomings as contributing factors to the disaster. The maintenance function was found to be lacking in many areas including the lack in maintenance of equipment such as fire pumps; the minimal response to inspection reports; a history of shortcuts, inexperience and bypassed procedures; and a failure to communicate maintenance activities and concerns from one shift team to the next. Inadequate equipment maintenance may not result in disaster, but even the maintenance of routine office equipment such as photocopiers, could lead to morale changes in the employees relying on these equipment.

A related area of interrelationship activities requiring further attention is the use and supply of electronic systems. During the first half of the twentieth century, when Radcliffe-Brown (1957) proposed his theses about identifying physiology as one of the potential natural sciences through which societies and organisations can be studied, electronic processing was in its infancy, and virtually unknown in business organisations. Since then, information technology and processing completely changed the way in

which organisations operate, similar to the dramatic changes which the industrial revolution brought to the operations functions within organisations (Morgan, 2006: 16). This evolutionary change initially placed the spotlight on systems development and electronic processing as separate essential strategic functions within organisations (Morgan, 2006: 47), but then advanced to the stage where electronic processing is accepted as a natural tool to aid most of the functional processes, and for which software can be purchased as a resource. Examples of the types of systems supplied by the logistics function and observed in the research sample include improved online communication systems between the operations and the external market, including suppliers and customers such as a 'just-in-time' order and supply system (Peaucelle, 2000: 452-467), or the use of e-commerce to communicate with customers (Westerman et al., 2006: 230-238). While it was necessary to recognise and isolate the development of information systems as a separate function in the past, the separation today is more with respect to the purchase of information systems software as just another tool, and the internal processing and electronic distribution of transactions and information as part of the distribution centre and channels within organisations.

Protection, Security and Healing

No observations were made with respect to protection of organisations, analogous to the skin and exoskeleton of organisms. This function may not be applicable to all types of organisation since the need for protection may differ among organisations depending on the type of operation of the organisation. Further investigation reveals little research into physical border security, although advertisements from security providing organisations are widely available. More research is conducted into the more recent

requirement for electronic access or firewall security such as the paper by Greenwald et al. (1996) in which they discussed the policy and practice in developing an access firewall for academic information security, while Böck (2009) produced a paper on the ease of bypassing the firewall access restrictions introduced by Windows 7. Further research into the importance of protection functions and the organisations benefiting from active protections will assist in determining the functional importance of protection, and could contribute to the taxonomy of organisations as promoted by Radcliffe-Brown (Radcliffe-Brown, 1957: 33, 34).

Observations analogous to the independent immune and healing systems of organisms were low, but case studies could be detected in the sample with respect to health, safety and security issues, and academic journals not included in the sample also cover these functions. One of the case studies in which the health function was involved as a participant, and the security function could be observed as the requestor for change was due to ethical issues demonstrated in case of the treatment of AIDS employees in South African organisations. Dickinson (2006: 697-717) examined the way in which workers with HIV/AIDS were helped by peer educators in large South African companies. He found that initial compulsory screening of new employees for AIDS was blocked by the government, thus preventing companies from regarding HIV positive applicants as being 'non-self' or a risk to the company. The companies complied with the regulations, but at the same time a ground-level-up movement was started by voluntary employees within the organisations. This reaction moved away from a security issue, to an effort to develop tolerance and assist in health issues in the organisation. This case at the participant level was dealt with by the formal and informal healing function and

activities within the organisation rather than a more restrictive function of security. The movement was informally allowed by internal management, and tolerated by executive management. The volunteers, in addition to their own work, actively sought out members with AIDS, educated them and the other employees on the dangers, assistance and options open to sufferers, and not only thereby assisted members with AIDS and their families, but also helped in promoting a culture of tolerance in the organisations. Dickinson argued that trade unions could further promote the “possible trajectory of workplace peer educators as a new industrial relations actor” (Dickinson, 2006: 697).

Research projects covering health and safety, however, also included the work done by Probst et al. (2008) in which they explored the underreporting of injuries in the United States to the Occupational Safety and Health Administration (OSHA) upon which the certification of compliance for the organisation depends. They found that “while the annual injury rate reported to OSHA was 3.11 injuries per 100 workers, the rate of eligible injuries that were not reported to OSHA was 10.9 injuries per 100 employees. Further, organizations with a poor safety climate had significantly higher rates of underreporting (81% of eligible injuries unreported) compared with organizations with a positive safety climate (47% of eligible injuries unreported)” (Probst et al., 2008: 1147).

On the other hand, even the existence of the health and safety laws and regulatory bodies does not always ensure a safe and conducive working environment. Research undertaken with respect to health and safety issues in the meat industry found that incidents reported during the research period, included injuries due to heat or excessively cold environments. While the latter was inevitable in the industry

researched, the importance of the cooperation between management and the health and safety committees in the unions with respect to the workplace environment was regarded as important (Lloyd and James, 2008: 713-730). A safe, ambient and clean working environment is important as a common feature valued by the incumbent in his/her role within the organisation. By including the perspective of physiology of the organisation in the study of protection, health, security and safety, the emphasis moves on from considering the functions as essential due to external regulatory pressure, to an essential internal function, integrated with the other functions, and operating on both formal as well as informal peer-assistant levels.

Although the sample did not include all the functions, case study examples of research conducted in these functions and other low observation functions could be found, and demonstrates the value of including these functions in the holistic approach offered by the study of the physiology of organisations.

Key Functional Interrelationships

Radcliffe-Brown maintained that the study of functions do not refer to rigid goals, rules and structures as supported by other theorists such as Malinowski and Parsons, but by their interrelationships with other functions, both in their operational activities and the impact they have on these other functions. The second part of the research therefore addressed these interrelationships with respect to the role they performed during change activities, the main functions impacted during these activities, and the types of activities.

Table 6.2 provides a summary of these key interrelationships derived from the research dataset summarised in Appendix 4. The findings are presented in the table in six columns the first of which identifies the function. This is followed by the percentage of observations, also presented in Table 6.1; the dominant role(s) observed for the function during change activities, the major function identified as the impacted function during this change process; whether the change process could be identified as incremental or innovative; and the type of change process.

Function	Percentage of Observations	Dominant Role as percentage of observations	Major function impacted in change project or as recipient	Involvement in Incremental and Innovative change and percentage of positive results	Type of Change Programme in which Participant for >20%
Acquisition	171 (4.8)	Participant (78) Recipient (15)	Operations (66) External (24)	Incremental (53): Pos(88) Innovative (48): Pos (70)	Business-related (26) Staff-related (25) Market-related (20)
Distribution	11 (0.3)	Participant (73)	Included in Acquisition	Incremental (25): Pos(100) Innovative 75): Pos (77)	Process-related (50) Business-related (38)
Accounting	102 (2.9)	Participant (71) Recipient (27)	Operations (54) External (16)	Incremental (51): Pos(73) Innovative (49): Pos (77)	Business-related (29)
Maintenance	19 (0.5)	Participant (100)	Operations (63)	Incremental (68): Pos (77) Innovative (32): Pos (67)	Staff-related (53) Market-related (21)
Protection	0	0			
Security	78 (2.2)	Participant (64) Recipient (29)	Operations (40) Internal (19) External (19) Executive (18)	Incremental (64): Pos (86) Innovative (36): Pos (63)	Staff-related (31) Control/Regulatory (24)
Health	9 (0.3)	Participant (89)	Internal (53)	Incremental (75): Pos (100) Innovative (25): Pos (50)	Staff-related (75) Process-related (25)
Internal communication	264 (7.4)	Participant (94)	Operations (82)	Incremental (60): Pos (82) Innovative (40): Pos (77)	Staff-related (31) Market-related (23) Business-related (21)
Internal information	8 (0.2)	Participant (75)	Executive (50) Operations (50)	Incremental (83): Pos (100) Innovative (17): Pos (0)	Staff-related (33.3) Business-related (33) Control/Regul. (33)
Internal management	25 (0.7)	Driver (100)	Operations (64)	Incremental (88): Pos (86) Innovative (12): Pos (33)	Staff-related (72)
Total Internal	727 (20.5)	Participant (74)	Operations	Incremental (58): Pos (83) Innovative (42): Pos (73)	

Table 6.2 Profile of internal functions in their roles in change programmes and processes

With respect to the level of influence exerted by them, the internal functions were found to be predominantly involved as participants within change processes, in line with the proposed framework in physiology discussed in Chapter 4. The only exception was internal management acting as drivers in incremental change processes. In the cases where internal functions were observed as requestors for change, it was mainly with respect to internal security or health issues to be resolved locally. The main participants in change processes were observed to be the communications functions, especially development and motivational communication; the acquisition and accounting functions, especially with respect to allocating additional funding and resources to support changes; and the security functions by identifying and addressing areas of security risk within the organisation.

Functions influenced as the recipients of the change processes in which internal functions acted as the participants, were found to be predominantly the operations and other internal functions. Exceptions are the supply and accounting functions where relationships with the external market and financial environment such as suppliers, customer payments, creditors and sponsors could be identified as relationship actors. Again this is in line with the proposed interrelationships identified in the framework for the human physiology in which internal functions were observed in supportive roles except for the digestive, respiratory and protection systems.

The major types of interrelationships of internal functions were found to be the involvement in programmes to obtain staff and other resources, and communication to develop, motivate, inform, instruct and encourage change. Various other types of interrelationships include changes to the workplace environment and individual pay and

working conditions, again in line with the expected types of interrelationships expected from internal functions within organisations. The dominant type of change programme in which internal functions were observed is incremental programmes in which existing processes are addressed. Functions also identified in innovative programmes are accounting and logistics, with the internal functions closely linked to relationships both within and external to the organisation.

Various case study examples could be identified in the research sample to demonstrate the key interrelationships and the impact that a study based on the physiological framework of organisations can have on the knowledge about the functioning of organisations.

Accounting and Fund Allocation

Interrelationships affecting the accounting and funding functions were found to be widespread, from impacting individuals in their remuneration, the ability to successfully fund change programmes, to the need to support business and product developments. Two research papers addressed the issue of perceived fairness and equality of pay in organisations, thereby providing examples of instances where members of organisations will accept additional pay for additional work, but also link their perception of what is fair in pay to the overall condition of the organisation, that is, fairness in sharing both in good and bad times of the organisation. Subramony et al. (2008) investigated pay expectations of employees as part of a national survey in the United States of America, and found that the organisation's financial performance can be used as a prediction of what the employees will consider and be willing to accept as a fair and competitive pay

(Subramony et al., 2008: 778-788). Equal pay for equal work may not, therefore, be a concept that should be applied horizontally across all organisations, but, as in the case of organisms, may require flexibility since employees may accept different pay offers, provided the offers are perceived to be fair within the organisation and fair based on the overall competitiveness and financial status of the organisation. Similarly, the research performed by Wade et al. (2006) into executive pay and the effect that can have on the perception of a fair pay scale, found that in the cases where there is an observed overpayment at executive level, the expectation is also for an overpayment, that is above market levels of pay, for the subordinates, and vice versa (Wade et al., 2006: 527-544). While willing to sacrifice during low performance times, employees are expecting to benefit when times are prosperous. Analogous to the packaging and distribution of oxygen by the respiratory system in the physiology of the human body, the distribution of available funds are expected to be fair in all parts of the organisation.

Other functions participating in changes in accounting practices that are of interest are the influence from the wider external environment, specifically the regulatory bodies, and the input from the internal security function. This was demonstrated in the financial model developed and proposed by Acharya and Yorulmazer (2008) in which they modelled the circumstances under which failing banks could and should be bailed out (Acharya and Yorulmazer, 2008: 2705-2742). They proposed that the liquidity of the banks should be considered together with a factor of the moral hazards which can arise if the bank restricts its operation to fail-safe transactions, to the detriment of other banks. Although not directly relevant to the physiological functioning of an organisation, this demonstrates the impact on the function and organisation in search of additional

funding from sources external to the organisation, analogous to the case of whether an individual's life should be extended by means of artificial respiration or not. The interrelationship in this case is with players in the external environment, but the consequences will impact the organisational functions as well.

Security and Controls

Security was also identified as a function with multiple interrelationship links both internal and external to the organisation.

Case studies addressing security management controls focused strongly on incidents in which elements of fraud or unethical performance were observed, compared to the value set of the organisation or regulatory bodies, and explored the ways in which the organisation can recover from, and the impact this performance has on its external environment. Yu et al. (2008) investigated the impact of organisational crises due to unethical trading by senior executives on the market, and especially on other organisations within the same sector. They defined an organisational crisis as a "situation where stakeholders believe that the default social codes of the stricken organization are violated . . . once a violation of default social codes is detected, the organization loses the benefits of conformity, because stakeholders are rendered uncertain about what to expect of it." (Yu et al., 2008: 454). They explored the wider interrelationships in two cases, one of Putnam Investments in 2003, where a whistle blower leaked the information of unethical early dealing by senior executives. This instance was regarded by the market as symptomatic of the investment sector (contagious elements) and although the senior executive was sacked, it also resulted in

the tightening of regulation within the sector. This was compared to another case involving Atlas Aircraft losing their chief executive in 2001 in an aircraft accident. In this case the crisis was regarded as localised to the organisation, and did not result in any additional external impact on peer organisations. The organisation was allowed to address the crisis situation by itself (Yu et al., 2008: 455, 456). This highlights the different internal and external interrelationships and the need to ensure that the right interrelationships are followed depending on the situation of change.

Sueyoshi et al. (2009) expanded on potential solutions leading to the early detection of instances and elements which could lead to crises, by proposing a decision support framework for internal audit prioritization in a multi-unit car rental organisation. They proposed that various decision criteria should be considered, such as previous performance, reliability of the systems and operations, frequency of audits, customer complaints, and quality and control ratings, in order to decide on the frequency and level of audits per unit (Sueyoshi et al., 2009: 222). This again not only supports the ongoing need for internal security checks, but the interrelationships between this function of security and control and the functions of continuous observation for the health and wellbeing of the organisation and its members in addition to other relevant functions.

Communications

The internal communications function was identified not only as the dominant function during change activities, but also as a complex function with respect to the acting functions and their interrelationships. Success often depended on the availability of a

good feedback system and a networking structure linking management with other organisational functions, analogous to the integrated feedback control loop in the hypothalamus to control the production of hormones.

One of the case studies identified within the research sample which demonstrates the relationships played by more than one of the communications functions, and the impact thereof on other functions, is the research conducted by Chreim et al. (2007) on the set-up of a pilot and the subsequent roll-out of reorganisation in the Canadian Health Service (Chreim et al., 2007: 1515-1539). The objective of the restructuring project was to consolidate end services to patients by combining selected health services offered by different professionals into “well-being” clinic models, offering a one-stop choice of services to the public. While setting up the pilot, care was taken to prepare the professionals for the change by offering education about their new roles (Chreim et al., 2007: 1518) and to provide information on similar and other successful models through conferences and visits in which the advantages of the improved resource management model were explained. Only when this pilot was found to be successful, was it rolled out to the rest of the health service, this time with the help of members from the initial pilot, reporting on improved productivity, and motivating the new teams. The overall project, relying heavily on adequate communication at all levels, was regarded as successful.

A case study with a less positive outcome, is the research done by Royle (2006) on the changes in operating practices in an Italian fastfood chain, in which management decided to change the practices more in line with the McDonald practices of strictly controlled and standardised services and operations (Royle, 2006: 757-779). From a

communications point of view, the activities affecting the operational staff included training in changes to practices; the change in employment from full-time to part-time staff; and the requirement for higher productivity through stringent targets. The initial training was accepted by the existing permanent staff, but the higher emphasis on productivity, especially with the new part-time staff, led to health and safety issues and strike action. Success from communication can only be determined if the impact of the interrelationships with all functions have been evaluated.

Internal Management

In the overall analysis of the role played by internal management in assisting changes within organisations, it was shown that internal functions feature strongly as participants in change. There were very few programmes in which they could be observed as requestors, drivers or functions impacted by the change, supporting the proposition that the internal functions operate largely independent, but very much in touch with the needs of all members in their operational tasks within the organisation.

The case studies in which internal management activities were identified covered mainly the monitoring of staff morale and health issues, such as in the AIDS case reported by Dickinson (2006) where supervisory management identified problems with staff and allowed informal peer-educators to operate within the departments to assist in developing a tolerance throughout the organisation. The instances in which managers of internal functions acted as drivers of change were low, and the types of change projects they were leading were mainly incremental programmes to improve existing internal functioning of the organisation, such as the redevelopment and training of staff, either

due to business restructure or to develop staff in general, to promote values and to address specific staff welfare and condition issues.

However, when considering the results of the innovative change programmes for which internal management was observed to be the driver, all four of the business-related change programmes either had negative or mixed results. This was demonstrated in the research by Vaast and Levina (2006: 190-201). In this case the information systems development manager resigned and, although informally supported by the executive, the task of replacing the manager and influencing the successful employment and development of the new person in this position fell on a committee set up by the human resources department and the users. The appointment decision was not widely accepted and when the new manager developed the department on the basis that, as experts in information technology, they can prescribe to users instead of cooperating with them, general dissatisfaction spread. The result, as observed in the case study research, was that the appointment of the new manager and the handling of this innovative change was regarded as unsuccessful. The chief executive officer asked the manager to resign, and reversed some of the drastic changes that happened over the period of change. This highlights the supportive role of internal functions, and the difficulty for these functions to impose innovative change without the full support of the executive.

The interrelationships of internal functions were found to be analogous to the interrelationships of the visceral functions of organisms, predominantly concerned with the well-being of each of the individuals within the organisation, including equipment regarded as essential to the operation of the organisation. This internal focus however is

expanded to include the external environment for functions such as accounting with respect to income and expenditure, security to prevent unwanted intrusion by 'non-self' influences and the acquisition of essential people, supplies and equipment for the organisation. The interrelationships operate mostly in a participative role in change activities, and it was shown that these interrelationships and impact on other functions and the environment should not be ignored, but rather expanded in the study of organisations.

Conclusions

With the exception of the internal functions not widely observed in the research sample, it was possible to identify internal functions within organisations and organised societies analogous to the internal or visceral functions studied within the physiology of the human body as a living organism. This however, only demonstrates that the knowledge about these functions exists and is available even though this knowledge and research may be at vocational rather than academic level. The management of internal functions are alluded to in the control and feedback systems for the functions, and discussed in more detail in Chapter 8.

Internal functions of survival and protection were identified in the research as logistics, accounting and funding, workplace maintenance as the survival functions; protection, security and health and safety as the protective functions; and internal communications as an essential motivational function within organisations. These functions were found to support the most important law of life which, according to Silver, is the need to generate energy to perform tasks essential for life (Silver, 1998: 322).

Survival functions not widely observed in the research project include workplace maintenance and waste management, analogous to the functions fulfilled by the kidneys and colon in the body. Workplace maintenance can be linked to the concept of power by the individual when faced with a workplace unsuitable to perform its allocated tasks (Taylor et al., 2003: 435-458). All the requirements should be covered as identified by Taylor et al., including the types of equipment and the maintenance of these equipment and ambient environment. It is important to understand the contributions and values of the internal functions, and not to regard them as 'non-core' activities of the organisation that can be outsourced as a first line of cutting costs (Augurzky and Scheuer, 2007: 263-277), but be valued as vital support functions. The study of the physiology of the human body highlights the impact of the real cost of outsourcing of these vital internal functions, analogous to the use of dialysis machines for failing kidneys, and organisations should explore alternative options to cutting costs or improving failing internal functions within organisations.

Protection functions, including protection, security and health, similar to some of the survival functions have also not been well covered in the research sample. Research and further information is required on protection, analogous to skin and first level of defence against undesirable entry to the organisation. The second level of defence, analogous to the immune system is better covered with respect to the insistence by external regulatory bodies on acceptable protection against fraud, and the compliance to health and safety regulations such as the Research Governance Framework for Health and Social Care (2005) issued by the Department of Health. However, from the perspective of physiology of organisations, an understanding is required of the role of

regulatory bodies on organisation and the resulting impact on individual functions. Externally imposed regulations could be compared to acts of immunisation against potential processing fraud and damage to organisations that can spread to other organisations (Yu et al., 2008), or could become an unnecessary interference in the autonomous self-maintenance of the organisations. This includes regulatory controls on fraud, but also insistence of health and safety regulations. Compare this to the internal and often informal action of mutual assistance and whistle-blowing culture inherent in some organisations analogous to the organisation's immune system.

Internal communications, also studied as culture (Morgan, 2006: 116), is important in both the normal daily operations within organisations, but also during times of change. This is one of the complex functions within organisms, relying on a sound feedback control system and a networked link among all the functions within the body, including the brain. An integrated functional perspective could furthermore include the interrelationships between both the formal and informal feedback and network structures. Analogous to the endocrine system of hormonal production during both normal functioning of the body and in times of stress or changing circumstances, it is important to research the ongoing effect of internal communications as part of the culture of the organisation compared to the imposition of motivational or process changing messages on the various functions and individuals within the organisation. It is possible for a culture to be changed for short periods of additional activity, but a permanent change may require continuous injection of motivational messages analogous to the use of insulin for diabetics.

As demonstrated in the feedback control function essential for effective internal communications, it is important to research and understand the management control of the internal functions through a study of the physiology of organisations. In physiology these controls were observed to be localised with only information transfer links to executive management for exception reporting. This is opposed to the general theories of structures in which common hierarchical structures are assumed for organisations. Mintzberg offer alternative structure charts for organisations, but not in full perspective (Mintzberg in Segal-Horn, 1988). This area could not be observed in the research sample and could benefit from further research.

Chapters 7 and 8 discuss the research of the operations or motor, and executive or cognitive functions through similar analyses.

Chapter 7 Operations or Motor Functions

“..muscle has been called ‘a machine for converting chemical energy into mechanical work’”

(Barrett et al., 2010: 102).

Introduction

The objectives of the research are to evaluate the feasibility of Radcliffe-Brown’s theses that a natural science for the study of societies and organisations can be manifested through the study of their physiology. It was necessary in Chapter 3 to delimit the context within which a study of physiology is possible to organisations and organised societies. The framework, developed from the study of the physiology of the human body in Chapter 4, provided the starting point and framework for research into the physiology of organisations. In Chapter 6 the findings of the research were analysed and discussed with respect to the visceral or internal functions of organisations. In this chapter the focus is on the motor or operations functions. In order to meet the objectives of the research, the findings are evaluated with respect to the ability to observe the functions and their roles as identified in the framework for human physiology and then to explore the interrelationships among the operations functions and the other functions or players within and external to the organisation in situations of change.

Unlike visceral functions in human physiology which form a closer link to identifiable functionality such as digestion, motor functions are covered in the study of human physiology as the functioning of excitable and mostly skeletal muscle, involved in converting chemical energy into mechanical work (Barrett et al., 2010: 102). Muscle cells

operate in groups of motor units under the initiation and control from their motor cortical areas in the central nervous system (Barrett et al., 2010: 241); are dependent on the visceral functions to ensure that they have the right amount of oxygen and nutrients to perform their allocated tasks; and in the case of skeletal muscle, work closely in conjunction with the skeletal bones, tendons and joints as levers (Barrett et al., 2010: 106). Table 7.1 recognises the differences in the roles and interrelationships that the operations functions, analogous to the motor functions in organisms, play within an organisation and these are discussed in more detail in the rest of the chapter.

Evidence of Functions and Roles

Skeletal muscle, as the motor units within the body, work in coordinated teams with the bones, tendons and joints, under direct stimulation from the central nervous system, to produce the mechanical effort of mobility and agility required from them. To enable a meaningful framework within which the operations or motor functions could be observed and analysed within organisations, the major systems and functions participating in the activities of the operations of organisations were identified as listed in Table 7.1. The aim was to focus on the importance of these functions with respect to their contribution to the organisation as a whole, thus enabling the organisation to compete for resources within its external environment. Functionalists and contingency theorists focused on the operations functions in their propositions that the development of an optimum structure is part of the strategic process and should follow the competitive strategy adopted by the organisation (Morgan, 2006: 55-57).

Physiology, however, addresses functionality and interrelationships, and although structure is important, the underlying functionality in organisms manifests itself in the

processes involved in producing the products and services offered to a competitive external market and this could be compared to the development of a talent, such as a sport or craft using the operations functions (Morgan, 2006: 88).

Table 7.1 presents the findings of the observations which could be detected by role for all the functions and sub-functions identified in the operations category.

System and Function Codes		Function in Organisation	Function in Physiology	Total and percentage of Observations	Percentage of observations of Functions by Role				
System	Function				Requestor	Driver	Impacted	Participant	Recipient
Operations	Endurance	Heavy industry Transport, production	Slow muscle for movement and balance	71(4.0)			33.8	2.8	63.4
	Manufacturing	Precision manufacturing	Hand muscle using tools	228(12.9)	1.3		25.4	7.9	65.4
	Service	Retail and service	Fast hand muscle	239(13.6)	0.4		23.4	4.6	71.6
	Verbal	Professional service	Fast facial muscle	133(7.6)	5.3	1.5	24.8	6.8	61.6
	Multisector	Multiple	All muscle units	103(5.8)	3.9		26.2	2.9	67.0
Total				774(44.0)	1.9	0.3	25.6	5.6	66.6
Training	Training	Operational or professional training to perform jobs or tasks	Repetitive muscle operation until automatic under control of cerebellum	71(4.0)		1.4		97.2	1.4
Marketing	Customer Service Sales and marketing	External communications to market and customers	Use of facial expression and speech for external communication	50(2.8)			26.0	12.0	62.0
Total				173(9.8)	4.0	4.0	12.2	49.7	30.1
Total				223(12.7)	3.1	3.1	15.3	41.3	37.2
Information	Monitor	Internal monitoring against targets	Use of senses for immediate observation.	83(4.7)				95.2	4.8
	Research	External market research	Continuous monitoring by cerebellum	138(7.8)	2.2	0.7	13.0	64.5	19.6
Total				221(12.5)	1.4	0.5	8.1	76.0	14.0
Operations management	Plan and Develop	Development of future plans. Initiating and setting of targets and goals	Interpretation of signals. Initiate and set targets for action	110(6.2)	0.9		15.5	25.5	58.1
	Operations manager			362(20.6)		29.0	44.5	5.5	7.2
Total				472(26.8)	22.5	34.1	7.8	11.4	24.2
Total Operations or Motor (49.7 % of the total observations)				1761	7.4	9.8	16.3	24.2	42.3

Table 7.1 Numbers and percentages of observations of the operations functions and their roles in change activities

A full set of functions and codes used in the research sample is presented in Appendix 1.

1761, or 49.7 percent of all the functional actors observed in the research sample were

by members of operations functions, emphasising the strong focus on the roles recognised for the operations functions within organisations.

Operating Units

The operating units were grouped together and include the functions equivalent to the slow and fast motor units in the fingers (manufacturing, service), arms and legs (endurance) and the face (verbal) involved in the interrelationships to the external environment, all operating in conjunction with the assisting bones and tendons as tools and equipment (Barrett et al., 2010: 106). 44 percent of the observations within operations functions were from the operating units themselves. The dominant role of the operating units is not only as the recipient of change activities in 66.7 percent of the observations, but also as the impacted function in the change programmes in 25.6 percent of the observations, a total of 92.3 percent in a receiving role. The findings of the dominant roles of operations functions are supportive of the direct control observed in the physiology of organisms in which the motor muscle units are dependent on direct stimulation from the central nervous system, assisted by other chemical messages, in order to perform or modify their activities.

Training, Information and Marketing Functions

The training function separates the specific job- or task-related training of operating units from the general training and development which, in an organism, is comparable to stimulation by additional hormonal communication messages. This job-training function is analogous to the ability of the cerebellum to learn and subsequently monitor the sequence of smooth motor actions through repetition (Barrett et al., 2010: 258).

Training is the least represented function at four percent observations within the operations function. Although the numbers are relatively low, the dominant role for the job-related training function, at 97.2 percent, is as a participant in change processes, mostly in order to impact change or improve operational processes.

Operational information refers to proprioception, or the ongoing monitoring of the performance of relevant operating units in order to ensure that the operations are smooth and in line with expectations (Barrett et al., 2010: 158, 632); and the input from the external market research information equivalent to the eyes and ears to detect competitive opportunities or threats (Barker et al., 2008: 83). It is, therefore, understandable that the information gathering functions have been observed for 76 percent of their activities in the role of a participant in change processes.

The information-related function impacts on the operating units in 43.5 percent, operations management for 22 percent, and the external environment in 14.3 percent of the observations of activities in which they are participants. Information functions are featuring strongly in programmes related with controls and regulation, as well as partner relationship programmes. This operations function was subdivided into a monitoring of internal performance, equivalent to proprioception, and external information gathering, equivalent to external senses such as vision and hearing. Most of the observations indicated the monitoring of operational performance against targets as the most important part of information. Significant types of change interrelationships, resulting in negative and mixed results of the change process were found to be the imposition of targets by operational management; inadequate information about changes; and the inability to provide additional staff and resources to execute the

changes. Research papers in which mixed or negative results were identified with respect to targets imposed by management, found that tight targets and the continuous measurement thereof can be regarded as a hindrance to innovation or performance standards as found by Nayak (2008) and Faulconbridge and Muzio (2008). Nayak explored the creativity in a supermarket retailer and found that with respect to operations control, there was a conflict between constant monitoring and control and the ability to operate creatively in the store, resulting in staff demotivation and negative performance results (Nayak, 2008: 420-439). Faulconbridge and Muzio compared the importance of professionalism within international law firms to the imposed financial targets placed on the lawyers in order for the firms to remain profitable within their environments. They found that the lawyers were willing to accept the targets and measurements on condition that they do not conflict with their own professional standards and codes of practice, therefore resulting in mixed results regarding the interrelationship (Faulconbridge and Muzio, 2008: 7-25).

Marketing refers to the use of the fast muscle in the mouth and facial expression to allow communication to the external market, suppliers and competitive environment (Barker et al., 2008: 84). The sales, marketing and customer contact functions were well represented at 12.7 percent of the observations, and evenly as participant in 41.3 percent and as recipient in 37.2 percent of the change processes in organisation.

Operations Management Function

The operations management function was selected as comparable to planning and decision-making from the motor cortex areas with respect to the operating activities,

required for the organisation by senior operations management (Barker et al., 2008: 83). Of the observations made for operations functions within the research, 26.8 percent were for the operations management. This was also borne out by the role of the operations management function as a driver in 34.1 percent of the observations for this function. However, operations management also acted as a requestor for change in 22.5 percent, and as a recipient of change activities in 24.2 percent of the observations. In the instances in which operations management was observed in the role of a recipient of change, the participants were either the research and information functions, or the external market environment.

The role and relationships of operations management was observed in Table 7.1 as evenly spread in the roles of requestor to change, driver of change programmes and the recipient of change activities. It was not observed strongly either as the impacted function or as a participant in individual change activities. An analysis of operations management as the driver of change, and the operations functions impacted by the related change programmes, is presented in Table 7.2. The table furthermore presents the success rate of these programmes and whether they were classified as incremental or innovative programmes.

The spread between incremental and innovative change programmes for which operations managers were the drivers of change shows a distinct emphasis on incremental programmes at 65.6 percent of observed programmes. However, although their involvement in innovative programmes was only 34.4 percent, the percentage of these innovative programmes rated as successful was low at 31.9 percent.

Halme (2002) explored learning in organisations by following and comparing the ways in which a forestry, paper and pulp organisation approached changes in the way in which they manage the forests in their care. Following a merger, an operations manager recommended an innovative change to forest management, away from intensive towards a more eco-friendly smaller scale forest management style. This was attempted by the operations manager in 1990 as a major innovative change programme and strongly resisted by the other foresters (Halme, 2002: 1097) who regarded it as an admission of failure of their previous approaches to forestry management. However, in 1992, biodiversity became a key discussion point and issue for the United Nations and external pressure began to mount on senior executives to become more aware of the ecological balance in their work, including forest management. This time the project had the driving support of executive management, responding to the wider regulatory environment as the requestor. The new smaller scale forest management approach was implemented, supported by adequate communications and learning support. An innovative change project, which failed when initiated and driven by the operations management, succeeded when sponsored and continuously enforced by corporate management (Halme, 2002: 1087-1109).

Functions Requiring Further Attention

The indication is that the operations functions are well represented within the research sample, and further analyses could be conducted to explore the roles and interrelationships of these functions within and external to the organisations. Some of the functions not so well observed in the research sample were customer service, on-

the-job training and operations within the endurance sector at three and four percent of the observations of operational functions.

These functions were however regarded as important in their interrelationships as indicated in case studies in the research sample. Customer service as a verbal function of operations did not feature strongly as a separate function in the sample, except in case studies analysing the impact of tight targets and controls on the staff (Taylor et al., 2003). Research by Ramirez et al. (2007) into the adoption of high performance work practices (HPWP) by telephone companies in the UK and USA during the 1980s and 1990s, found that, in order to stay competitive, the companies replaced a large number of blue collar workers with fewer technical and outsourced services staff. Although this downsizing of the previous type of workers negatively influenced the motivation of the leavers, the remaining and new technical recruits were fully trained in the new technology, and accepted the changes to their work practices (Ramirez et al., 2007: 495-517). This positive response to training in new processes, supports the storage of newly created smooth muscle movements in the cerebellum through repetition (Barker et al., 2008: 86, 87), and was found in various other successful case studies.

The low percentages of observations of operations within the endurance sector, such as mining is discussed again in the next section as part of the key interrelationships identified for these sectors.

Unlike the internal functions operating mostly as participants in change processes, the dominant roles of the operations functions vary from a recipient of the operating units; participant in the case of the information and monitoring functions; and the multiple

role relationships of requestor, driver, participant or recipient for the management and the marketing functions. These dominant roles will be discussed as part of the key interrelationship analyses for each of the operations functions in the rest of this chapter.

Key Functional Interrelationships

In this section the operations functions are discussed in more detail in order to explore the interrelationships in their dominant roles as recipients of change for the operating units, but also as the participant in the other functions. Table 7.2 provides a summary of these interrelationships derived from the summarised dataset presented in Appendix 4.

The findings are presented in the table in six columns. The first column identifies the function and is followed by the percentage of observations, also presented in Table 7.1.

The final four columns list the dominant roles observed for the function during change activities; the major function identified in the opposing role to the function's dominant role; whether the change process could be identified as incremental or innovative; and the type of change programmes in which the functions participated.

Unlike the analysis of the internal or visceral functions, it is more difficult to conduct a comparative analysis of the operations or motor functions to physiology due to the integrated way in which the muscle, bone, and nervous systems work, as demonstrated in the framework for human physiology. An additional analysis was, therefore, conducted by separating the different types of operating units, analogous to the slow and fast muscle cell units, and analysing each of the groups in organisations with respect to their interrelationships and impact.

Function	Percentage of Observations	Dominant Role as percentage of observations	Major function in change relationship. (Unique) function in sector of Operating Units	Involvement in Incremental and Innovative change and percentage of positive results	Type of Change Programme in which Participant for >20%
Operations – Verbal	133 (7.6)	Recipient (62)	Communications(33) Training (8) (Work Environment)	Incremental (51): Pos(76) Innovative (49): Pos (54)	Staff-related (35) Market-related (27) Business-related (21)
Operations – Manufacturing	228 (12.9)	Recipient (65)	(Information (20)) Communications(19) Supplies (15) (External Market) (Executive)	Incremental (51): Pos(90) Innovative (49): Pos (83)	Business-related (31) Staff-related (26)
Operations – Service	238 (13.6)	Recipient (72)	Communications(36) Supplies (14) Information (10)	Incremental (48): Pos(94) Innovative (52): Pos (65)	Market-related (29) Business-related (23) Staff-related (23)
Operations – Endurance	71 (4.0)	Recipient (63)	Communications(23) Supplies (21) Training (12) Information (10) Management (10)	Incremental (19): Pos(68) Innovative (81): Pos(35)	Business-related (48) Staff-related (25)
Operations – Mixed	103 (5.8)	Recipient (67)	Communications(44) Supplies (17) Training (14) Information (12)	Incremental (70): Pos(93) Innovative (30): Pos (79)	Staff-related (51) Business-related (48)
Training	71 (4.0)	Participant(97)	Operations (75)	Incremental (57): Pos(95) Innovative (43): Pos (77)	Staff-related (33) Market-related (22) Business-related (20)
Marketing	223 (12.7)	Participant(41) Recipient (37)	External (72)	Incremental (42): Pos(85) Innovative (58): Pos (83)	Market-related (50) Business-related (25)
Information	221 (12.5)	Participant(76)	Operations (44) Management (22)	Incremental (56): Pos (95) Innovative (44): Pos (88)	Partner-related (27) Business-related (21)
Operations management	472 (28.8)	Driver (34) Recipient (24) Requestor (23)	Operations (85)	Incremental (66): Pos(68) Innovative (34): Pos (32)	Market-related (34) Staff-related (21)
Total Internal	727 (20.5)	Participant (74)	Operations	Incremental (58): Pos(83) Innovative (42): Pos (73)	

Table 7.2 Profile of operations functions in their roles in change programmes and processes

During the evaluation of the acceptability of the sample in Chapter 5, the split by operations sector was based on broad market sectors as presented in the business media. However, in order to evaluate the sample for its suitability to a physiological framework for the study of organisations, the sectors were reclassified according to the major type of muscle, indicated in Table 7.1. Four physiological sectors were identified, namely the endurance sector, analogous to slow muscle units; manufacturing, or fast

hand muscle together with the use of tools and equipment; service, or fast hand muscle operating directly with the customer; and verbal or the fast facial muscle units.

Reclassification of the current sector split referred to in Chapter 5 found that manufacturing organisations support either fast hand muscle, in other words, operations that require precision and coordination of the operators and the use of precision tools and equipment in the execution of their tasks (manufacturing); or else support the slow skeletal muscle for slower, coordinated action of operators and usually large equipment, set up and built for endurance in action, such as transport, mining, heavy industry or construction work (endurance). Independent government institutions and service organisations were grouped together as the service sector, which could then be split into enduring service such as transport and utilities; precise service organisations such as the health service, engineering, sport and leisure; and finally verbal services based on the use of facial muscle such as education, financial services and the media (verbal). Multisector organisations could be split into small businesses which were grouped together with the fast hand muscle sector, or had to be left in a mixed sector category if it was not possible to identify one specific dominant muscle equivalent. This mixed group was found to be unsuitable for further analysis within this section because it was not possible to isolate individual types of operations within them.

Further analyses and discussions of the operating units as the recipients of change programmes use this reclassification as a framework in order to determine whether the results can benefit the study of organisations. Each of these sectors was, therefore, further analysed with respect to the functions influencing the sector as the recipient of change, as well as the types and success rates of the change programmes in which they

were observed to be involved as recipients. The impact on each sector is briefly discussed separately.

Common Interrelationships over all Operations Sectors

The initial analysis was to determine the influence exerted by the various participating functions in the change process on the operating units. An analysis of the observations split by sector is presented in Table 7.3.

		Physiological Sector Type of Operating Units as Recipients of the Change Process				
		Percentage of sector totals in Operations as Recipient				
Participants	Total	Verbal	Manufacturing	Service	Endurance	Mixed
Executive communication	3	1.2	0.0	1.2	0.0	
Executive Decision	19	2.3	5.3	2.3	3.8	1.7
Executive Information	5	0.0	0.0	2.9	0.0	
Total Cognitive	27	5	8	11	2	1
Operations management	24	7.2	6.0	1.7	9.6	1.7
Marketing	17	2.4	2.7	5.8	1.9	
Operations	1	0.0	0.0	0.0	1.9	
Information	72	15.7	20.0	9.9	9.6	11.9
Training	48	8.4	9.3	9.9	11.5	13.6
Total Motor	162	28	57	47	18	16
Internal communication	160	32.5	19.3	36.0	23.1	44.1
Internal distribution	3	0.0	0.7	1.2	0.0	
Accounting	25	3.6	4.0	5.8	3.8	6.8
Health	5	0.0	1.3	0.6	3.8	
Maintenance	10	3.6	1.3	1.7	1.9	1.7
Logistics	77	10.8	15.3	14.0	21.2	16.9
Internal information	1	0.0	0.0	0.6	0.0	
Security	14	4.8	4.0	1.7	0.0	1.7
Total Visceral	295	46	69	106	28	42
External Market	22	4.8	9.3	2.3	5.8	
External Wider	10	0.0	1.3	2.3	1.9	
Total External	32	4	16	8	4	0
Grand Total	516	83	150	172	52	59

Table 7.3 Participants in change and their impact on different operations sectors as recipients

Analyses and comparisons were done by calculating the observations of each participating function as a percentage of all observations within the physiological sector. Evaluation by percentage was regarded as necessary in order to allow a comparison not only of the importance of the impact of the participating functions within the sector, but to be able to compare the level of importance across the sectors.

The sector mostly impacted by the participating function has been highlighted and further explored to determine whether a pattern can be observed. While an element of bias has been identified in the sample, the validation in Chapter 5 recognised that the spread over business sectors was even enough for further analysis, although this was not tested as a spread by physiological sector. In Table 7.3 the numbers of observations by physiological sector ranges from 52 for endurance organisations to a maximum of 172 for precision service organisations. Although this range indicates a higher focus of the research published in leading academic journals for the service and manufacturing sectors, the number of observations within the other two sectors are still high enough to warrant further analysis.

Participant functions influencing the operating units were regarded as common to all or to some of the functions if the difference in percentage observations was less than 50 percent between the highest and lowest observations, calculated as a percentage of the highest observation. The highest percentage of the remaining participant observations across the sectors was highlighted as a potentially unique relationship for that sector. This part of the analysis requires further research as some of the percentages used to highlight unique relationships are very low and therefore not reliable as evidence of

differentiation among sectors. A summary of the common and unique interrelationships is presented in Table 7.4.

Business Sectors	Verbal	Manufacturing	Service	Endurance
Common relationships with participating functions	Logistics Training Accounting Internal communication	Logistics Training Accounting Internal communication	Logistics Training Accounting Internal communication	Logistics Training Accounting Internal communication
Relationships in which the participating function features stronger than for the other sectors	Security Maintenance Executive communication	Performance information External market Executive decision Security	Marketing Market information Internal distribution Executive communication Internal information	Operations management Health Operations

Table 7.4 Common and dominant relationships of operational sectors

The interrelationships that were observed within an acceptable range of importance over all four of the identified physiological sectors in Table 7.3, are job or professional task-related training; the availability of adequate funding for the required changes; the availability of adequate supplies; and the influence of internal communications. The importance of task-related training ranges from 8.4 percent for verbal organisations, to 11.5 percent in endurance organisations. This reflects the general importance of repetitive learning and training as observed in the role of the cerebellum as the main monitoring and controlling function of the motor functions within the human body. The second, and similarly important requirement of oxygen to the operation of cells, is the funding, ranging from 3.6 percent for verbal organisations to 5.8 percent for service organisations. Logistics as a common participant ranges from 10.8 percent in the verbal sector to 21.2 percent in the endurance sector. Finally, internal communications as a common participant in change processes range from 19.3 percent in manufacturing to 36 percent in service sectors.

Dominant Interrelationships: Verbal Sector

The verbal sector, equivalent to the operation of fast facial muscle in human physiology, was equated to organisations offering verbal products such as advice, education or information to their customer market.

Operating units in organisations in the verbal sector were observed to display a high interrelationship with the internal function responsible for the workplace maintenance; relatively high level of interactions with the monitoring and control by operations management; the direct participation by operations and executive management; and the importance of security.

As highlighted in Table 7.3, the importance of the interrelationship between the operating units and the internal maintenance function is the strongest in the verbal sector at 3.6 percent of the observations in this sector versus less than two percent in endurance and precision service sectors. Two of the research papers that demonstrate the interrelationship between workplace maintenance and the operating units within the verbal sector are by Woodhams and Corby (2007) and Brown and Humphreys (2006). Woodhams and Corby researched the progress made within the service organisation with respect to the implementation of, and compliance with, the disability legislation between 1995 and 2003 in the United Kingdom. They found that, based on the various points of evaluation, the sector was a good predictor of the degree of success of support to disabled workers. The sector most likely to comply was found to be the government-linked service sector, including adapting the workplace environment and the readjustment of duties to suit disabled staff (Woodhams and Corby, 2007: 556-580). Brown and Humphreys, on the other hand, addressed a lack of attention to the

workplace environment during the merger of two colleges, resulting in a general dissatisfaction in professional staff about the better environment that existed pre-merger (Brown and Humphreys, 2006: 232-257).

Further analysis as to the role and interrelationships between security and the operating units indicate that the type of security within the verbal sector focuses on the identification and addressing of fraud and ethical conduct of staff. Ouchi (2006) researched the development of a successful model for devolution of power during the process of decentralisation within three large school districts in the United States. He deduced that one of the success factors was the introduction of accountability of all senior and operating staff within the decentralised schools, including the introduction of annual parent rating of the school, and the peer and subordinate's rating of individual professionals within the school to ensure quality and ethical behaviour (Ouchi, 2006: 298-307).

An example of negative results of an innovative programme in the verbal sector is the imposed implementation of a technology-based CRM (customer relationship management) system by executive management in a bank in New Zealand (Shum et al., 2008: 1346-1371). The bank was the largest operating division located outside the parent home country and the CRM system was rolled out within the New Zealand bank without suitable support. The objective was to provide better customer information, but as the new system did not link to any of the older existing systems in the bank, it did not provide more information, and the workload of the operating staff doubled, without additional compensation within an already low remuneration structure. The implementation of the CRM in this venue was regarded as unsuccessful.

These unique participatory functions demonstrate the direct control of the fast fatigable facial muscle by the cortex in the effort of speech or facial expressions, the importance of ethics and security to the products offered, but also the extent to which the role played by executive management in the products can support or hinder the operations of the sector.

Dominant Interrelationships: Manufacturing Sector

The physiological equivalent for this sector is the functioning of the fast hand muscle, especially when operating with tools, and includes mostly precision manufacturing and related organisations.

A profile for precision manufacturing organisations as presented in Table 7.3 shows that, in addition to the common functions, organisations in this sector are strongly influenced by the information of performance against targets together with market research at 20 percent of its observations; and requests from their external customer and the competitor market at 9.3 percent. In addition requests from executive and operations management formed a total of 11.3 percent of the sector observations and security issues four percent.

The involvement of performance monitoring information as a participant in change mainly focused on the setting, measuring and control of production targets for the operating units. The imposed target interrelationship activities were found to be mostly regarded as acceptable and successful, however some case studies showed negative results during the change process. In the research conducted by Glover and Wilkinson (2007) into the successful expansion by western manufacturing companies into Korea,

they found that there is a conflict between the 'soft' human resources approach by western companies and the stricter quality management culture within Korea. It was not always possible to meet tight corporate targets in a different culture (Glover and Wilkinson, 2007: 1437-1455). Another negative result from the relationship between target setting and the operating units is from the work done by Lloyd and James on the impact of chain stores on the food production organisations in which the pressure of not only tight, but also changing targets resulted in the inability to meet all these targets on time (Lloyd and James, 2008: 713-730). These examples of negative results with respect to target setting and monitoring, demonstrate that, as in the case of the study of physiology, it is not the target setting and monitoring that is a potential problem. The problem can be as a result of continuous changes to targets and the inability to determine how these targets can be embedded as routine control, analogous to continuous changes in the use of muscle by sportsmen as opposed to learning and maintaining smooth muscle use.

With respect to the influence of security as a participant in change within the manufacturing sector, research done by Jaakkola and Renko (2007) and Lloyd and James (2008) highlight the importance of product security and ethics. Jaakkola and Renko explored the acceptability of prescription drugs to physicians as the customers of the manufacturing companies in Finland. They concluded that a high level of trust by the physicians in the ethical process of manufacturing, based on cooperation with the medical practices, and the low risk of the product to their patients, improved product acceptability (Jaakkola and Renko, 2007: 327-346).

Dominant Interrelationships: Service Sector

The service sector was interpreted as analogous to the functioning of the fast hand muscle, usually in direct contact with the object of manipulation. Organisations included in this sector are the health service, retail, engineering, sports and leisure organisations.

In addition to the common interrelationships, the analysis identified four dominant interrelationships in which this sector showed a stronger link to participants than the other sectors. Although their percentage impact on the sector is small, these interrelationships have been identified as the importance of market contact through the organisation's marketing and customer services units at 5.8 percent; input from wider external research at 2.9 percent; the importance of internal distribution to their successful operation at 1.2 percent; and a higher awareness of the importance of internal staff morale and welfare than observed in the other sectors.

Within the retail business sector, which was classified as part of the physiological service sector, the interrelationship of the operating units with the marketing departments focused on the need for the best method to present products to the market. The research emphasised the impact of a strong brand, either a strong own brand, or an association with a strong partner brand, as important. This was demonstrated in research done by Helmig et al. on co-branded products (Helmig et al., 2007: 285-304) and Oubiña et al. on the variables impacting own store brands (Oubiña et al., 2007: 1013-1035). The importance of customer services units as an initial customer contact was, in particular, addressed in the precision service sector of the health service. The research done by Van der Meer et al. (2005: 162-172) demonstrated that an initial

screening of patients by a customer services unit contributed positively to the faster and more efficient service performed by the health departments.

In line with the research which indicates the importance of cooperation with other well-known brands as a success factor in marketing, this sector also shows a strong relationship with the external research units from which they can get information on wider opportunities for success. In their research into the development of a “well-being” model for the Canadian health service, Chreim et al. highlighted the importance of external research into similar success models, and the impact it may have on partners for the model towards its successful implementation (Chreim et al., 2007: 1515-1539). Similarly, the external research conducted by the management of the Starbucks organisation into the use of strategic partners and the impact of changes on investors and wider acceptance of the customer market, was shown in the research done by Sarasvathy et al. (2008: 331-350).

One of the case studies in the service sector addressed the management approach in a care home for the elderly, with the objective to turn the business from a failing care home to a success story with a waiting list for residents. Management involved staff through regular meetings, weekly briefings, and shift changeover meetings, resulting in successful support for residents. However, most of the care assistants were part time workers on minimum pay, and they regarded these meetings as “out of hours” meetings for which they did not get paid. Although they were loyal to the residents and liked the work, there was still tension between management and the assistants regarding the value of the imposed changes unless they received additional support to cover the extra hours (Wilkinson et al., 2007: 1279-1297).

The reliance of the precision service sector on internal distribution is demonstrated in the research performed by Madsen et al. (2006) in the longitudinal case study of the implementation of a paediatric intensive care unit in the United States and the importance of the availability of resources, including beds (Madsen et al., 2006: 239-248). The total number of observations of the role played by internal distribution is, however, not enough to accept this as conclusive evidence that internal distribution is a dominant participant-recipient relationship which is unique to this sector.

The unique participatory functions support the importance of the ability of organisms to continuously modify and control the fast muscle units for precision work, including the need for feedback information from the immediate environment and internal support to perform tasks.

Dominant Interrelationships: Endurance Sector

The endurance sector was equated to the functioning of slow muscle units in the body. These muscle units in the arms, legs and back have a slower, but more enduring action, and assist the body in movement or transportation, heavy lifting or manual labour. Organisations included in this sector are heavy industries, including heavy manufacturing, mining and raw material organisations, transport, and production such as farming.

As per Table 7.3, organisations in the endurance sector show a strong reliance on the need to obtain the resources they need from suppliers at 21.2 percent. Operations management is the main decision-maker at 9.6 percent, and again as one of the common interrelationships, on-the-job training was observed to be important at 11.5

percent of observations. This sector of organisations also shows a strong health and safety awareness for their staff at 3.8 percent of observations.

The relationship between operations management and the operating units in endurance organisations was observed to be concerned with proposals and instructions about new technology for operations and changes to existing processes. This was demonstrated in the research with respect to the implementation of the Virgin Trains pendolino service by Ivory and Vaughan (2008). In this project, although the management objective was profit-related, the management decision on the development proposal was based on research in other similar successful operations, especially in France, and wide internal consultation before implementation (Ivory and Vaughan, 2008: 93-106). This supports the fact that if changes to endurance or slow muscle units have to be made, it is necessary to base it on valid reasons and detailed development plans, analogous to learning in the cerebellum. The change process is slower than in other sectors, and likely to require the double-loop learning concepts inherent in cybernetics used in organisations (Morgan, 2006: 84, 85).

The influence exerted by the need to obtain resources for endurance operating units, was shown to be mainly concerned with material required to change processes, structure or workplace environment, at a total of 13.3 percent of observations, followed by suitable staff at 7.7 percent. This requirement is suitably demonstrated in the recent major changes required with the introduction of new types of equipment and technology. Ramirez et al. (2007) researched the work practices employed, and the success of, the change-over in the UK telecommunications sector to new technology. They found that although the restructuring did not always work out, the requirement for

the correct and suitable electronic systems, equipment and staff was key to the eventual success in the organisations researched (Ramirez et al., 2007: 495-517). Another study which demonstrated not only the need for adequate and suitable equipment and people, but also the interrelationship with the wider regulatory environment, is the study performed by Ivory et al. (2007). They explored the need for a UK water plant to comply with the regulatory requirement for suitable and safe sludge treatment at the plant. Since the project was initiated externally as a regulatory requirement, the focus of the change was on selecting the right equipment, supplies and staff in order to succeed (Ivory et al., 2007: 224-240).

However, not all the change programmes in which the operations functions were the recipients in change, were observed to be successful, as indicated in column 5 of Table 7.2. An example of a case study in the endurance sector which was not regarded as having a successful outcome is the research by Roper et al. (2007) into the role of trade unions in the restructure through outsourcing within a local authority in the UK. Influenced by their trade union, the technical support operating units, targeted to be outsourced to an external partner, opposed the decision through strikes and the external partner cancelled the deal with the executive of the authority (Roper et al., 2007: 1589-1607). The result was that the chief executive officer resigned, and a new deal was agreed whereby the staff remained and the focus changed to improved procurement as a solution to the financial problems of the authority rather than the planned outsourcing of services.

Summary of Operating Unit Relationships

Radcliffe-Brown suggested that a comparative study could be used to classify types of society or organisations, based on the functions common and unique to that society or organisation. The evaluation of classification systems for living organisms in Chapter 4 acknowledged that there cannot be only one system, although the macro system developed by Linnaeus for plants and animals, based on physical appearance, is still used (Silver, 1998: 257-258). However, common and unique interrelationships have been identified among operating units as the recipients of change processes and this could benefit a classification system for organisations. Common interrelationships were identified with internal functions to provide funding and supplies to operating units and the important role of job training, analogous to the role of the cerebellum, as participant functions. Although speculative, the interrelationships summarised in Table 7.4 highlight the influence of communications on the verbal and service sectors, the importance of management monitoring and external research information in the manufacturing sector and the importance of health and safety in the endurance sector as unique sector related interrelationships. This is an area that could benefit from further research, not only to confirm any findings, but to establish the feasibility of this analogy of physiological functioning for organisations.

Interrelationships in which operating units are the recipients and which have not been fully explored because of the low numbers of observations in the research sample, include the internal monitoring and information gathering from staff with respect to health and safety, analogous to somatosensory perception, and the operating and maintenance of the equipment used within the sectors. This latter can be compared to

the maintenance of the bones which act as levers for movement and heavy lifting in the limbs, and no research papers were observed to cover this aspect of the functioning of organisations. Further research is required to correct this shortcoming.

Conclusion

The objectives of the chapter were to determine whether functions analogous to the functions identified in the study of the physiology of the human body could be observed within the operations functions of organisations, and to explore and compare the relationships identified in change programmes to relationships in the human body.

Operations functions were well represented in the research sample, and observed mostly in the role of the functions impacted by change and as the recipients of the change processes.

A function with low observations was the job-related training function. Job training is often regarded as the transfer of vocational know-how and therefore not considered as integral to the knowledge offered by academics to management. Exceptions are if the knowledge form part of one of the major disciplines offered at university, such as engineering or medicine in which case the training may also involve 'off-the-job' training and education (Smith, 2007: 109, 110). From a physiological point of view, this training forms an integral part of the operations of the cerebellum in the brain, and should be incorporated as part of operations management decisions and controls. The performance of operating units is continuously subjected to targets and closely monitored for progress, as seen in the role played by the motor cortex in the initiating action, and the cerebellum to ensure smooth muscle movements. These latter smooth

operations are acquired by on-the-job or professional training until the operations become routine as shown by the common interrelationship with the training function.

Another operations function that could not be adequately explored because of the limitations of the sample is the role of equipment and their maintenance as players in the operations of the organisation (Latour, 2007: 71) analogous to the role of bone cells in organisms (Barrett et al., 2010: 371-374). This relationship within the human body acknowledges the role played by skeletal bones within the body acting in conjunction with the skeletal muscle as essential as tools and levers, especially in the execution of precision or endurance operations.

The analysis of key interrelationships focused on operating units analogous to muscle units in organisms. In the research project it was found that by splitting the operating units into different classes of verbal, manufacturing, service and slow endurance sectors, similar to the different types of excitable muscle in the body, it is possible to distinguish between the different types of operating sectors and their interrelationships within and external to the organisation. It has to be accepted that, similar to the physiology of the human body, organisations are likely to contain all the different types of operating units, such as its customer services, sales and marketing departments as a fast verbal section, while the dominant core operation could actually be the service or manufacturing sector units, analogous to fast finger muscle (Prahalad and Hamel in Segal-Horn, 1998: 220-233; Morgan, 2006: 59). The core competency or the dominant sector does, therefore, not necessarily mean that all the other types of operations should be ignored, or that it is not possible to diversify into other sectors, although it may mean losing important talent to trade in the external market.

Interrelationships common to all sectors were found to be internal motivational communication; job-related training; adequate task-related supplies for normal operations; and funding to support operations and enable changes.

In addition, it was found that verbal sector organisations work in close cooperation with senior and executive management and are more concerned with their own internal work environment than organisations in the other sectors, analogous to the direct link between motor cortical areas and fast facial muscle units.

Manufacturing organisations were found to be especially subject to management targets and performance monitoring, and sensitive to requests from the external market environment. Service organisations were also found to be subject to targets and performance management; aware of the need to cooperate with external partners and the value of brand in order to market their services; rely on marketing and customer services to promote their services; and are reliant on a good internal distribution system to ensure that they are in possession of adequate resources and staff to perform their tasks. Both of these sectors can be compared to the precision fast finger muscle under direct and continuous control and monitoring of the cerebellum.

Finally, the endurance organisations were found to be more aware of ecological and other wider environmental influences; have a high need for a smooth running supply system; and are aware of the needs of their own staff and resources. This time the muscle contraction duration is longer and the operations become sub-conscious and learnt. However, for continuous support these muscle units do need nutrients and support to match the effort.

Whether this distinction contributes towards a classification system for different types of organisation still needs to be verified, although the broad distinction can be made to the controls and stimulation of different muscle types by the cerebellum and motor cortices in the brain. Exploration into the functions, roles and interrelationships of the operations or motor functions within organisations showed that there is value in observing and studying these functions comparatively within a physiological framework as proposed by Radcliffe-Brown (Radcliffe-Brown, 1957: 153).

Although key to the theories of the structural functionalists, the organisation structure of the operations functions was not explored except for the reclassification of the types of operations into the different types of muscle units. Interrelationships within the units could then be explored, but the impact of the span of control and the direct influence and guidance from the cortical areas in the brain was not directly translated to organisations. Examples include the smaller teams, direct supervision and need for continuous innovation of electronic manufacturing in a highly competitive market versus the larger teams and the slower need for change in the endurance sector.

In this chapter it was possible to explore and demonstrate the importance and value of an integrated functional perspective in which all the functions can be considered in their roles in change and the impact they have on the functions, and especially the operations functions, as the main recipients of change processes. Chapter 8 discusses the analysis results of the executive or cognitive functions of organisations analogous to the central nervous system of organisms.

Chapter 8 Cognitive or Executive Functions

“An anomaly is known to science only if it is first perceived in the consciousness, in the form of an obstacle to the performance of functions, or discomfort or harmfulness” (Canguilhem, 2007: 135).

Introduction

Chapter 8 presents the analysis and findings of the meta-analysis of published research papers as affecting the roles and interrelationships of management functions observed in change programmes within organisations. The management functions, and specifically the executive functions, were interpreted as being analogous to the nervous system in living organisms presented as a prototype framework in Chapter 4. In the study of the physiology of organisms and the human body, the nervous system is studied as a separate topic with respect to its structure, integrated relationships, and its unique higher functions (Barrett et al., 2010: 167-299). Another important extension of the study of the nervous system in organisms is the role played by the senses such as vision and hearing and the way in which information, gathered by the senses, is recorded, interpreted and eventually used for conclusions and decisions made by the cognitive part of the brain (Barrett et al., 2010: 167-227).

Appendix 1 contains a list of the physiological and organisational functions used in this research. Table 8.1 is an extract of this list which only includes the management functions within organisations, analogous to nervous system functions. The functions and research findings have been split into information, analogous to sensory perception (Barrett et al., 2010: 167-227); management planning, decision-making; and external

communication, analogous to the higher functions of the brain (Barrett et al., 2010: 229-299). Not all the higher functions of the brain could be identified in the research sample, or are relevant to the study of physiology. Examples include the study of emotion and the study of the concepts of self-consciousness and meaning as applied to organisations. One of these higher functions has, however, been identified as suitable for observation and study, and that is the function of communications, both internal and external to the organisation. Internal communication, analogous to the hormonal system in organisms has already been covered in Chapter 6, but this is different from the areas in the brain identified for the understanding and utilisation of language as an externally focused means of communication.

The identified management functions are analysed and discussed in more detail in the rest of this chapter and include the integrated management functions of all the internal or visceral, operations or motor, and unique executive or cognitive functions of the brain as observed in organisations. Although this implies some repetition of parts of the functions already addressed in previous chapters of the thesis, the aim of this chapter is to gain a perspective of the role of management by exploring the interrelationships of all the relevant management functions.

Evidence of Functions and Roles

Table 8.1 lists the management functions used in the research project, and links these functions to their equivalents in the physiological functions observed in the study of human physiology. The table is divided into sections addressing information, planning and decision-making, communication and players external to the organisation.

System	Function	Physiological Function	Number and percentage of Observations	Percentage of Observations of Functions by Role				
				Requestor	Driver	Impacted	Participant	Recipient
Information	External research	Sensory scanning	22 (1.4)				100.0	
	Market research	Focused perception	138 (8.6)	2.2	0.7	13.0	64.5	19.6
	Management information	Interpretation of somatosensory perception	15 (0.9)			6.7	80.0	13.3
	Performance monitoring	Proprioception	83 (5.2)				95.2	4.8
	Internal information	Somatosensory perception	8 (0.5)	25.0			75.0	
Total			266 (16.5)	1.2	0.4	7.8	77.9	12.8
Decision making	Executive management	Voluntary cortex decision	430 (26.7)	32.8	34.7	4.2	8.6	19.7
	Operations management	Voluntary motor cortex decisions	362 (22.5)	29.0	44.5	5.5	7.2	13.8
	Internal management	Reflex decisions in midbrain	25 (1.6)		100.0			
Planning	Strategy and planning	Memory, learning and planning cortex	69 (4.3)	5.8	4.3	7.2	40.6	42.0
	Design and develop	Control of posture and movement	110 (6.8)	0.9		15.5	25.5	58.2
	Job training	Repetitive training in cerebellum	71 (4.4)		1.4		97.2	1.4
Total			1067 (66.2)	23.6	31.7	5.5	17.6	21.7
Communication	Public relations	Language and speech in cortex	55 (3.4)		10.9	9.1	54.5	25.5
	Sales and Marketing	Language and speech – motor cortex	223 (13.8)	3.1	3.1	15.3	41.3	37.2
Total			278 (17.3)	1.2	2.3	7.6	68.8	20.1
Management (53.7 percent of total observations)			1611	13.8	18.6	6.4	41.2	20.0
External Market	Competitors	External immediate environment	18				61.1	38.9
	Customers		130	16.2		1.5	20.0	62.3
	Partners		69	2.9		1.4	14.5	81.2
	Suppliers		63			4.8	7.9	87.3
Total			280	8.2		2.1	18.6	71.1
External Wider Environment	Peer group	External wider environment	7	14.3			57.1	28.6
	Pressure groups		35	31.4		5.7	31.4	31.4
	Regulatory institutes		63	41.3		1.6	46.0	11.1
	Sponsors		64	28.1	3.1	9.4	31.3	28.1
	Management consultants		19	10.5	5.3		78.9	5.3
Total			188	30.9	1.6	4.8	42.0	20.7
External Actors (13.1 percent of the total observations)			468	17.3	0.6	3.2	28.0	50.9

Table 8.1 Numbers and percentages of observations of management functions and their roles in change activities

Table 8.1 presents the research findings in five columns. The first three columns identify the business systems, functions and equivalent physiological functions used in the

research. In column four, the numbers of observations in the sample are provided together with a percentage of the total number of observations within the management group of functions. Column five identifies the roles of each of the functions as a percentage of the observations for the function in order to identify the dominant role performed by the function within a process of change in the organisation.

All management functions could be observed within the research sample, except for the analogous higher functions of the brain, discussed in the introduction and which may not form part of the physiology of the organisation, such as emotion or self-awareness.

The first group of management functions are the functions analogous to the sensory perception in organisms at 14.2 percent of observations. This equates to the observation, collection and initial presentation of external environmental and market research information equivalent to the vision, hearing, smell and taste of organisms. It also includes the proprioception function within organisms, responsible for measuring and adjusting muscle movement to retain balance and smooth movement, equivalent to the target setting and regular monitoring of operations performance. Reporting from internal functions, or the equivalent of somatosensory perception, refers to the internal monitoring and control of the homeostatic status of health and morale within the organism and management information refers to the interpretation of all the information from the senses in the relevant cerebral cortical areas of the brain. Of the management functions, the internal and management information functions were least observed at less than one percent of the total management observations. As presented in Table 8.1, the information functions mainly act as participants in individual change activities.

The second group of management functions covers the planning and the decision-making management functions at 56.9 percent of observations. This is understandably high due to the management focus of research papers in the sample journals used for this research. Management functions are split into planning, decision-making and implementation through training.

The functions identified as internal and operations management refer to the role played by the part of the nervous system directly influencing and relating to a specific set of internal or operations functions. From the research papers used in the meta-analysis sample for this thesis, it was usually possible to identify a specific function in relationships with other functions during a change process. However, it was not always possible to identify the hierarchical level in managerial structure at which the action was taken. To overcome this, any activity not directly attributable to the operators within a function, was allocated to one of the managerial functions: internal management for management activities within the internal functions observed at 1.3 percent; operations management for management activities within motor functions at 19.3 percent; and executive management for executive management activities at 22.9 percent of the observations of management functions.

Operations design and development functions were observed at six percent, strategy and planning at 3.7 percent and job training as the implementation action of management decisions in operating units at 3.8 percent of observations. Unlike information, the dominant roles of these functions were observed as requestor and driver for the management functions, and to a lesser extent also as a recipient, in the change processes. Strategy and planning functions participated both as participant and

recipient in change processes. These multiple roles observed for the functions will be considered as part of the analysis of interrelationships of the functions.

In addition to the information gathering and the management decision functions within organisations, one of the higher functions of the brain, the interpretation and utilisation of language to communicate externally to the organisation, was translated as public relations at 2.9 percent, and sales and marketing functions at 11.9 percent of observations. These functions were identified in both roles of participant and recipient in the change processes. Further analysis of interrelationships covered both roles.

Functions Requiring Further Attention

From an analysis point of view, the management functions as identified for the nervous system within the human body could be observed in the research data, except for the functions linked to emotion and the concept of meaning and self-awareness which are closer to psychology than physiology. The number of observations for some of the functions, such as internal information as the equivalent to somatosensory perception, was very low, and this was discussed in Chapter 6. Functions requiring further attention due to the low number of observations in the research sample are the external research functions analogous to the major senses of sight, hearing and taste; and internal information functions analogous to the somatosensory perception in organisms.

External Research Functions

According to Table 8.2, 55 percent of the contribution of the executive environmental research function is to assist executive management in strategic decisions. Kelly and Gennard (2007) conducted research by interviewing directors of 40 organisations in the

UK with respect to the role and influence of directors in strategic decision-making. In addition to defining the importance of the role of strategic decision-makers at an executive and board level, they emphasised that the executive group “monitored, reviewed and, if necessary, amended strategy in the light of changes in the organisation’s internal and external environment relative to when the strategy was first formulated” (Kelly and Gennard, 2007: 106). Both the original and revised strategies depend on meaningful and adequate research information for the decisions.

However, the information provided by the external research functions is not always heeded by management, or results in successful change programmes. The case study research conducted by Ruokonen et al. (2008) compared two Finnish case studies with different outcomes in their approaches to develop and move innovative software products in to the international market. The first company, although offering software that can link to that of a well-known company, did not make any effort to understand what their customers actually wanted, or researched their competitors, and eventually had to withdraw their product from the international market. The second company, on the other hand, offered a simpler stand-alone product, developed close links with partners and developed a strong information base on customer and competitor intelligence, continuously learning from mistakes and changes to conditions (Ruokonen et al., 2008: 1179-1202). Although this second company also eventually withdrew from the international market, the decision was not forced on them because of a lack of success, but was a deliberate decision not to invest more in new technology in direct competition with new larger players.

The participating role of the market research function has been indicated as important for innovative products or services at 60 percent of the observations, as well as for incremental changes to existing products, services or processes at 40 percent of the observations. One example of new innovations relying on information from a market research function was found in the work done by Burchielli et al. (2008) on the comparison of assistance and subsequent success factors in establishing homeworker organisations in Chile and India. They found that in addition to regular meetings and training required to establish the homeworker groups, an essential role was performed by market research, such as in the case of homeworker seaweed collectors who first identified which food and cosmetic companies are using seaweed before completing plans and negotiating contracts with these companies (Burchielli et al., 2008: 167-180). An example of innovative change, relying both on market and wider external research information, is the research into the market impact of the Exxon Valdez' disaster, and the need for Conoco to respond and change (Bagley, 2008). After the disaster of the grounding and oil spills from the single hull tanker, Conoco identified and recognised the importance of the potential legal consequences of the disaster, conducted research into alternatives, and moved to double hull tankers to prevent a repetition and gaining acceptance from their customers as well as the wider external environment (Bagley, 2008: 378-390).

It is therefore not only the process of researching the environment that is important, but analogous to the relevant cortical areas in the brain, also the ability to interpret and apply the researched information.

Internal Information Functions

The role of internal information as a decision tool within organisations refers to the analogous functions of proprioception, or the ongoing monitoring and adjustment of muscle movements; and the information from the somatosensory receptors with respect to pain, temperature and pressure within the body. In the research sample the equivalent monitoring of operations performance against targets and the internal monitoring of health and morale were identified and are listed in Tables 8.1 and 8.2.

Unlike the change programmes to which the external research functions contributed as participants in the change processes, the programmes relying on internal information from the operations functions were mostly incremental at 73 percent of the operational monitoring observations, and 83 percent for the internal information function.

Continuous performance targeting and monitoring was found to be consistent with the ongoing proprioception required within organisms to ensure that they can and do maintain their balance within their environment, but also highlighted that unnecessary changes to the targets can negatively impact their performance and the morale of the staff. This was demonstrated in the research which found that tight and ever changing targets in a supermarket store restricted innovation by staff to attract customers (Nayak, 2008: 420-439). Only six observations could be made with respect to research conducted on internal morale measurement in which internal information acted as participants. Of these observations, two were involved in the promotion of tolerance to minority groups within the organisation, as discussed in Chapter 6, such as information collected and tacitly accepted concerning the informal role played by volunteers in organisations in South Africa in promoting assistance and tolerance to AIDS sufferers

(Dickinson, 2006: 697-717), or information on the need for tolerance of disabled workers (Woodhams and Corby, 2007: 556-580) which was not fully implemented by many private sector firms.

Information gathered from both internal and external sources provide important input to enable executive and operations management to respond to changed circumstances and/or requests through either innovative or incremental change responses. However, the availability of this information does not necessarily imply that perception will automatically lead to understanding and change. Other important factors, such as the frequency of information, and the perspective afforded to the acquired information, need to be included in interrelationships to be considered. In their plea for evidence-based information to support business decisions, Pfeffer and Sutton referred to the many management decisions based on the previous experiences, values and beliefs of the managers instead of on actual information gathered, interpreted and applied to the relevant decisions (Pfeffer and Sutton, 2006: 5). This interpretation and application of the information collected by the research and information functions will be discussed in more detail in the section on senior management.

The next section of this chapter discusses the findings of key interrelationships among functions and the external environment of the organisation in situations of change. The dominant roles identified for each of the functions guide this analysis by function. As an example, the environmental research and information functions analysed their role involvement as the participants in change processes whereas the management decision-making functions analysed the research findings with respect to their roles both as requestors and drivers of change.

Key Functional Interrelationships

A summary of the findings of interrelationships and impact of the management functions in the research sample is presented in Table 8.2.

Function	Percentage of Total Observations	Dominant Role as percentage of observations	Major function impacted in change project or as recipient	Involvement in Incremental and Innovative change and percentage of positive results	Type of Change Programme in which Participant for >20%
External research	22	Participant (100)	Executive (55) Operations (27)	Incremental (41): Pos (100) Innovative (59): Pos (100)	Business-related (32) Partner-related (23)
Market research	138	Participant (65)	Operations (60) External (24)	Incremental (40): Pos (97) Innovative (60): Pos (91)	Business-related (32) Market-related (29)
Internal information	15	Participant (80)	Executive (25) Operations (25) Internal (25) External (25)	Incremental (33): Pos (100) Innovative (67): Pos (88)	Business-related (33) Regulatory (33) Process-related (25)
Performance monitoring	83	Participant (95)	Operations (87)	Incremental (73): Pos (93) Innovative (27): Pos (81)	Staff-related (28) Market-related (24) Regulatory (20)
Internal information	8	Participant (75)	Internal (50) Executive (33)	Incremental (83): Pos (100) Innovative (17): Pos (100)	Staff-related (33) Regulatory (33) Business-related (33)
Executive management	430	Driver (35) Requestor (33) Recipient (20)	Requested by: Executive (61) External (30)	Incremental (34): Pos (78) Innovative (66): Pos (74)	Business (47) Market (17)
Operations management	362	Driver (45) Requestor (29)	Requested by: Operations (52) Executive (25)	Incremental (66): Pos (87) Innovative (34): Pos (78)	Market-related (33) Staff-related (21)
Internal management	25	Driver (100)	Operations (64)	Incremental (88): Pos (86) Innovative (12): Pos (33)	Staff-related (72)
Strategy and planning	69	Recipient (42) Participant (41)	Operations (70) Executive (25)	Incremental (46): Pos (100) Innovative (54): Pos (87)	Regulatory (36)
Design and develop	110	Recipient (58) Participant (26)	Operations (71)	Incremental (32): Pos (89) Innovative (68): Pos (79)	Market-related (71)
Job training	71	Participant (97)	Operations (96)	Incremental (56): Pos (95) Innovative (44): Pos (77)	Staff-related (33) Market-related (22) Business-related (20)
Public relations	55	Participant (55) Recipient (26)	External (77) Operations (20)	Incremental (57): Pos (35) Innovative (43): Pos (69)	Market-related (47)
Sales and Marketing	223	Participant (41) Recipient (37)	External (72) Operations (23)	Incremental (42): Pos (85) Innovative (58): Pos (83)	Market-related (50) Business-related (25)

Table 8.2 Profile of management functions in their roles in change programmes

The results are presented in Table 8.2 for each function in terms of the percentage observations per function; the dominant role in which the function was perceived; the relationships observed for these dominant roles; the split between incremental and innovative programmes in which the functions participated, including the success rate observed in each type of programme; and the type of change programmes.

Key interrelationships are discussed for selected senior and executive management functions; the influence of players in the external environment on the organisation; and the use of language as the means of communicating with the organisation's external environment.

Results from the meta-analysis research conducted for this thesis have been analysed for management with respect to their roles as a requestor, driver or participant in change programmes, or as a recipient of a change activity as presented in Table 8.1. Management were observed in the dominant roles as requestors and drivers of change, while the roles involved in the interpretation and planning are more prevalent as participants and recipients within the change activities. The subsequent analysis of these two groups of management functions will, therefore, focus on participant and recipient roles for the planning functions, and requestor and driver roles for management.

Planning and Strategy Functions

The link functions between perception and decisions within the central nervous system are the functions of interpretation, learning and memory (Barrett et al., 2010: 289-295). Within organisms these functions equate to the areas within the brain in which the information observed and received from the senses is stored, interpreted and analysed,

as parts of the higher cortical areas in the brain (Barker et al., 2008: 102-103). From an organisational point of view this refers to the functions supporting executive and senior management for the accumulation, retrieval, interpretation and evaluation of the information as input to decision-making. It was possible to isolate the functions of strategy and planning, and design and development as separate pre-decision functions within organisations.

However, similar to the functions of equipment maintenance, equivalent to bone cells, the function of memory, or the equivalent storage and bulk retrieval of information, was not readily observable in the change programmes included in the sample research papers. This does not mean that memory banks, such as archives or computer memory stores, do not exist and play an important role within organisations, but rather that the selected research sample did not contain papers on these functions. Two research papers addressed the knowledge mix at top management level, but not the availability of a knowledge pool. Cho and Hambrick (2006) addressed the impact of deregulation and, therefore, essential change in strategic direction in major public airline companies in the USA (Cho and Hambrick, 2006: 453-469) and the need to ensure that sufficient knowledge is made available to executives from their own internal sources over a period of time. Kabanoff and Brown also researched the importance of a knowledge and experience mix for the strategic decisions of top companies listed on the Australian Stock Exchange (Kabanoff and Brown, 2008: 149-171).

The research sample presented in Table 8.2 showed that strategy and planning was involved both as participant and recipient in change while design and development acted mostly as a recipient of change. This supports the physiological interrelationships

identified in Chapter 4 in which the planning cortices in the brain, receive information from other sensual and motor cortical areas, and then pass the interpreted information on to the frontal lobe for decision making. Various case studies could be found in the sample to demonstrate the importance of viewing these important interrelationships in organisations.

An example is the decision of Renault to reintroduce an assembly plant in Brazil in the 1990s twenty years after closing the first plant in that country. Giraudeau (2008) found that the proposals on which this decision was based included an analysis of the strengths, weaknesses, opportunities and threats (SWOT) of the Brazilian economy; together with the organisation's own financial status; and the emotional interpretation of information that Senna, Renault's formula one racing driver, was Brazilian (Giraudeau, 2008: 291-308). The decision was taken to expand into Brazil but to monitor the situation closely over the subsequent few years.

A case study conducted by Karra et al. (2008) demonstrated the value of operational planning and development in organisations. They conducted the longitudinal study of an entrepreneur who managed to establish two successful international organisations from Turkey. Based on environmental research and the interpretation pointing towards a niche market for international leather accessories, the entrepreneur developed prototype examples of leather accessories with their planned outlets before acquiring a sponsor for the manufacturing. In the first instance, the factory owner was the main shareholder, and as they disagreed on the company's future, the entrepreneur left and formed a similar competitive product and manufacturing chain, this time for a different, more affluent and international market. Again his interpretation of the available market

information together with the design of the products contributed to the success of this second venture which eventually outgrew the first (Karra et al., 2008: 440-458).

The role of design and development as the interpreter of information and the designer of new services of products, not always led to successful change programmes. Newell et al. (2008) explored the interdependencies that played a role in the unsuccessful launch of an innovative biomedical product in the United States. The decision to launch a new product based on tissue engineering research was based on expertise in the research and the development of the product, but was not supported by sufficient information on market acceptance and especially the cost of the development of the product. The project and product were abandoned when they realised the cost implications and the fact that the marketing will have to be different than for their previous 'pill' based products (Newell et al., 2008: 33-54).

These case studies demonstrate the importance of suitable interpretation of available knowledge and development expertise, and also the importance of the integrated approach in which case all the research, information, planning and development functions operate to support management decisions for incremental or innovative change in the organisation.

Management as Decision-Makers and Drivers of Change

In Table 8.1, the dominant roles of executive and operations management were found to be the driver as well as the requestor for change. The number of observations in which internal management were identified as playing any role, were low and the

percentage distribution is, therefore, not as robust as for the other two managerial functions.

Table 8.2 presents the findings of the further analysis of executive management and operations management as the drivers of change programmes; the sources of the requests leading to these programmes; the types of programmes; and success rates. Programmes requested by operations management were observed to be driven by operations management as well, while the requests from executive management were either implemented by executive or by operations management. The dominant impacted functions were observed to be operations, although the programmes driven by executive management also impacted the other functions. Most of the requests received by executive management were from external sources and resulted in innovative change programmes while the requests received by operations management were from both internal operational sources or the external market environment and predominantly led to incremental change programmes. This is in line with the physiological knowledge that change to motor functions can be either reflexive in response to internal information, or voluntary as deliberate innovative change decisions responding to cognitive requests or external sensual stimulation (Canguilhem, 2007: 175).

Change programmes in which the executive management retained the driving role within the research sample were mainly concerned with major changes to the business, such as mergers, expansion, reduction or restructuring of the business and programmes concerned with the marketing image of the organisation. Of the business-related programmes, instances were recorded of programmes with some mixed or negative

results. Mixed results imply that while some of the participants in the change programme, usually the drivers, regarded the outcome as positive, other impacted functions did not regard the outcome as successful.

Meyer and Attenborg (2007) performed a longitudinal study of a failed merger between a Norwegian and Swedish telecommunications company. Initially the merger process was regarded as successful, meeting all the interrelationship requirements set by external regulatory bodies; information gathering on external market potential and internal performance; and planning and proposals for implementation. However, disagreement arose when the top level management structure and the share exchange for the merger were discussed for agreement. The proposal from the Norwegian company was regarded by the Swedish company as a take-over rather than a partnership merger. Further information gathering and input from both within and external to the organisations revealed basic differences in values, attitudes and performance, leading to the stakeholders of the organisations being unwilling to surrender their previous control to the benefit of a newly merged organisation (Meyer and Attenborg, 2007: 257-271). Early warning signals of dissatisfaction could have stopped the merger earlier and prevented the subsequent dispute as to who had to pay for the cost of the failed merger.

The changes requested and driven by executive management and affecting the image and marketing practices of the organisation were observed and mostly found to be involved in developing a marketing image for the organisation or new products. The research conducted by Martin et al. (2007) into the impact of bribery within multi-national organisations in an attempt to market in diverse market places, is in line with

the case study of Meyer and Attenborg. Martin et al. conducted and analysed a world-wide survey of 4,000 organisations and found that there are differences and conflicts between the home and local country images on what constitutes bribery in marketing. They found that various factors such as a country's national culture, social institutions, political constraints and firm level financial drivers, impact the level of the marketing image and marketing that is acceptable as non-bribery (Martin et al., 2007: 1401-1422). While these examples demonstrate and support the roles and interrelationships of the executive within the organisation, they also point out that even in studying the interrelationships as the basis of the physiology of organisations, the study of exactly what matters in these interrelationships is not easy and straightforward as multiple factors impact decisions and plans from both within and external to the organisations.

External Players as Requestors for Change

The above statistics and examples refer to the observations in which the executive management and operations managements acted in their roles as both a requestor and driver of change. There is, however, one other section of this role relationship that needs to be explored and analysed in more detail. This is the interrelationships between the executive management group as driver of change, and their external environment partners as the requestors for change as shown in Tables 8.1 and 8.2.

Requests initiated by external players that resulted in change programmes driven by the executive were mainly with respect to regulatory issues. Regulatory requests to organisations to change their business model were mainly observed for government or semi-government institutions based on deregulation or changes in policy, as addressed

in various research papers, such as the need for the Canadian Health Service to change their method of operation to a patient oriented approach (Chreim et al., 2007: 1515-1539); a similar request for change in the UK (Addicot et al., 2007: 93-105); decentralisation of education into districts in the USA (Ouchi, 2006: 298-307); reform of the Audit Commission and Public Service in the UK (Roper et al., 2007: 1589-1607); the deregulation of electricity companies in Europe (Rodríguez et al., 2007: 536-560); and banking deregulation in France (Bertrand et al., 2007: 597-628). In all of these cases, the innovative changes to organisation were based on the regulatory pressure for change rather than as a result of voluntary executive decisions for change.

External requests for change from regulatory control bodies are, however, also as a result of fraudulent action by individual organisations or groups of organisations causing the organisation or sector to change their internal controls. Examples of research identifying this link between organisational changes driven by executive management to improve their internal controls, based on the requests from external control bodies, include the following. Keating et al. (2008) investigated the impact that a declaration of high telemarketing costs of not-for-profit organisations (NGO) in the USA showed misreporting by poor performing organisations (Keating et al., 2008: 417-446). They concluded that poor performing NGOs tended to misrepresent their telemarketing expenses used for fundraising in order to present a lower cost base, although this was not legally allowed. This resulted in demands for these organisations to restate their expenses. The Enron scandal, however, did not only affect the company, but resulted in the introduction of the Sarbanes-Oxley Act 2002 in the USA, leading to the requirement

for organisations to improve their internal controls (Chhaochharia and Grinstein, 2007: 1789-1825).

The observations of change programmes requested by external market players were mainly with respect to changes required to products and services from customers or partners. Most of the sample research projects addressing these interrelationships were empirical work to determine the success factors of organisations to successfully address the requirements and subsequent loyalty of their customers. Yim et al. (2008) found that there are links among quality satisfaction, trust and customer loyalty at staff levels to the needs of their customers in fast food and hair salon services in Hong Kong (Yim et al., 2008: 741-756). With respect to dedicated provider and customer links, the research conducted in a survey of component manufacturers and users by Fang (2008) found that an important success factor is the degree to which the two organisations cooperate with respect to the final requirements, the innovativeness demonstrated by the part manufacturers and the combined speed to market (Fang, 2008: 90-104) of new products. As an indication of negative results is the research by van Doorn and Verhoef (2008) in which they explored the impact of service failures through critical incidents and the impact that it can have on the supplier-customer relationship. They found that customers who had a history of good general trust, pricing experience and information sharing with their supplier in the past, will accept a critical incident more readily than if the past performance history was not good (van Doorn and Verhoef, 2008: 123-142). This latter paper enforces the requirements of internal and external relationships that are important to the success of organisations in their immediate market environments.

Management functions of planning and decision-making were found to support the roles and relationships identified for the central nervous system in organisms. The planning functions form the memory and learning links between the observation and decision-making functions, although it is possible for decisions to be made on a voluntary basis without the use of these input functions.

Language and Communications Functions

Separate from internal communication as analogous to the hormonal system in organisms, is another type of communication used by organisations, equivalent to the higher function of language and speech, especially well-developed in humans (Barrett et al., 2010: 295). Whereas the internal chemical language of organisms allows the different cells and organs within the body to communicate and interrelate with each other, the use of the higher functions in the brain such as memory, learning, use of language and speech, enables the individual to communicate and interrelate with the external environment. Language, and the meaning behind the language, is not covered, only the concept of being able to communicate with the external environment and the ability to project an image of the organisation through some kind of language, such as branding, negotiations or public relations.

In Table 8.2 executive communications, identified as public relations, was identified mostly as participant in change activities while the marketing and customer relations functions featured evenly as a participant in and as the recipient of change. The use of language, therefore, features strongly both in participating with other parties, or being influenced by other parties.

The role of the external communications functions can be equated to the function of external communication in living organisms, used as a means to attract partners or prey, or a means to promote or proclaim their existence to players within their environment. The distribution of the recipients of executive communications in Table 8.2 shows that most of their interrelationships are directly with actors in the external environment and with respect to programmes to establish a specific market image, or to promote the company and the involvement in partner relationships and business development programmes. Business development interrelationships and regulatory interrelationships were mostly observed with players in the wider environment, while marketing and partner relationships were with players in the immediate marketing environment.

The operations communication function, as the participant in a change process, was found to be mostly involved in market-related programmes. Both the externally focused communications functions were, therefore, observed to be strongly involved in image and market-related programmes.

Pfarrer et al. (2008) conducted a study into how different organisations attempt to reinstate their image in the market after various incidents of disaster or unethical behaviour. They found that Texaco, after a whistle blower's disclosure of fraud, quickly accepted and disclosed the scandal and acted swiftly through internal actions and an open declaration of activities, which were accepted by the market. Other companies, such as Conoco after the Exxon Valdez oil spill and Enron after executive fraud, were not so quick in accepting blame, or passed the blame on to others – acts that were not accepted favourably by the market (Pfarrer et al., 2008: 730-749). Conoco only managed to achieve full reintegration and acceptance after they subsequently decided to

introduce double hull tankers in order to prevent future spillages (Bagley, 2008: 378-390), a delay which could have been averted by earlier public communication of their intentions.

The challenge in creating a corporate image for organisations which can be successfully communicated to the external environment was demonstrated in the research conducted by Jack and Lorbiecki (2007). They explored BT after the merger with Marconi in 1999 when it had to change its image from a British telecommunications organisation in order to operate in global markets. This was done by changing the name to BT and emphasising its global reach after the merger. British Aerospace had a similar concern in the global market, and addressed this again by changing its name to BAE, but this time included in the communications its dedication to the security aspect required by the Ministry of Defence (MOD) in the development of the products through tight security clearances of staff. The third organisation investigated was the BBC. It was not necessary for the BBC to change its image in order to expand globally. It was already represented globally through its World Service, and actually had to build on its Britishness globally, but then expand and promote its dedication to regional support locally (Jack and Lorbiecki, 2007: 79-94).

The role of communications as a participator in change is one of the main methods of an organisation to project its image in the market, promote its products and address concerns from the external environment. These findings, therefore, support the physiological model of the value and use of external communication and language for individuals. However, these functions were also observed as the recipients of the change process as discussed below.

The communications functions were however also observed as the recipients of interrelationships from other functional actors within and external to the organisation in an effort to initiate change activities as presented in Table 8.2. The total number of observations in which executive communications responded as a recipient of change is relatively low and in response to interrelationships with the wider external market, the internal functions and from executive functions. The total number of observations in which operations communications such as marketing was influenced as a recipient of change was higher. These stimulants for change were mainly received from the various operations functions, from the internal functions and from the external market environment. Influence from the internal organisational functions and participation by internal and external players, are in line with the physiological links of the knowledge and understanding of language, and the use of the mouth and facial expressions to express this language to the outside environment, based on the interactions within the brain.

Research conducted by Ogden and Watson (2008) on the process used by UK electricity organisations in determining comparative remuneration for their top executives provides an example of the involvement of corporate communications, and especially the negotiating aspect thereof, in the change process, both as a recipient of the process and subsequently the driver of the change to pay. They concluded that by communicating and negotiating with various parties such as shareholders, remuneration committees, advising consultants, comparator companies, and management, it was possible to devise an acceptable pay structure (Ogden and Watson, 2008: 711-739). The example demonstrates more than one type of communication with multiple players

both internal and external to the organisation. Other observations, also with respect to staff pay and conditions, involve the communications with external labour unions, in response to essential cutbacks in staff required by government as in the case researched by Kelloway et al. (2008). They explored the steps taken by a provincial government in Canada by liaising and then involving a mediator in its effort to prevent a strike by union members. This strike was only averted after intense negotiations with an imposed media blackout between the government and the union (Kelloway et al., 2008: 806-817).

Communications functions, whether internal or external communication, play an essential role in any organisation. It is, however, important to recognise the different interrelationships and domains of the two types, and to ensure that both the commonalities and differences are considered in the study of these functions as demonstrated by Kärreman and Rylander (2008) in a case study of brand development for a consulting firm in Sweden. They found that the brand developed by a programme driven by executive management involved all three communications functions, namely corporate Public Relations, market relations and internal communication. The proposed brand from head office was one of an athlete winner to present an image of being ahead in their field. The involvement of the communications functions were to 'sell' the brand to the wider environment, the market and partners, and the internal staff, but not all of these participating activities had positive results. Although positive as a general image, it was not regarded as presenting a positive message to internal staff or external suppliers (Kärreman and Rylander, 2008: 103-125).

Conclusion

In this chapter the focus was on identifying the roles and interrelationships that were observable for the management functions, analogous to the central nervous system in the body. Management functions could be observed in the research sample. However, there are some of the functions that were either not observed, or not researched as they were regarded to be outside the scope of the study. Of the observable functions, the dominant roles as the requestor, driver, participant or recipient of change, broadly reflect the interrelationships observed in the nervous system in the human body as presented in Table 4.6. The main drivers were identified as the management functions equivalent to voluntary brain functions. The research and reporting functions analogous to the major senses, proprioception and somatosensory perception were observed as participants in change activities, with either the management or the operations functions as the main recipients of change. On the other hand the management functions responsible for interpretation and planning acted as both recipients of and participants in change activities, thus demonstrating the mutual integration of these functions in the preparation for decisions.

Some of the higher functions of the nervous system, such as emotion, meaning and understanding were not covered, or could not readily be observed in the research sample. The emotion and limbic systems, for instance, impact the ability to link events to memory and the emotional reactions to events, both of which may have equivalents in the ability of executives in organisations to utilise their cumulative information sources, or react rationally to external events impacting on the organisation. Some of the case studies, already cited as demonstration of other interrelationships within

organisations, also address these functions, such as the efforts explored by Pfarrer et al. for organisations to reinstate their image after disastrous events (Pfarrer et al., 2008: 730-749). The different approaches followed by the organisation in the study could suggest emotional bluntness on behalf of the organisational executives, but could also indicate some other pathological or personality disorder, equivalent to the study of the impact of drugs on human reaction.

Another function which was not specifically explored within the management or nervous system, as they usually emanate from conscious decisions, is the aspect of procreation through sexual activity, equivalent to the decisions with respect to mergers, take-overs or spin-offs of independent business units. Many examples could be found in the sample on the impact of change from these business decisions for expansion or reduction. However, as physiology studies the interrelationships resulting from the decisions to merge or divest, rather than the reason behind the decision, it was included in the analyses as a type of change, rather than a role or function.

Information, analogous to the senses in organisms, is well covered in management theories and research, to the extent that one of the metaphors identified by Morgan refers to organisations as brains (Morgan, 2006: 71-114). Information is essential to the continued persistence of organisations, and can be effectively studied through methodologies such as the feedback loop mechanism pioneered by information theorists such as Argyris and Schön (Morgan, 2006: 81-87). However, by including the integrated perspective of the physiology of senses, additional areas of information gathering and use can be explored: It increases the awareness of the importance of all three types of information, namely, internal information on the morale and well-being

of the organisation, analogous to the somatosensory perception; information on the continuous target setting and monitoring of the operating units, analogous to the proprioception to ensure balance in movement; and the gathering of external information, both locally around the organisation and wider scanning of the environment, analogous to the use of the major senses such as sight, hearing, smell and taste. Tools such as the balanced scorecard developed by Kaplan and Norton (1996) as balanced source of information to support management decisions, do provide this balanced view, but are still weighted towards the external market environment and product delivery to the market.

The study of the physiology of the management functions of organisation also add the dimension of the interpretation, storage and use of the information gathered by the 'senses'. Collecting information is not enough if this information is not interpreted into understandable meaning, and stored in a manner in which the information can be recalled and analysed for future use as and when required (Kelly and Genard, 2007: 106; Bagley, 2008: 378-390; Ruokonen et al., 2008: 1179-1202). The organisational equivalent to memory as a source of historical information was not observed in the research and as essential part of the understanding and use of information, could receive more attention in academic research.

Higher management functions of strategy, planning and decision-making are functions well addressed by theorists since Weber, including contingency theorists focusing on strategy (Morgan, 2006: 42-48) and the focus on core competencies in the making of strategic decisions (Prahalad and Hamel in Segal-Horn, 1998: 220-233). A balanced perspective, however, also has to address the concerns about the implementation of

change based on the strategies and the impact these changes have on both internal functions within the organisation and as perceived by the external environment. The research showed that similar to the limitations in the controlling powers of the brain over internal survival functions, imposition of incremental changes by executive are not always successful, similar to the limitations in success of innovative changes if not supported by the executive.

Another function which can benefit from a different perspective is the higher function of language within organisms, and especially humans, as this contributes to an effective means of communication of organisations with their external environment. Chapter 6 already addressed the value of internal communications, analogous to the hormonal functions in the body, and it is necessary to understand the differences between internal and external communications and the need to either separate, or to address them in integrative supporting roles to each other (Kärreman and Rylander, 2008). External communication by organisations to the external markets and partners do not reflect internal messages or impact the flow or understanding of internal messages. The physiological sources and functionality are different.

Management organisation structures have always been and still are the focus of various theories and research, ranging from hierarchical structures to the identification of different types of structure (Morgan, 2006: 20, 43, 52, 102; Mintzberg in Segal-Horn, 1998: 239-241). Most of the theorists attempted to create an ideal structure for organisations. However, in the study of physiology, the structure of the nervous system is linked to their function of control, and as perceived in the human physiology, differs among functions. Internal functions have local control, except for the communication or

hormonal system in which case it is an integrated network structure, linking with most functions in the body. Opposed to this is the hierarchical structure of the autonomous nervous system in which case the number of synapses or hierarchical level depends on the distance of the muscle cells from the central nervous system while the span of control of the muscle cell units can also vary depending on the type of action required by the muscle units. This research project did not address the structures of the organisations in the sample, but learning from the physiology of the human body, new areas of research can be identified even in this already heavily addressed area. As an example, the reduction of middle management may not always be suitable or even practical as a means to reduce costs since there are too many other factors and implications to be considered.

Chapters 6 to 8 presented the findings of the research project with respect to the functions identified for organisations analogous to the physiological functions forming the framework for the research and study of the physiology of the human body.

Physiology is not the only natural science in the study of humans or organisms, but provides a balanced and integrated understanding of the functioning of these living organisms. Chapter 9 brings the arguments back to the proposal by Radcliffe-Brown that there should only be one branch of science for the study of organisations, comprising all the different types of science, and of which physiology is one of the natural sciences.

Chapter 9 Is a Science of Human Society Possible?

“a theoretical science of human society is possible; that there can be only one such science, although certain fields within the science may be capable of relatively separate treatment.” (Radcliffe-Brown, 1957: 3)

Introduction

The question raised in Chapter 1 was whether it is possible to bridge the gap in understanding between the complex organisational theories developed and researched by academics within the different paradigmatic streams, and the presentation of this knowledge by academics and consultants to managers as metaphors to assist them in addressing operational problems. In 1937 Radcliffe-Brown, an anthropologist and one of the founder members of the functional structuralist movement, proposed that it is possible to bridge this gap by introducing a single branch of science for the study of human societies. He suggested that this single branch should include all four types of science, namely abstract, natural, applied sciences and the arts (Radcliffe-Brown, 1957: 9), but admitted that at time of his theses, a natural science in the form of the study of the physiology of organisations was not yet available. The objective of this research project and thesis was to evaluate the feasibility of Radcliffe-Brown’s theses, especially the study of physiology as a natural science as a potential bridge of knowledge between academics and managers.

This concluding chapter consists of three sections. The first section is a critical evaluation of the research approach and methodology followed in the research project.

The second section explores the contribution that a study of the physiology of organisations can make to enhance existing understanding and address current and future issues. The third and concluding section offers a proposed way forward, including further research directions.

Research Approach – A Critical Review

By adopting Radcliffe-Brown's theses for the study of physiology to enhance understanding of the functioning and structure of societies (Radcliffe-Brown in Kuper, 1977: 37; Burrell and Morgan, 1979: 52), this research project had to accept and address both the philosophical criticism raised against Radcliffe-Brown and the functionalists, as well as practical problems in conducting the required research. The philosophical concerns of reification, generalisability and tautology were identified in Chapter 2 while additional practical concerns relating to the research were added in Chapters 3 and 5.

All of these concerns influenced the selection of the research approach, and the decision was made to address these concerns as follows: Limit the scope of the field of study to organisations or organised institutions; use a prototype framework of functions instead of a grounded observation of functions; use secondary meta-data to provide a large enough sample to enable generalisable results; and focus on change within organisations in order to be able to identify interrelationships among functions.

The benefits and limitations of these research decisions are discussed in the rest of this section.

Scoping the Field of Study

Chapter 3 addressed the practical concerns affecting the identification of an acceptable field of study for the research project. Concepts of scope, scale and identity were considered and used to delimit a suitable field of study.

Radcliffe-Brown maintained that a society can be studied as a persistent system which maintains its structural continuity over time and in which the components are in a relationship of fulfilling specific functional roles towards the persistency of the organised society (Radcliffe-Brown, 1957: 25, 26). He however, also admitted that it could still be difficult to delimit the society as a field of study and introduced the concept of scale when he suggested that the separate branch of science for the field of study of human society is distinct from the study of the human being in which the cells are the components (Radcliffe-Brown in Kuper, 1977: 27). The arguments in Chapter 3 expanded on this concept and concluded that the scale for the study of the physiology of an organisation should not only focus on component and entity, but consider persistency as a means of identifying the unit of study. Society was therefore divided into two levels of scale. In the first level which also formed the focus for this project, organisations and independent social institutions are regarded as being responsible for their own self-maintenance and identity with individuals performing the processes as the components of these units. The higher level of scale recognised these organisations and institutions as fulfilling the functions in the self-maintenance of a nation state. Research for this thesis could be delimited to the study of the human being as the component and organisations or organised societies as the unit. This excluded the study of organisations fulfilling functions in nation states as the separate higher scale of study.

Within this scalar level of research it was also necessary to identify and isolate an organisation and organised society as an independent entity, and to determine its boundary in order to be able to study its physiology. Various alternative theories were discussed in Chapter 3, and for the purpose of this research and thesis, a combination of three theories was selected. Maturana and Varela referred to an 'autopoietic living unity' as having control over its own internal maintenance while retaining a consistent external identity (Maturana and Varela, 1980: 87, 94); Playfair and Chain used concepts of 'self' and 'non-self' to further delimit a persistent unit (Playfair and Chain, 2005: 8,9); and Radcliffe-Brown proposed a relationship of role by individuals within organised societies and organisations in order to maintain the functioning of these persistent entities (Radcliffe-Brown in Kuper, 1977: 51).

By separating the field of study into different levels of scale within which self-maintaining institutions and organisations could be identified, it was possible to focus on a single platform and prevent confusion arising from determining internal and external relationships of the organisations. An example is the role performed by economy, financing and accounting with respect to organisations. National and international economy could be classified as external influences affecting the marketing and financing of the organisation, whereas accounting and fund management such as budget controls were regarded as internal functions. At the higher level of nation states, the national economy would, for instance, be regarded as an internal function while global economy will assert external influences on the national economy.

While this scalar and organisational delimitation seemed logical and relatively straightforward, there were problems and limitations inherent in this approach. The

main problem was to determine boundaries of organisations operating as independent self-maintaining entities but on a global scale. Conglomerates consisting of independent business units, either geographically based or based on product offering, were regarded as 'families', in relationships of position rather than functional relationships of role (Radcliffe-Brown, 1957: 19,20). Global organisations with central control over branches in foreign countries were included as single organisations. The effect of this mode of operation could be observed in case studies. One example is the effect of imposition of central values, procedures and targets by a western manufacturing organisation on the workforce in Korea (Glover and Wilkinson, 2007: 1437-1455). They found that the 'soft' human resources approach of the west conflicted with the strict quality management culture in Korea and led to conflict within the organisation. From a physiological point of view this separation of scales, identities and interrelationships of roles versus positions could be made to work, but it does increase the complexity in delimiting study topics and themes.

Prototype Framework of Physiological Functions in Society

The research approach, however, also had to address the concern of reification raised against functionalists in which power of thought and action is accorded to the functions within an organisation (Silverman cited in Burrell and Morgan, 1979: 196). Radcliffe-Brown defined the concept of function as the interconnected relationships between the individual processes and structure and not the inborn and fixed concept of function criticised by theorists like Silverman (Radcliffe-Brown in Kuper, 1977: 51). He proposed a qualitative observational approach in which the customs and processes within societies are observed in order to identify functions and structures supporting the persistence of

the society (Radcliffe-Brown, 1957: 70-71). This approach would have been lengthy, prone to subjective interpretation and difficult to gain consensus on acceptable functions.

In Chapter 3 the argument moved from a qualitative observational method to identify the functions within an organisation, towards developing a framework used in the study of human physiology as an analogous prototype framework (von Bertalanffy, 2006: 84, 85) that can build on the existing knowledge of persistent living organisms and be validated for its suitability for the study of organisations or organised societies. The prototype framework, developed in Chapter 4, referred to the functions in the human body as studied and presented to medical students, not as reified functions but in their interrelationships. However, care was also taken to ensure that the framework supports the main functions required for life (Silver, 1998: 322; Barrett et al. 2010: 1) and adheres to the requirements of a standard prototype classification system, namely consistency, mutual exclusivity and completeness (Bowker and Leigh Star, 199: 62, 10, 11).

The framework of physiological systems and functions developed in Chapter 4 was adapted for the study of organisations according to a set of guidelines developed and presented in Chapter 5 and Appendix 1. It was at this stage of research that practical problems were experienced in the construction and use of the prototype framework. Although physiological systems and functions are grouped differently in medical study guides for the study of the physiology of the human body, it was possible to propose a standard classification prototype framework of systems and functions in Tables 4.3 to 4.5. Transferring this framework to the study of organisations in Appendix 1 and Chapter 5 proved to be more problematic and various problems were encountered.

The integrated interrelationships between management and the functions under their control, made it difficult to treat all management functions as a separate system analogous to the nervous system in physiology. The framework was therefore altered to allow management functions as well as the related information functions, analogous to senses, to be linked to the functional categories of internal, operational and executive functions respectively. This alteration did not result in duplication and the framework retained its mutual exclusivity.

Functions in the prototype framework such as the reproductive systems and organs could not be identified as commonly known standard systems and functions within organisations. It was possible to identify and record the types of mergers, acquisitions, spin-offs and diversification as change programmes within organisations, but not specific functions dedicated to these change decisions and acts. These functions were dropped from the organisational framework, and recorded as types of change programmes rather than functions. Reproduction is not regarded as essential for the persistence of a living organism, but for the continuation of the species and further research is required to determine the role and importance of equivalent functions within organisations.

The function of human resource management could not be directly linked to an analogous function in the physiology of the human body. To retain consistency, the framework used in the research project separated the main human resource functions into its components of recruitment and placement as part of supply; training and organisational development as part of communication; and payroll as part of the

accounting (fund allocation) functions. This offered a logical functional split, but is open to alternative groupings by other researchers.

The transformation of functions such as the gastrointestinal and cardiovascular systems into analogous systems and functions to obtain and distribute supplies was also problematic. In the human body each of these two systems are distinct and the cardiovascular system distributes all types of nutrients, cells and material through a single network of blood vessels. In organisations the supply and distribution functions are often combined in a logistic system, but different systems exist for different types of supplies or material such as people, equipment, post, electronic messaging and information. The proposed framework for organisations separated the types of supply into different functions within the supply chain as a means to evaluate the importance of each separate type to the functioning of the organisation. A formal accepted functional framework for organisations may have to agree on the separation or combination of these functions as standard.

The data processing and systems development functions caused concerns similar to the human resources and logistics functions and it was difficult to identify a one-to-one link between the human physiology and organisational functioning. Information technology as a recent evolutionary development in organisations was allocated unique strategic and functional status as a separate IT department by early contingency theorists (Morgan, 2006: 56). However, during the past decades it became unnecessary for organisations to develop their own software as these are on offer as equipment and systems, in other words, becoming part of the logistic systems of organisations. The function was therefore split into its component functions. The development and

manufacture of electronic systems and equipment as products were allocated to the operations functions for the software or hardware product manufacturing organisations. For the other functions in an organisation, systems and hardware were viewed as additional tools to be acquired and maintained as part of the logistics and equipment maintenance functions. Central processing and electronic mail were regarded as parts of the 'cardiovascular' system of the organisation, responsible for the central control over the distribution of information and communications, as well as the maintenance of the distribution channels involved in this process. Information processing as such was linked to the senses or analogous management functions.

A final area of concern in transforming the prototype framework was with respect to the hormonal system, translated as communications within organisations. The hormonal system consists of different functions and organs producing different stimulating hormones as messengers to act on the cells. In organisations it was not possible to identify specific functions dedicated to the production of different kinds of messages to staff, although the types of messages could be identified. Similar to the different types of supplies, the functions in this part of the framework, therefore, represent different types of messages as the functions within the system of communication. This area will require further research, not only with respect to where these messages are generated in organisations, but also their importance in the operation of the organisation.

At the stage of proposing a framework to be evaluated for the feasibility of the study of the physiology of organisations it became clear that much further research and discussions are required before a standardised framework can be formulated for the study of the physiology of organisations. It was however possible to settle on a

framework for this research project which broadly supports the analogous prototype framework in human physiology and still adheres to a standard classification system of consistency and exclusivity. Whether the framework can be regarded as fully comprehensive will need to be tested through further research.

Secondary Literature as the Source of Sample Data

To evaluate the feasibility of Radcliffe-Brown's thesis that the study of the physiology of organisations and organised human societies is possible and desirable, the research had to find evidence of functions and their interrelationships in organisations and organised societies similar to those observed in the study of human physiology. It also had to ensure that the sample of data for analysis is acceptable in size and spread in order to enable generalisable results and conclusions. Chapter 5 evaluated and argued the options available for the research project.

In order to obtain a large enough sample for the analysis and results to be generalisable, the options of secondary data and a content- or meta-analysis of published papers were considered. Secondary datasets are provided on types of companies and their financial performance, but do not readily include the functions performed within these organisations. A content analysis would have been possible by identifying the functions listed in the company reports or organisation structures of a large number of organisations. This would have provided evidence of functions analogous to functions identified in the human body. However, company reports do not list all the functions within the organisations, and it would have been more difficult to obtain organisational structures for a large number of companies. It would also have been difficult, if not

impossible to detect interrelationships among these functions as required by Radcliffe-Brown (Burrell and Morgan, 1979: 43). Selecting to perform a meta-analysis of published research papers in academic journals posed another set of practical concerns such as potential bias in the selection of the material; unfamiliarity and potential unreliability of the data underlying the published research; and the subjectivity of the conclusions reached by the researchers and authors of the papers (Bryman and Bell, 2003: 219, 220). The selection of papers would also have to be subjective, just addressing specific functions, therefore increasing the risk of reification.

To limit the shortcomings in the methodologies, as well as the fact that qualitative observations in a single organisation would have been too small to deliver generalisable results, a compromised sample selection method was selected, namely to use secondary published research papers to generate a sample set of data for the project. Papers were selected from academic journals in which organisations, functions and interrelationships could be observed and coded within a strict set of guidelines to reduce subjective interpretation of the papers. The guidelines and processes for selection and coding are discussed in Chapter 5 and Appendices 2 and 3. This method was regarded to be no more subjective than similar qualitative interpretation and observation within a single or a group of organisations due to the use of the strict guidelines. It was also possible to obtain as large a sample as required by simply increasing the numbers of published papers in the sample. Academic papers could, and were, also used as case study examples within the analysis.

The top 30 academic journals were selected based on criteria offered by four different studies and based on factors such as judgement by peers and frequency of citing.

However, the initial evaluation of the sample raised some concerns affecting the generalisability of the research sample and conclusions. Although four lists were used to identify and select academically acclaimed research papers, the sample evaluation showed a bias towards research projects in Europe and the United States, with only forty percent of the papers based on research conducted in other parts of the world. This bias can be ascribed to the lists being compiled by western universities and publishers, and the conclusions arrived at in this thesis will require further research to determine whether they are applicable to all cultures and countries.

The codification of the data in the articles focused exclusively on the ability to identify functions and their interrelationships as mentioned in the research papers. The interrelationships could be identified since the selected research projects were change oriented projects, but the interrelationships produced snapshot data and not full interrelationship flow among functions. The arguments used to decide on change projects are discussed in the next section, and the snapshot interrelationships, while providing enough data to interpret, will have to be confirmed in further research.

Focus on Change

The objective of the research project was to evaluate whether the prototype framework can be applied to the study of organisational functions. Relying on independent research projects as a source of information does not describe the flow of functional interrelationships throughout organisations. An alternative approach was found by focusing on events and interrelationships observable in change programmes and processes within organisations, in the same way in which the study of pathology

enhances the knowledge of the physiology of the human body (Canguilhem, 2007:209). Arguments addressed in Chapter 5 identified the common types of organisational research conducted and published in academic journals and used for the selection of the sample. Most of the papers were found to be presenting abstract theories; developing mathematical simulation models for marketing or finance; testing and evaluating specific theories; or exploring changes to organisations and the impact of these changes on the organisation and/or its environment. Of these types of research projects, the focus on change and the empirical testing of theories were regarded as the most appropriate for the observation of functions and their interrelationships. In addition to observing interrelationships among functions it was also possible to identify further information on the types of change, the reasons for change and the perceived results of the change activities.

The paper selection criteria in Appendix 3 included papers in which organisations, change programmes and interrelationships driven by the change events could be identified, with the following caveats and concerns. It had to be accepted that research into event-driven change programmes does not fully provide a function flow perspective of organisational processing, but the larger sample size compensated by allowing the findings to be generalisable. Further research will be required to observe and test whether the normal process flow of interrelationships in organisations support the findings of this research.

Another concern with respect to the sample was the reliance on secondary material and the danger of being influenced by subjective conclusions of the researchers and authors of these papers. This concern was addressed in the coding guidelines in Appendix 3, by

stating that the purpose and conclusions of the research papers must be ignored and codification must only concentrate on identifying organisations, events and interrelationships as part of the data.

A shortcoming of the use of data from meta-publications, and the focus on change events within these papers relate to the danger that if functions identified within the prototype framework could either not be observed in the sample, or were poorly represented in the sample, the analysis of the impact of the interrelationships affecting these functions was not possible. Where possible these functions were identified for additional attention and research in Chapters 6 to 8 and are summarised in the next section of this chapter.

Summary of Research Approach

The research approach selected for the project was advantageous to the project but contained elements of risk and shortcomings. Delimiting the scope of the field of study of organisations allowed the physiology of an organisation to be studied, but could not effectively be applied to all, such as globally operating organisations.

The use of a prototype framework provided a systematic approach to identify similar functions and their interrelationships in organisations and the analysis confirmed an analogy to the prototype framework of human physiology. It was possible to identify poorly represented functions and ask the question of why these functions could not be readily observed. A one-to-one translation of the functions as studied within the physiology of the human body was, however, not possible for all organisational functions. A concern is that both the prototype framework and the translation of the

functions for organisations were developed for this project, and may therefore not be accepted as consensus frameworks within academic circles.

The research approach to use secondary literature and create a dataset of functions and interrelationships from these research publications allowed a large and objective enough sample to be collected for analysis. An additional focus on change as one of the selection criteria for the literature also allowed interrelationships among functions to be identified and coded. Similar to the concern about the fact that the framework was subjectively developed, the use of secondary literature to create a dataset for analysis may be prone to subjective identification of functions and therefore reification. A strict guideline to assist in the creation of this dataset was used and is paramount in similar research projects. An additional concern lies in the selection of the secondary publications to include research from all over the world and all functions.

This research project did not address the functioning at the next higher scalar level, that is, institutional analysis and theories addressing nation states. It also did not cover conglomerates that could also be interpreted in relationships of position within the families of business units.

Why Study the Physiology of Organisations?

In this section it is necessary to address the issue of tautology and whether an integrated functional perspective of organisations as proposed for the study of physiology of organisations by Radcliffe-Brown contributes towards our existing knowledge and understanding of organisations (Burrell and Morgan: 1979: 57). It is also

important to evaluate whether this integrated perspective can be applied to some of the current organisational issues.

The analysis in Chapters 6 to 8 presented the findings of the research project by identifying functions not readily observed in the sample, and the key interrelationships among the functions within organisations. Both these perspectives highlighted advantages to be gained from the study of the physiology of organisations as an integrated functional perspective of organisations and include the following key points to be discussed in more detail in this section. Internal functions such as workplace and equipment maintenance, protection, security and healing processes could either not be observed or only as low numbers in the research sample. Internal communications was identified as a function which can benefit from a different perspective within organisations, and by comparing how organisations communicate both internally and externally with players in their external environment. It was necessary to revise the classification of operational activities in organisations to match the muscle unit types in the prototype framework. This alternative perspective requires further attention with respect to understanding and future research within organisations. With respect to the management functions at all levels, the findings pointed towards the differences in the mode of management within the three categories of internal, operations and executive functions, and also to the extent of influence and power available to management in the different groups.

Poorly Represented Internal Functions

The numbers of observations by function in Figure 9.1 demonstrate that the focus of publications used in the research favours the management, operations, supply and accounting functions. This bias towards management, operations and the internal focus on finance, supplies and communications was also observed in undergraduate and post-graduate textbooks (Smith, 2007; Linstead et al, 2009). A balanced perspective should, however, include all the functions, including the lesser observed internal functions such as workplace maintenance, health, access and security control functions. Internal functions in the prototype framework for the study of human physiology, were found to be important for the survival of the individual since their focus of operation is to ensure that the needs and requirements of all the cells in the body are met; that they have an ambient environment to fulfil their tasks; and that they are protected against external interference or potentially damaging internal action (Barrett et al. 2010: 1). The question that needs to be addressed within the study of organisations is therefore whether these internal functions should not also receive the same attention as the 'vital' functions in organisms. Some case study examples of research within these functions and their impact on the organisation were found and discussed below.

Taylor et al. (2003) in their research into the reasons for high absence among call centre staff found that, in addition to stress arising from tight targets and continuous monitoring, a main cause was the ineffective air conditioning system. Although management did not alter the targets, they improved the air conditioning and general work environment throughout the organisation, and absence due to illness dropped (Taylor et al., 2003: 435-458).

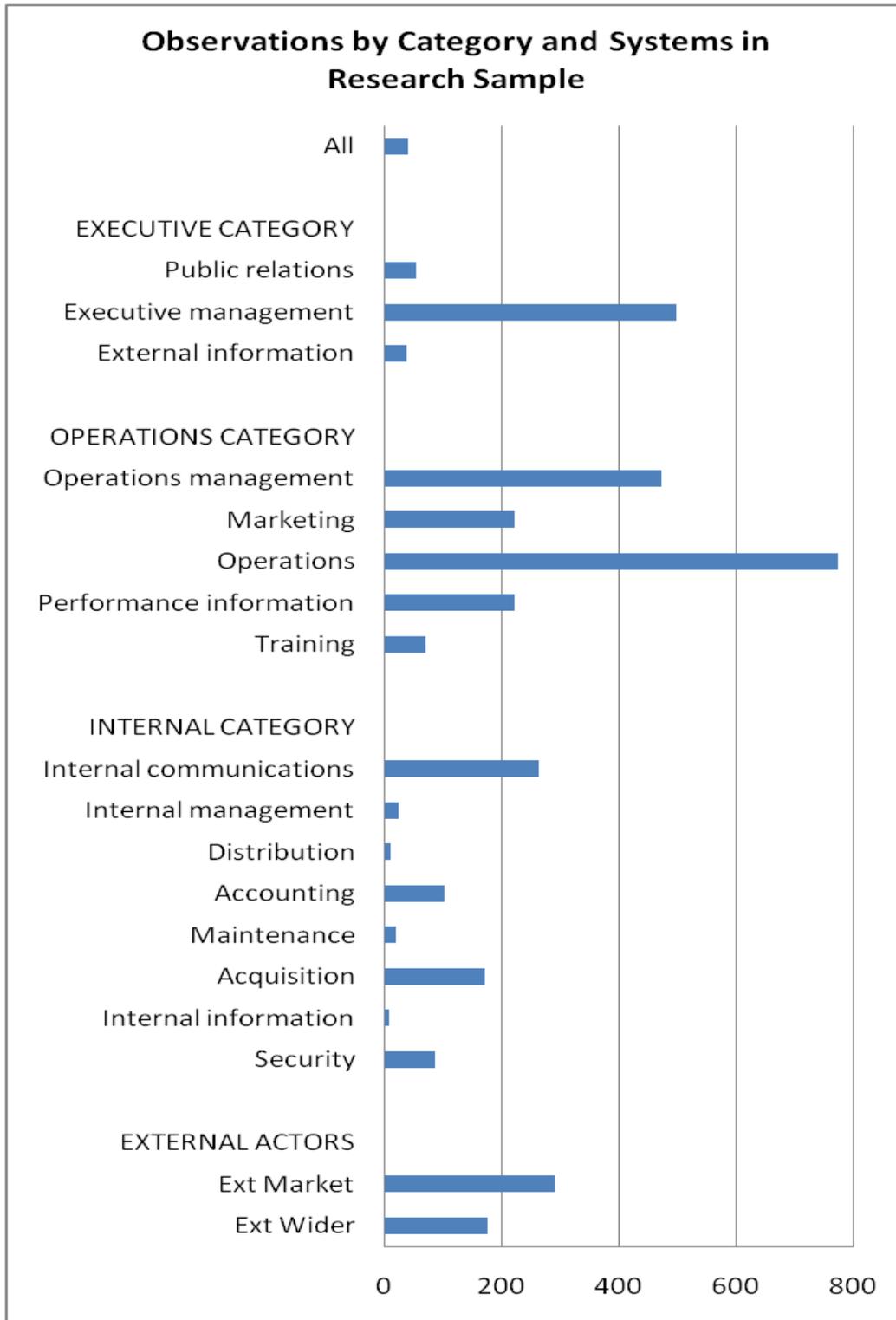


Figure 9.1 Observations of Functions within the Research Sample

The importance of the workplace maintenance function to the organisation was also demonstrated by research about outsourcing in the German hospital sector. Augurzky

and Scheuer (2007) found that the functions which were most often outsourced in order to cut costs include IT services, catering and cleaning. They also found that “the first wave of outsourcing in the German hospital sector in the 1990s largely failed because of adaptation problems on both sides” and that in some cases “quality problems and patients’ complaints have led to them to stop contracting outside firms and return to providing the services in question themselves.” (Augurzky and Scheuer, 2007: 272, 273). The impact of effective workplace management and the total cost of outsourcing, including quality and adaptation problems needs to be considered before one of the vital internal functions is outsourced.

An example of a function, analogous to the independent immune and healing roles performed by white blood cells and platelets in the bloodstream, and more generally categorised as part of the ‘informal structure’ within organisations (Smith, 2007: 76, 77) could be detected as that of the peer educators on AIDS in South African organisations (Dickinson, 2006: 697-717). These educators acted independently from management but were tacitly tolerated and supported to assist AIDS sufferers with practical advice while also promoting better understanding amongst other employees. In this case the communications, security and healing functions interrelated in support of individuals in the organisation, independently of direct instructions or requests from senior management, analogous to the immune and hormonal systems in the body.

Internal and External Communications

Communication, analogous to the hormonal system in the body, was found to be the internal function most active as the participant in change programmes, as presented in

Figure 9.2. It was however also found that this function, unlike the hormonal system that exists as a separate, yet highly integrated and network controlled system in organisms, could only be observed through its types of communications and not as a separate independent system. At the next scalar level of studying nation states, communication has already established its own identity as the separate function of media for internal communication, and international relations for external communications. Within organisations, however, communications either feature in management training material (Smith, 2007: 160-182) as a management process or is split into the reasons for communication such as culture, conflict resolution or motivation (Linstead et al. 2009), again to inform managers.

Chapter 5 identified the difficulty to translate the recognised function of human resource management into an analogous function within organisms. It was necessary to split its processes into logistics (recruitment), fund management and accounting (job classification and payroll) and communications (training and development). This different perspective from the physiology of organisations could raise the question of whether the function of human resource management requires further research, and possibly reorganisation of its sub-functions. Whereas a dedicated human resources function was necessary as part of evolutionary change in organisations during the second half of the twentieth century to address and resolve the inequality issues of the workforce in organisations, the time may be ripe to rethink the processes.

An integrated functional perspective shows that the impact of communication or the lack thereof, depends on the audiences and the messages, and should not be addressed as a single activity of management or a cultural phenomenon in the organisation.

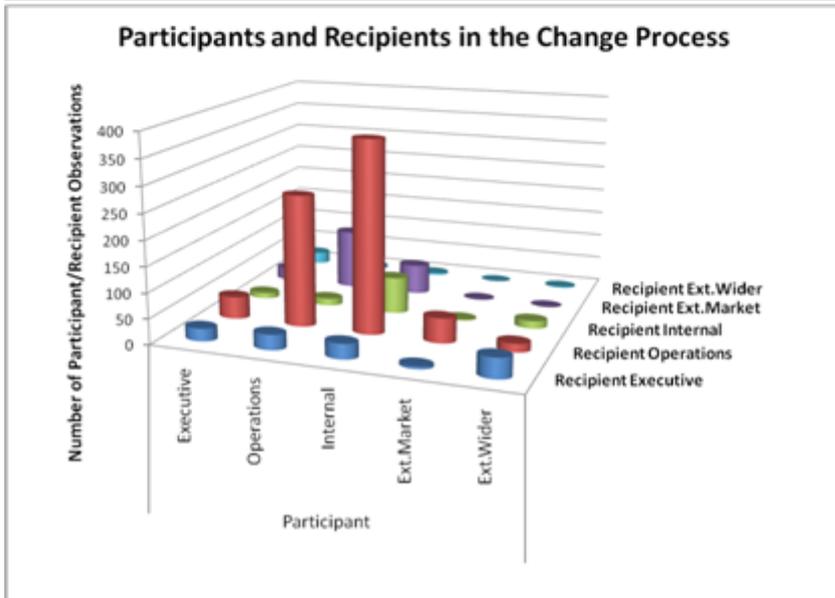
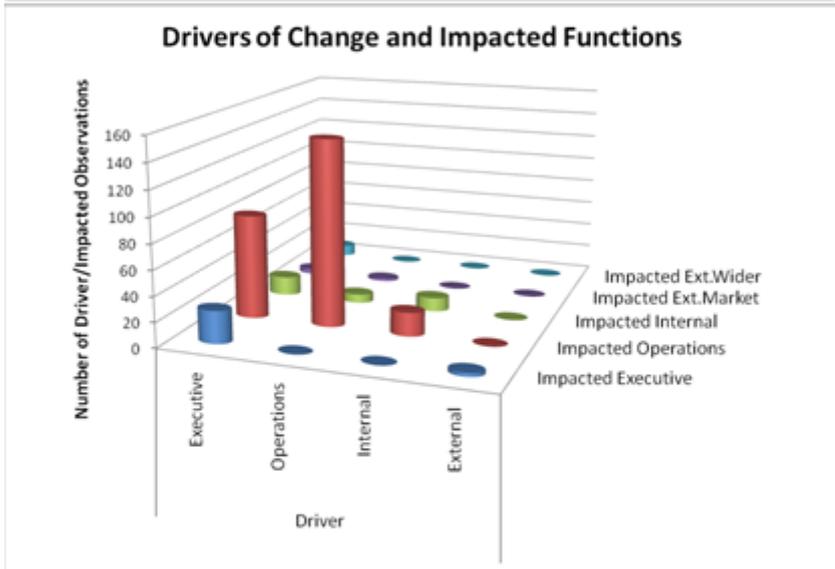
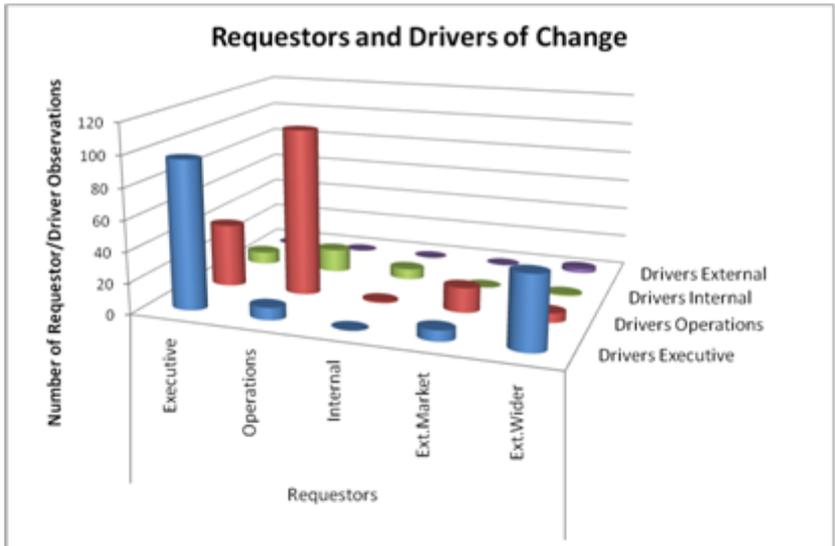


Figure 9.2 Interrelationships of Functional Roles observed in the Research Project

Brown and Humphreys (2006) researched the success of a merger between two further education colleges in the UK. They found that, although the project was regarded as a success by management, completed within cost and time, the teaching staff in one of the colleges became de-motivated. This was ascribed to the fact that this particular college building did not receive the same funding and attention as the other college, and the staff were not kept informed or motivated during the process of the merger.

Suitable motivation and communication about the reasons for the imbalance in funding could have prevented this lowering of morale (Brown and Humphreys, 2006: 232-257).

Another case study demonstrated the difference between internal and external communication and the danger of ignoring the impact of communication on all the different functions within the organisation. Kärreman and Rylander (2008) explored the impact of the development and implementation of a new brand for a consulting firm in Sweden. The development of the new brand image was initiated by corporate management and the accepted brand was that of a winning athlete, to portray the image that the organisation is competitive and striving to be a winner. When the corporate, market and internal communications functions attempted to 'sell' the brand image to their audiences, it was accepted by the wider corporate and customer market, but not by all the internal employees or the suppliers. In these cases the focus on winning was regarded as either not relevant or potentially negative to internal functions and some of the suppliers (Kärreman and Rylander, 2008: 103-125). A different image which applied to all audiences, or different messages to the different audiences could have been of benefit to the organisation.

Different Perspective on Operations

In order to enable a translation from the prototype framework of the physiology of organisms to organisations, it was necessary in Chapter 7 to reclassify the types of operations into endurance, precision and verbal operations analogous to the muscle unit types within organisms (Barrett et al. 2010: 105). This revised perspective on the operations and their interrelationships to management and other functions allowed observations to be made which could assist in addressing theoretical debates about teamwork versus bureaucratic targets and controls as preferred models for organisations. The analysis showed that it should not be either-or alternative choices, but that the structures of operations within organisations are dependent on their processes as promoted by Radcliffe-Brown (Radcliffe-Brown in Kuper, 1977: 19, 20) and recognised in the physiology of organisms.

Although further research is required to test the subjective interpretation of my research, the findings suggested that all operations functions rely on funding, logistics (including staff), on-the-job training and internal communications as the common interrelationships. It was also found that target setting and ongoing controls are accepted as the norm, analogous to the initiation of action by the brain and the ongoing sub-conscious monitoring and control of smooth action for the duration of the activity. However, it was also found that endurance organisations were more likely to have fewer target changes, but tighter control, as opposed to precision and verbal organisations in which case the targets may change often, in addition to tight controls, thus supporting the acceptability of bureaucratic management in endurance organisations versus

smaller team and initiative-driven operations and management controls in the precision and verbal organisations, especially within competitive environments.

The relationship between operations management and the operating units in endurance organisations could be observed in changed targets with respect to the introduction of new technology for operations and changes to existing processes. The research project into the implementation of the Virgin Trains pendolino service by Ivory and Vaughan (2008) showed that the proposal was based on research in other similar successful operations, especially in France, and wide internal consultation before implementation (Ivory and Vaughan, 2008: 93-106). Ramirez et al. (2007) researched the work practices employed, and the success of, the change-over in the UK telecommunications sector to new technology. They found that although the restructuring did not always work out, the requirement for the correct and suitable electronic systems, equipment and staff was key to the eventual success in the organisations researched (Ramirez et al., 2007: 495-517). This supports the fact that if changes to endurance or slow muscle units have to be made, it is necessary to base it on valid reasons and detailed development plans, analogous to learning in the cerebellum.

Case studies to demonstrate the tighter control as well as the need for initiative and teamwork in precision and verbal organisations could also be found in the sample. Lloyd and James (2008) researched the impact of chain store requests on food production organisations in which the pressure of not only tight, but also changing targets resulted in the inability to meet all these targets on time (Lloyd and James, 2008: 713-730). Royle (2006) researched the impact on staff and external labour force of an Italian fast food organisation to implement the standard model of McDonalds in its organisation. This

model required task specialisation, standard processes and service to customers, and very tight performance measurement and controls. It was found to be unpopular with existing staff, most of whom were replaced by temporary staff, and by labour unions, but accepted by the new staff and the public (Royle, 2006: 757-779). These examples of target setting and monitoring demonstrate that, as in the case of the study of physiology, it is not the target setting and monitoring that is a potential problem. The problem can be as a result of continuous changes to targets and the inability to determine how these targets can be embedded as routine control, analogous to continuous changes in the use of muscle by sportsmen as opposed to learning and maintaining smooth muscle use.

Management and Their Interrelationships

It is with respect to the decisions made by management on changes required within the organisation that an integrated functional perspective can be beneficial. In Figure 9.2, executive management was identified mainly in the roles of driver or requestor for change. Of the change programmes in which they were involved, more than 20 percent were regarded as not fully successful by the recipient and impacted functions. This can be demonstrated by research conducted into the difficulties experienced by global organisations to impose a single corporate culture in different parts of the world, where the corporate culture may conflict with local customs and cultures (Glover and Wilkinson, 2007: 1437-1455); and by a case study in which lawyers in an international legal firm elected to abide by their own professional ethics in preference to imposed directives from central senior management (Faulconbridge and Muzio, 2008: 7-25). These case studies support the prototype framework in which the control loops

identified for functions are not directly from the cognitive brain to the cells, but follow a more complex and integrated route. Executive management needs to consider all affected functions before initiating and imposing a new or different set of values.

However, the opposite can also be demonstrated in the research conducted by Halme (2002) into the approach to the management of forests in a paper and pulp company in Finland. Halme found that after a merger, one of the operations managers attempted to introduce a new approach of eco-friendly small-scale forest management in the organisation, only to be rejected by the other operations managers as an unacceptable non-traditional approach. However, after the rise in ecological awareness at the United Nations, external pressure increased on executive management, and the same approach was initiated and driven by the executive, successfully introduced and used as a unique selling point in subsequent marketing drives. This supported the impact identified from external peer pressure on the executive, and the fact that long term permanent changes can be influenced if introduced and driven by executive management through continuous learning and communication.

Functions which could benefit from an integrated perspective were also identified in a recent report on the reasons for the collapse of the Icelandic Bank (Sigurjonsson, 2010: 33-45). Sigurjonsson found the main reasons for the collapse to be a lax attitude towards corporate governance and inadequate risk management from within the organisation, the government and society. Compared to the prototype framework, the analogous physiological functions will be the immune system. However, the actual collapse was due to inadequate liquidity to underwrite reckless loans and investments, referring to the analogous respiratory system discussed in Chapter 4, which can result in

death of an individual within minutes even if the body is still healthy. Multiple functions contributed and were interrelated in the collapse.

Integrated Functional Perspective – Future Prospects

Physiology for studying organisations must also satisfy the need to address issues and concerns of organisations in the complexity of modern society, its multinational societies and global businesses. Some of the issues identified during recent decades that are still valid today, include the issue of surveillance and control which have become part of the modern life of uncertainty; flexibility as one of the postmodern forms of organisation; and the impact of technology or digitisation (Clegg in Tsoukas and Knudsen, 2003: 556-561; Reed, 1992: 200).

Surveillance and Control

Surveillance and control include the various surveillance activities listed by Dandeker as information collection, storage and retrieval; and various methods of supervising people and objects in order to ensure compliance (Reed, 1992: 200-205). It also refers to the intensification of controls in modern accounting principles, the use of governance and control regulations in organisations, and the impact of expanding personnel management procedures and practices. All the functions mentioned as complicating issues of surveillance can be found in the framework of physiology. Equivalents in the human body were observed in the need to distinguish between 'self' and 'non-self' elements, in other words, its access control and protection; and the immune system, searching out 'non-self' individuals and non-compliant processes within the organisation. Although these functions were not well represented for organisations in

the research sample, examples could be detected of papers addressing the need for surveillance, controls and regulations. Examples include the impact of whistle blowers in the case of unethical behaviour among executive management (Yu et al., 2008: 452-472); or models to support the prioritisation of audits (Sueyoshi et al., 2009: 219-231).

In the field of medicine, public health and mass immunisation managed to build up an internal resistance in populations to diseases like typhoid and measles. Issues in organisations and organised societies addressing intrusion, unethical and fraudulent operations within the organisations could be researched and interpreted as another application aimed at boosting the immune systems of organisations.

Flexibility and Different Forms of Organisation

Issues relating to forms of organisation include decentralisation; product specialisation and customisation; and a move towards smaller companies (Clegg in Tsoukas and Knudsen, 2003: 558). These issues can be addressed in an alternative perspective of functions and their integrated interrelationships provided by the framework for studying the physiology of organisations. It is also possible to apply the different relationships of role versus position (Radcliffe-Brown in Kuper, 1977: 21).

Decentralisation refers to the formation of separate business units, in which case the process can be studied as procreation in order to form new members in a family of businesses. Thereafter, the decentralised business unit becomes a separate physiological entity, in a relationship of position to the originator and other members in the 'family'. This complies with the interrelationships of role versus position as promoted by Radcliffe-Brown and discussed in Chapter 3. However, decentralisation can

also be regarded as reorganisation, usually in the operations function. In this case it becomes a different way in which to engage the 'muscle' in the operations function, without greatly affecting other functions in the organisation, except in their roles as supporters and participants in the change process.

The operations function in Chapter 7 shows an even split between incremental and innovative change programmes, evenly spread over market-related, business-related and staff-related programmes, thus covering both types of reorganisation of the operations function and business. Size, and the specialisation and customisation of products do not affect the vital life functions required to ensure the persistence of the organisation. However, product specialisation and customisation do affect the products or services offered to the market, and the way in which the organisation deploys the 'talent' or core competence, analogous to the use of different skeletal muscle units by athletes versus craftsmen (Morgan, 2006: 88). Interrelationships should, however, include the support required from the internal functions in the process.

Technology

A further issue to be addressed is the role of technology and its impact on the study of organisations. Technology formed one of the underlying issues in most of the metaphors presented by Morgan. However, it is also one of the topics which could benefit from a different perspective, such as being part of the physiology of organisations. The Industrial Revolution and emergence of factories during the nineteenth century changed the way in which products were manufactured, from labour intensive cottage industries, to a reliance on large machinery and equipment as a lever to enable faster production

and to produce more products to enter the markets (Morgan, 2006: 17). While this led to debates around the concept of the division of labour and the bureaucratic movement in organisation theories, the need for ever more complex and larger equipment was never queried. Machinery became accepted as an integral part of operations and a step in the evolution of organisations, analogous to the development of skeletal bones as levers to enable limbs to operate in land-based animals.

The use of computers since the 1950s started a similar evolutionary phase in business. During the 1960s and 1970s, large organisations invested in computers and systems development departments in order to develop electronic systems that could assist in the routine processing of functions such as accounting, sales, inventory and distribution. Contingency theorists Burns and Stalker included technology as one of the key factors to be considered at a strategic level to ensure that an organisation can compete in its environment (Morgan, 2006: 55), and the computer and systems development department became a major separate function. However, similar to the acceptance of manufacturing equipment as an integral part of companies, electronic processing became accepted as a tool rather than a luxury in organisations. It is no longer necessary for an organisation to develop its own software applications as these are on offer, together with personal computers, as resource tools and essential supplies. Desktop processing equipment has become a tool to be supplied to relevant functions and staff and maintained as part of the workplace maintenance function. However, it does raise one point which was found to be absent in the research sample for this project. Latour, in his Actor-Network-Theory (ANT), introduced the concept that objects can also be actors (Latour, 2007: 72), thereby highlighting the importance to include equipment,

their roles and their maintenance, as part of the study of the physiology of organisations, analogous to the role and maintenance of bones within the body.

The development and manufacture of electronic systems and equipment, in line with the manufacturing of machinery, still plays a major role in the operations functions of manufacturing or software development organisations, mainly to produce software and hardware products to offer in the market. For the other functions in an organisation, systems and hardware have become just additional tools.

Central processing and electronic mail can be regarded as part of the 'cardiovascular' system of the organisation, responsible for the central control over the distribution of information and communications, as well as the maintenance of the distribution channels involved in the process. This requires further research as it forms one of the split distribution systems, in addition to others such as supplies, people, equipment, information and communication identified earlier in this chapter. The internet and electronic messaging have become marketing tools for organisations; part of its central distribution system for information; and communications pressure influences from the external environment.

The research into the feasibility and desirability of studying the integrated physiological functioning of organisations as a natural science suggested that it is feasible within the boundaries of the identified limitations and concern, and can add value even in today's complex environment. However, Radcliffe-Brown's theses for a separate and single branch of science for studying societies and organisations, with individuals as the building blocks, stated that the single branch should include all four types of science. To

determine whether this inclusive scientific approach for the study of human societies and organisations could provide an alternative proposition to current organisation studies, it is necessary to return to the initial concerns identified in Chapter 1 and to position the study of the physiology of organisations within the wider context of science, including all types of science.

Physiology of Organisations in Perspective

In Chapter 1 three areas of concern were identified with respect to organisation and social research, namely the perceived complexity inherent in the various organisation theories developed in academic circles (Starbuck in Tsoukas and Knudsen, 2003: 176); the diverse interests, expectations and interpretation by the different target audiences of the theories (Burrell in Tsoukas and Knudsen, 2003: 525, 526); and the absence of an integrated pool of evidence-based knowledge about organisations which can bring the audiences closer together, and promote professionalism in management (Khurana and Nohria, 2008: 70-77).

Radcliffe-Brown proposed a single branch of science for the study of societies to address these concerns and this project focused on the evaluation of the physiology of organisations as a potential natural science within this single branch of science as indicated in Table 9.1. The research results indicated that it is feasible to develop an integrated perspective of the functioning of organisations which is common to most organisations and to present a framework which can be used to understand and explain some of the concerns relating to the complexity and individualism ascribed to organisations (Starbuck in Tsoukas and Knudsen, 2003: 176).

Scale of science	Abstract science of meaning and behaviour	Abstract science of logic	Natural science of structure, function and process	Applied Sciences and the Arts
Examples	Philosophy, psychology	Mathematics, modelling	Anatomy, physiology, chemistry	Medicine, Pharmaceuticals, Education
Focus of study	<i>Behavioural relationship</i>	<i>Relationship of position</i>	<i>Relationship of role</i>	<i>Application and presentation</i>
Level n+1 Organisation to conglomerate	National psychology Organisational psychology	World economy International economics World statistics	Nation states, Central governments,, Conglomerates Function/Structure Language/Discourse Politics Organisations, Autonomous institutions within structured society	Global issues Diplomacy Global education
Level n Human to organisation	Organisational psychology Social studies Individual psychology	Market economy, Partnerships Economics Simulation modelling Demographics	Function/Structure Language/Discourse Processes Human (organism)	Consultancy Sector specialisation General, professional education
Level n-1 Cell to organism	Cellular biology	Microbiology Bacteriology, virology	Physiology Anatomy Chemistry Cell	Medicine Pharmaceuticals Health education

Table 9.1 Scale/relationship perspective of the study of human societies

The integrated pool of knowledge could provide a common accepted repository to work from. The research, however, did not address Radcliffe-Brown's full set of hypotheses, but the findings provide an indication of how the types of science can benefit from the introduction of the study of the physiology of organisations as one of the natural sciences in this branch.

Abstract sciences, such as philosophy will not disappear, but could benefit from an additional focus and understanding of the functioning of organisations in order to explore and develop theories to question and guide empirical testing. Economic and

financial modelling based on the mathematics of probabilities will still be required for market and trend analyses. Philosophical development of theories within all four quadrants of Burrell and Morgan’s paradigm matrix (Burrell and Morgan, 1979: 22) including the study of meaning and consciousness as applied to society and organisations will still require research and debates.

Physiology was identified and evaluated as one of the natural sciences in the functional quadrant of the paradigmatic matrix for the study of organisations and provides an integrated perspective of the functioning of organisations towards the self-maintenance of the persistency of the organisation as presented in Table 9.2.

Internal Functions	Operations Functions	Executive Functions
Survival -Finance and Accounting -Logistics -Workplace maintenance	Operational Units -Endurance Sector -Precision Manufacturing -Precision Services -Verbal	Information -Internal Morale and Welfare -Operational Performance -Market research -Wider research
Protection -Access security -Audits/ policing controls -Safety, Health and Welfare	Operations Planning -Design and Development	Strategy and planning
Internal Communication -Training and Education -Motivational -Ethics and Culture	Market Communication -Sales and Marketing -Purchasing	External Communication -Public Relations
Management control and decision making functions		

Table 9.2 Framework of Physiological Functions in Organisations

The analogous study of the physiology of the human body is not the only natural science but is accompanied by other related sciences such as anatomy, cell biology and chemistry. Structure has already been recognised as an important field of study among organisational theorists, although it can benefit from a revised focus when viewed in light of the knowledge that can be gained from studying the integrated functioning and

structure of organisations as proposed by Radcliffe-Brown (Radcliffe-Brown in Kuper, 1977: 20).

An important area for further exploration with respect to its links to the physiology of organisations is language and communications, especially the internal communication that binds cells and organs within organisms, and also underlies the unity and community of the individuals within their roles in organisations. This area did not form part of the research project except for being identified as a function analogous to the hormonal function in organisms and was observed as the most influential function acting as a participant in change projects within the sample analysed for organisations. Already addressed in organisations through studies of culture and various theories and methods of discourse analyses (Thompson, 2003), the importance of the study of organisational language and communication, analogous to the chemistry in organisations, was already recognised as an important area for study by Radcliffe-Brown (1957: 142, 143).

However, it is the applied sciences that can benefit from Radcliffe-Brown's theses of a single branch of science for the study of human society. From the point of view of applied sciences, the integrated pool of knowledge can reduce the partial perspective provided by some of the metaphors and theories to management. It can also separate the applied sciences into general and specialist streams, such as general business consultancy, analogous to general medical practitioners, and specialists in specific operational sectors or functions within the organisation such as specialist subjects of accounting or marketing. This general and specialist assistance to organisations already exists, and by focusing on a supportive integrated base of the knowledge of physiology

as a minimum requirement, the debate with respect to the professional status of management consultants, if not managers, can be advanced (Khurana and Nohria, 2008).

Khurana and Nohria (2008: 70-77) proposed that managers should be recognised as professionals, provided with adequate knowledge, and be subjected to suitable codes of conduct and ethics similar to other professions such as lawyers and surgeons. This proposal was debated by Barker (2010: 54) who maintained that professionals are in possession of specialised knowledge, and are guaranteed by professional associations. Since the functional roles of managers are regarded as general and variable, Barker argued that business schools cannot be seen as professional schools and managers not as professionals. This debate is still ongoing and the professionalism of managers was not addressed in this research. Comments made by the participants in the online debate initiated by Harvard Business Review (Hbr, 2010), however, raised two important points that did affect the evaluation of closer cooperation among the different participants and audiences of organisational research, theories and knowledge. Khurana maintained that historically the professions of surgeons and lawyers started off as apprenticeships, later developing into networks of professional institutes, but he agreed with Barker that there is still not a proper knowledge base for management and no integrative thinking on how to teach professional management. Universities are furthermore steered into a fund-driven direction for research and a bureaucratic control of teaching, which limits their freedom to pursue this integrative thinking for new directions (Parker and Jary, 1995). Managers, analogous to the nervous system within the human body, may not need to have more than a broad understanding of the functioning of all parts in the organisation,

but management consultants, analogous to medical practitioners, should acquire this specialised integrated knowledge to enable them to become professionals (Barker, 2010: 54).

Other members of the audience interested in knowledge about organisations are the students, practising and aspiring managers as well as the employees and individuals interested in organisations or societies. Art as the final type of science proposed by Radcliffe-Brown provides the channel through which complex knowledge and concepts can be presented at various levels of complexity. Similar to the advantage that a broad understanding of human functioning can have on the ability of individuals to know how to provide for a healthy body and mind, managers can gain knowledge at a broad level of functions and interrelationships, but then continue to expand their knowledge to a deeper and more specialist level in their chosen field of functional specialism. Business schools will be in a position to offer this integrated functional perspective of organisations as one of their core courses.

Conclusion

The thesis argued that by classifying the sciences involved in the study of human societies and organisations in line with Radcliffe-Brown's theses, it was possible to show that the study of the physiology of organisations displays properties of a natural science as demonstrated in Table 9.1 (Radcliffe-Brown, 1957: 9). Unlike the problems experienced by Radcliffe-Brown and other functionalists in identifying acceptable common functions performed by organisations, it was also possible to demonstrate that the process of functional identification could be accelerated by using a prototype

framework from the lower scalar level of the study of the physiology of the human body as presented in Table 9.2 (Bowker and Leigh Star, 1999: 62). By focusing on change, analogous to the study of pathology to understand physiology (Canguilhem, 2007: 43) it was possible to develop an integrated functional perspective on the interrelationships among the functions within organisations, and by using secondary literature as a source for the identification and coding of these interrelationships it was possible to gather a large enough sample to perform comparative analyses and obtain generalisable results.

As a means to develop closer relationships among the different audiences interested in organisational knowledge as identified in Chapter 1, I propose further debates and research in the following areas:

Revisit the propositions presented by early theorists, and especially the theses of Radcliffe-Brown for a single branch of science for the study of human societies and organisations. Although Radcliffe-Brown was regarded as a structural functionalist and therefore in the functionalist quadrant of Burrell and Morgan's paradigm grid (Burrell and Morgan, 1979: 22), his thesis, especially when including separate scalar levels for organisations and nation states, allows for the acceptance of the different types of science and therefore diversity in research theorising, evaluation, application and presentation. A focus on the natural sciences within this branch of science is necessary to test his proposition that an integral study of the functioning of organisations can be achieved by studying the physiology of organisations.

Radcliffe-Brown's theses for the study of the physiology of organisations as one of the natural sciences proved to be problematic and a research approach had to be adopted

which is different from his proposed grounded observations of functions in societies.

However, the approach followed in my research project requires further evaluation and debates by testing the acceptability and replicability of: using the functions identified in the study of human physiology as a prototype framework for organisations; collecting a generalisable sample from published papers by identifying only the required functions and interrelationships for the research instead of performing a content or meta-analysis of the papers; focusing on change management as a means to identify functional interrelationships. In summary, it is important to determine whether a study of the physiology of organisations is an acceptable option to study organisations.

My research project and thesis, applying the approach and methods mentioned above, highlighted functions which could not readily be observed in the research sample. I propose that, even though the research methods still need further evaluation, the questions should still be asked why the poorly represented functions such as workplace or equipment maintenance are not receiving similar research attention as the operational manufacturing and service functions. This means increasing research attention on the vital survival and protection functions in organisations which are currently underrepresented in research projects. This is a topical area for research into the reasons for the actual and potential collapse of organisations as well as organised societies. Examples include the liquidity problems resulting in the collapse of organisations analogous to oxygen depletion in organisms; upheavals in organisations and organised societies due to unacceptable personal needs or supplies to members; and the role of internal protection, security and safety to protect individuals as well as the organisations or organised societies within which they operate.

Radcliffe-Brown proposed that the study of the functioning of organisations should focus on interrelationships rather than pre-defined models of ideal functions of societies and organisations (Radcliffe-Brown in Kuper, 1977: 50, 51). I propose that this focus be validated especially with respect to the interrelationships which could be identified as key within organisations, such as internal communication and the relationships impacting operating units. Although recognised at nation state level as media and education, the communication functions in organisations were identified as the most influential functions in change activities but it was only possible to identify types of communication messages and not the functions producing these messages.

Communication is already the topic of intensive research and it may be worth expanding the perspective of research to include internal communication within organisations, both from the point of view of the underlying 'chemistry' that binds together the functioning of the organisation, but also in the types and impact of different communication messages and whether there should be formal structures supporting the different types.

With respect to the operations of organisations, it was found that the need for targets and performance monitoring could be accepted as part of the normal functioning of organisations analogous to the functioning and control of muscle units within organisms. However, I propose that research should be extended to the differences between the types of operating organisations, as envisaged by Radcliffe-Brown in his proposition for the need of a comparative study in order to be able to classify societies and organisations (Radcliffe-Brown, 1957: 69-71). I also propose focusing research on the further development of the different 'muscle types' similar to the applied science of

sport or craft developments in individuals, thereby building on the acceptance of the targets and monitoring processes, but linking them to wider functions within management and other organisational functions.

I therefore suggest that the current available pool of knowledge about organisational functioning can be expanded by addressing the functions not sufficiently covered, and increasing awareness of the interrelationships and mutual impact of functional activities within and external to organisations. I propose that this is achieved within the integrated single branch of science for human societies and that this enhanced framework of evaluated scientific knowledge can be used to provide a balanced perspective to managers and management consultants in their professional development.

Appendix 1: Physiological and Organisational Functions

Guidelines in Creating a Prototype Functional Framework for Organisations

1. Framework Classification and Format of Presentation

A prototype framework is regarded as a 'best example' of an analogous picture or metaphor of a similar framework. To support objective evaluation, the framework must comply with the underlying properties of a classification system of consistency, mutual exclusivity and completeness (Bowker and Leigh Star, 1999: 62, 10, 11).

1.1 Consistent and unique classificatory principles

The framework is structured in the three categories in support of the natural laws of living organism, that is visceral/internal functions to assist energy generation, motor/operational functions to respond to stimuli and cognitive/executive functions to plan for persistency (Silver, 1998: 322).

Within each category the systems follow the major systems as identified in the study of human physiology, followed by individual functions within each system (Barrett et al., 2010). All attempts must be made to ensure that the structure of category, system and function is consistent.

2.2 Mutual exclusivity

The integrative nature of the central nervous system, and especially the peripheral nervous system, could result in functions being allocated to more than one category and/or system. To prevent duplication the peripheral system equivalent, that is, the middle management functions, will be grouped together with the internal and operations functions.

Similar to the management functions, the sensory perception functions will be allocated to the main category of systems affected by the perception: somatosensory perception from the internal systems and functions will be allocated to visceral/internal systems; proprioception is allocated to motor/operational systems, and the special senses to the cognitive/executive functions (Barrett et al., 2010; Barker et al., 2008).

2.3 Complete system

In Chapter 4 attempts were made to ensure that the identified systems and functions in the prototype framework for human physiology are complete at a high level. Analogous functions identified in organisations will follow this framework to ensure that the prototype framework to be evaluated is as complete as possible. Concerns about functions not directly transferrable or missing functions must be raised and discussed as part of the analysis process.

2. Codification Structure

In order to enable the research data to be recorded and logically analysed, organisational functions will be coded. All visceral/internal functions will be preceded by V-, the motor/operational functions by M-, the cognitive/executive functions by C-, and relevant external players by X-.

Where possible the name of the function must link to organisational functions rather than to the prototype terms used in the study of the human physiology.

3. Sources of Information

Information relating to the analogous framework at the level of the cell as component and the organism (human body) as the living entity is based on the identified systems and functions described in Chapter 4 and sourced from standard handbooks for students in human physiology.

Sources for information on equivalent functions in organisations include acknowledged study handbooks on organisational and management studies, acknowledged professional and trade institutes and published company reports.

The analogous framework of functions to be used in the data codification and analysis of the functions of organisations is presented in the Table A1.

4. Adjustments to the Prototype Framework

In addition to above guidelines the following adjustments are proposed in transforming the prototype framework from human physiology to a physiology of organisations:

- It was not possible to find a direct match between the organisational function of human resources and the analogous functions in the human physiology. For this reason the framework split the functions generally attributed to human resources into supply and communication functions.
- It was not possible to detect organisational functions dedicated to sex and procreation hormones. Many examples could be detected of change programmes involved in mergers, acquisitions and divestment, but not in functions only focused on these activities. Recording of mergers, etc was restricted to types of changes and not to specifically dedicated systems.
- Supply and distribution in organisations do not follow a single common path such as in the gastrointestinal and cardiovascular systems. The framework therefore split the supply functions into the different types of supply, i.e. people, supplies, material, systems and equipment.

Table A1 – Physiological and Organisational Functions

System	Function	Physiology	Code in Dataset	Definition
Communication	Public relations	Language, speech Association Cortices	C-PR	Present the company's image and build relationships with external peers and wider public and economic partners
Decision-making	Executive management	Planning, decisions Cortex, frontal lobe	C-Mgr	Act on behalf of executive. Interpret internal and external information and decide on long term action or significant changes. Can be in charge of MI, Strategy, PR or External Research
Planning	Strategy and planning	Memory, learning Cortex, frontal lobe	C-Strategy	Develop future strategies and decisions based on understanding of internal and external information
Information	Management information	Interpretation of proprioception and somatosensory perception Association cortices	C-MgtInfo	Collect, interpret and report on performance and exceptional information from all parts of the organisation
	External research	Interpretation of special sensory perception Association cortices	C-Research	Observe and interpret external wider environmental conditions to identify trends, e.g. share market, ecology, regulatory, etc.
Marketing	Sales, Marketing Customer service	Speech Motor cortex	M-S&M M-CustServ	Communicate with the immediate competitive external market suppliers, customers, competitors, etc.
Operations management	Plan and develop	Motor Cortex	M-Develop	Design and develop new products based on research.
	Operations management	Motor cortex through cerebellum	M-Mgr	Responsible for the routine activities and performance against targets of operations areas and relearning in case of change
Operations	Endurance	Slow muscle Tendons and bones	M-Endurance	Operations units in the transport, distribution, material production sectors
	Service	Fast fatigue resistant muscle Small bones and tendons	M-Service	Operations units in the service and retail sectors
	Manufacturing	Fast muscle using tools Small bones and tendons	M-Manufacturing	Operations units in the manufacturing sectors
	Verbal	Fast facial muscle	M-Verbal	Operations units in education and verbal sectors
Information	Monitoring	Proprioception Cerebellum	M-Monitor	Reporting of operational performance and progress against targets for adjustments in order to meet overall goals
	Market research	Immediate environment perception through major senses	M-Research	Observe and interpret immediate competitive external environment to identify opportunities, threats and trends.
Training	Training	Cerebellum and cortex repetitive learning and training	M-Train	Operational task-related training as opposed to induction or wider conceptual training and development
All	All	All cells in the body	All	Tasks affecting or performed by all members of the organisation
Internal management	Internal management	Local pacemakers, synapses in spinal cord, brainstem and midbrain	V-Mgr	Reflex management (respond locally to problems) and integrative management in order to respond to concerns or execute top level instructions
Accounting	Fund allocation	Respiratory and haemoglobin management	V-AccAlloc	Routine recording and distribution of funds for salaries and resources. Budget and fund management
	Income	Inhalation of oxygen rich air	V-Accln	Receive, record and account for funds received from various sources
	Expenditure	Exhalation of carbon dioxide laden air	V-AccOut	Pay money based on requests, and record.
V-Maintain	Waste management Workplace maintenance Equipment maintenance	Kidneys, colon, bone cell maintenance	V-Maintenance	Management of the ambient environment, light, temperature, cleaning, waste management and building and equipment maintenance
Internal communication	Development	Pituitary gland - growth hormone	VC-Growth	Additional training to improve organisational development and training - ongoing or temporary
	Motivational	Adrenal cortex – 'Fight or flight' hormone, e.g. Adrenalin	VC-Motivate	Communications to instil the need for additional and improved action

System	Function	Physiology	Code in Dataset	Definition
	Productivity	Thyroid hormone	VC-Productivity	Communications and incentives or targets to improve productivity in the execution of tasks
	Resource management	Pancreas - effective breakdown and absorption hormone, e.g. Insulin	VC-ResMgt	Assistance, communications and development in the effective use of organisational resources i.e. supplies, equipment, material, etc.
Information	Internal information	Somatosensory perception and reflex	V-Perceive	Determine staff morale and signs of dissatisfaction. React to this immediately or pass on to executive if serious
Security	Policing	Lymphocytes	VCtl-Process	Adjust and expand the code of conduct, audit, legal and security controls to address breaches of security and other imposed regulations
	Audits	Lymph nodes and antigen recognition lymphoid tissue	VCtl-Filter	Ongoing or targeted monitoring of internal process controls to ensure compliance to regulatory requirements and code of ethics of organisation. Identify and mark potential foreign entrants
	Health and safety	Platelets, lymphocytes	VCtl-Heal	Ensure the health and safety of staff and the blockage of illegal or fraudulent access resulting in filtering of funds, assets, etc.
	Protection	Skin, skeleton	V-Protect	Buildings, safety fences, and security guards
Acquisition	E- systems	Gastrointestinal system – receipt and transfer of chemical messengers eg hormones, enzymes, etc	V-SuppSystems	Maintain electronic distribution network and user addresses and allow for continuous process and distribution of access to electronic systems, including IT, telephone, internet and other information networks
	People	Gastrointestinal system – receipt and transfer of proteins	V-SuppHR	Maintain means of transport of staff around organisation and locations for transport and allow free transport and access to control and other essential functional personnel
	Supplies	Gastrointestinal system – receipt and transfer of carbohydrates, lipids and minerals	V-SuppMaterial	Maintain distribution channels and addresses and enable ongoing distribution of post, supplies and material
	Equipment	Gastrointestinal system – receipt and transfer of minerals e.g. calcium	V-SuppEquip	Acquisition and distribution of equipment, processing tools
Distribution	Distribution centres	Heart	V-DistCentre	Schedule and ensure effective distribution of various material, supplies, equipment and people
	Distribution channels	Vascular network	V-Distribution	Maintenance of distribution channels
External Market	Competitors	External immediate environment	XM-Competitor	Immediate competitor for the same customers and / or suppliers
	Customers	External immediate environment	XM-Customer	Immediate or potential customer to benefit or be disadvantaged by the operations / products of the organisation
	Partners	External immediate environment	XM-Partner	Immediate operational partner in the customer/supplier market
	Suppliers	External immediate environment	XM-Supplier	Immediate supplier to provide materials, supplies or services to the organisation
External Wider	Economic competitors	External wider environment	XC-Economic	Economic partners and the wider economy
	Peer group	External wider environment	XC-Peergroup	Peergroup of companies in the wider market
	Pressure groups	External wider environment	XC-Pressure	Pressure groups for improved services e.g. ecology, employee relations, ethical behaviour, etc
	Regulatory bodies	External wider environment	XC-Regulatory	Wider government and / or regulatory institutions
	Sponsors	External wider environment	XC-Sponsor	Shareholders or sponsors in the case of not for profit / charitable organisations

Appendix 2: Journals Considered for Sample Selection

Selection Criteria

The selection criteria were identified to ensure a representative spread of organisational functions and activities and provide a random selection of change projects

Minimum of 30 journals, and approximately 10 usable project papers for each journal working back from the latest edition

Criteria for Journal selection:

Academically recognised journals in English speaking countries, based on lists recommended by the Leicester School of Management

Criteria for Field of study selection:

Cover all major organisational disciplines and functions:

General Management including strategy

Production, Manufacturing, Service functions

Sales & Marketing

Finance & Accounting

Organisational behaviour, HRM

MIS, Operational Research

Other functions and disciplines as recommended in the lists.

Criteria for selecting suitable papers from journals:

Essential Criteria	Desirable Criteria
Addresses a change process in an organisation	Able to identify specific sector of operation
Able to identify specific function(s) affected	Identify symptoms leading to correction or change
Able to identify the main driver for change	Identify diagnostic corrective or change action
Able to determine the outcome of change	Identify as many participants in change process as possible
Able to identify some of the participants in the change process and their role in the process	Identify impact per participant and affected functions

Selection Process

Step 1 Journal selection

- 1.1** Select a list of journals from University of Leicester Management Centre: Journal Rankings Information for RAE 2008
- 1.1.1 Bristol Business School - Alphabetical List of Journals, Version 1, June 2004
- Selected on: World Academic Elite as determined by common consent of researchers and editors (also showing CIF and imputed RAE score)
- 1.1.2 Geary, J., Marriott, L, and Rowlinson, M. (2004). Journal Rankings in Business and Management and the 2001 Assessment Exercise in the UK. British Journal of Management, Vol. 15, pp, 95-141.
- Selected on: Top 20 ranked based on most frequently cited (showing Cited Mean)
- 1.1.3 Erim Journals List.
[Http://www.eric.europa.eu/ERIC/PUBLICATIONS/EJL/content.html](http://www.eric.europa.eu/ERIC/PUBLICATIONS/EJL/content.html)
- Selected on: Primary set of ERIM journals based on judgement by peers and (ISI) impact scores
- 1.1.4 Harzing, A-W (ed; 2004). Journal Quality List. University of Melbourne
- Selected on: at least 3 A and/or B grades by selection groups or highest scores
- 1.1.5 Journal Rankings - Economic Journals
Rankings 5 and 5*

Results: Number of journals selected based on above criteria: 188

- 1.2** Generate shortlist from above selected list, including only the following journals in the following selection sequence:
- 1.2.1 Journals on World Elite List, ERIM primary list top rating, and Quality list with 3+ A selection gradings (W,E1,Q) (12 journals)
- 1.2.2 Journals on World Elite List, ERIM primary list top rating (W,E1) (5 journals)
- 1.2.3 Journals on BJM top 20 list and ERIM primary list (B,E1 or B,E) (7 journals)
- 1.2.4 Journals on BJM top 10 list (B with rankings < 10) (6 journals)

Results: Number of journals selected based on above criteria: 30

- 1.3** Analyse the 30 shortlisted journals for spread and applicability and modify list accordingly:
- 1.3.1 Spread based on field of contents and countries in which research were

conducted is presented in Table A2.2

An electronic version of the full list of 188 journals considered during this selection process is available on request. The list of selected journals is provided below.

Title	Selected in Lists:	BBS - World Elite (W)	ERIM Primary (E)	JQL - Qual Ranking of 3+ A-B (Q)	BJM – Cited Mean (B)	Economics Journals (EJ)	ABS (2010)
The Journal of Finance	W,E,Q,EJ	Y	x*	4A		5	4
The Accounting Review	W,E,Q	Y	x*	4A			4
Academy of Management Journal	W,E,Q	Y	x*	3A, 1B			4
Academy of Management Review	W,E,Q	Y	x*	3A			4
Administrative Science Quarterly	W,E,Q	Y	x*	4A			4
Strategic Management Journal	W,E,Q	Y	x*	3A, 1B			4
Journal of Consumer Research	W,E,Q	Y	x*	3A, 1B			4
Journal of Marketing	W,E,Q	Y	x*	4A			4
Journal of Marketing Research	W,E,Q	Y	x*	3A			4
Marketing Science	W,E,Q	Y	x*	4A			4
MIS Quarterly	W,E,Q	Y	x*	3A			4
Journal of Applied Psychology	W,E,Q	Y	x*	2A, 1B			4
Organization Science	W,E,Q	Y	x*	2A, 2B			4
Review of Financial Studies	W,E	Y	x*				4
Organizational Behaviour and Human Decision Processes	W,E	Y	x*				4
Journal of Management Studies	E,Q,B		x*	2A, 2B	5.2		4
Organization Studies	E,Q,B		x*	1A, 2B	5.3		4
European Journal of Operational Research	E,Q,B		X	1A, 2B	5.6		3
British Journal of Industrial Relations	E,Q,B		X	1A, 2B	5.3		4
The Journal of Operational Research Society	E, B		X		5.5		3
Human Resource Management Journal	E, B		X		4.6		3
Long Range Planning	E, B		X		4.6		3
Human Relations	B				5.2		4
British Journal of Management	B				5.1		4
International Journal of Human Resource Management	B				5		3
International Journal of Operations and Production Management	B				5		3
Work, Employment and Society	B				4.9		4
European Journal of Marketing	B				4.7		3
Journal of Marketing Management	B				4.7		3
Journal of Change Management							1

Table A2.1 Journals selected for research

Journals were analysed with respect to the academic focus of the journal, and the spread by country in which the research was conducted. This analysis provided an indication of the potential breadth and objectivity of the sample and the potential for the generalisation of the findings. A spread of the selected papers by journal type and country of research is presented in Table A2.2

Publication Category	Number of Journals	Number of Papers	North America	Europe	Rest of the World
Finance & Accounting	3	23	17	4	2
General Management / Strategy	8	107	44	42	21
Marketing	6	56	26	22	8
Operational Research/ MIS	6	46	11	22	13
Organisation Studies/ HRM	8	95	31	45	19
Total Number of Publications	31	327	129	135	63

Table A2.2 Spread of research papers by discipline and country

Appendix 3: Guidelines for Data Selection and Coding

Research Procedures

1. Selection Processing Notes

1.1 Selection of papers

- Selected 30 internationally accredited academic journals for scrutiny.
- Downloaded all published papers for the most recently available year, i.e. 2006, 2007 or 2008.

1.2 First Scrutiny

- Reject papers focusing on theory or critique of previous theoretical work.

1.3 Second Scrutiny – Summaries of papers

- Prepare summaries of remaining papers:
 - Identify specific organisation and organisational change.
 - Accept fully supported hypotheses.
 - Only accept propositions if enough evidence of success can be found in quoted studies.
 - Focus on change in the organisations and not the deductions made by authors.
- Reject if:
 - No change can be identified,
 - Not enough evidence exists of support for result claims.

1.4 Third Scrutiny – coding of summaries

- Identify functions involved in activities and allocate functional code as per functional framework.
 - Enter coded functions on coding forms.
 - Enter activity/ reason/ result information in free format on coding forms.
- Reject if coding not possible or insignificant for purposes of analysis (around a further 30% of papers during above 2 steps).
- Only identify, summarise and code the functions which can be observed in the published paper, although this may lead to partial tracing of the route followed in the change process. A full tracing of the route for specific types of change process should be addressed in subsequent research.
- Capture publication data and coded activity data in relevant databases.

2. Checkpoint Review Process

2.1 Review Functional Framework

- Clearly justify and define any new functions added to the framework.
- If changes to the framework, update the framework and adjust or update previous entries on the database.

- 2.2 Allocate higher level categories
 - Group the functions on database into higher level categories to assist in analyses.
 - Review and amend previous groupings if necessary.
- 2.3 Identify database functional fields that are problematic or inadequately supported. Remove or recognise the limited use of these fields for future analyses.
- 2.4 Develop/ update themes for all descriptive comments and categorise if necessary.
- 2.5 Run various analysis lists as interim findings.

3. Checkpoint Analysis Process

- 3.1 Analyse publications reviewed to date to check on spread over journals, countries, sectors and main themes.
- 3.2 Analyse identified projects against functional framework to check for main activities of change identification, drivers, affected, and success.
- 3.3 Analyse participation against functional framework to check for functions participating and being affected and level of success.
- 3.4 Identify gaps/ constraints/ problems in finding and amend future workload to cater for these.

4. Ongoing Quality Checks

- 4.1 According to a set timetable, review parts of the framework to ensure consistency, accuracy and quality.
- 4.2 Areas for quality review to include:
 - Functions as identified by functional categories.
 - Action themes as identified by types of action and action categories.
 - Other information in the database, e.g. sectors, classification of impact and success, etc.

5. Examples of Coding instructions and Forms

An example of the coding form instructions is presented in Table A3.1, a summary of one of the papers selected for the research in Table A3.2 and the subsequent coding of the case studies within the paper in Table A3.3.

A full electronic dataset of the academic papers selected for the research is available. A paper based set of summaries and coded forms is available as well as the electronic dataset captured from the coded forms.

5.1 Coding form and instructions used in research

Paper identification number	Unique number allocated to each paper
Sector/ Org class	As per pre-defined list of business sectors and organisations
Organisation size	Small or large
Project subset (in case of multiple case studies per paper)	Sub number used when more than one case study can be used from one paper
Change type	Innovative or Incremental
Requestor or complainant	Functional code as represented by the actor
Reason for request or complaint	Free format reason, later to be categorised by theme
Driver/champion of change / decider	Functional code as represented by the actor
Change process applied	Free format process of change to be categorised by type of change
Main impacted function	Functional code as represented by the actor
Overall outcome	Positive, Negative, Mixed (both positive and negative), Varied (first one followed by the other)
Effect of impact	Free format impact of change on the impacted function, later to be categorised by theme
Change process Number	Identification of each change process in the case study
Participant in change process	Functional code as represented by the actor
Recipient Function impacted by participant involvement	Functional code as represented by the actor
Involvement process	Free format type of change involvement, later to be categorised by theme
Result of change process interaction between actors	Positive, Negative, Mixed (both positive and negative), Varied (first one followed by the other)
Effect of impact on Recipient Function	Free format impact of change process on recipient, later to be categorised by theme

Table A3.1 Coding instruction sheet

Karra, N., Phillips, N., Tracey, P. (2008). Building the Born Global Firm: Developing Entrepreneurial Capabilities for International New Venture Success. <i>Long Range Planning</i> . Vol. 41, pp. 440-458	
Summary Notes	Functional Actor identification
<p>Case Study: Jenni & Neroli: a case of successful international entrepreneurship</p> <p>1992-1994: Jenni</p> <ul style="list-style-type: none"> • Founder (Karov) during travels from Turkey to Russia and Eastern Europe, found limited availability of women’s leather accessories and planned to exploit the Russian market. • Contacted acquaintance with leather factory to <ul style="list-style-type: none"> ○ Produce leather accessories ○ Supply these to budding entrepreneurs from Russia and Eastern Europe • Karov was only a minor stakeholder – factory owner did most of the financing • Popular product and Karov expanded by selling not only to agents but through main Eastern European stores <ul style="list-style-type: none"> ○ Built and established brand in Russia ○ Provided control over distribution <p>1994 onwards: Neroli</p> <ul style="list-style-type: none"> • Karov and partner disagreed about the company’s future (Jenni) • Karov left Jenni and created another leather accessories company, Neroli <ul style="list-style-type: none"> ○ Production in Turkey, material from Italy ○ Launched internationally ○ Used existing Russian links to compete with Jenni • Developed large international network and company <ul style="list-style-type: none"> ○ 750 staff involved in design, production, distribution and retail ○ Products available in 77 stores in 9 countries in Eastern Europe and Russia • Outpaced Jenni <p>Paper continued with further discussion on competences leading to the success story.</p>	<p>C-Manager M-Research</p> <p>XC-Sponsor XM-Partner M-Marketing XM-Customer</p> <p>M-Marketing XM-Customer</p> <p>C-Manager</p> <p>MO-Production M-Marketing XM-Customer</p> <p>M-Development MO-Production XM-Customer XM-Partner</p>

Table A3.2 Example of a case study research paper selected and summarised for analysis

Paper number/ type	1632 / Case E M	/ C E M
Sector/ Size of Organisation	Retail / Small L	/ S M L / S C
Project subset	1	2
Change type	Innovative (start market for leather products)	Innovative (produce and sell leather products)
Requestor or initiator of symptom	C-Manager	C-Manager
Reason for request or symptom	Identify niche in market for leather products	Want entrepreneurial freedom to manufacture and market leather accessories
Actual request or cause of symptom	Set up business to market leather products	Start up own leather accessory business
Driver/champion of change / decider	C-Manager	C-Manager
Change process applied	Set up business to market leather products	Start up own leather accessory business
Impacted functions	M-Marketing	MO-Production
Overall success /failure / stopped	Successful	Successful
Effect of impact	Develop international network for product	Successful international production and marketing business
Participant 1 in change process	C-Research	C-Manager
Function impacted by participant involvement	C-Manager	MO-Production
Involvement process	Identify market opportunity for products	Set up production unit for leather products
Result & effect of impact on function	Positive - take action	Positive – can produce to spec
Participant 2 in change process	C-Manager	M-Marketing
Function impacted by participant involvement	XC-Partner	XM-Customer
Involvement process	Develop partnership with production company	Set up customer and product distribution network
Result & effect of impact on function	Positive – supply of products to market	Positive – build successful sales network
Participant 3 in change process	M-Marketing	M-Development
Function impacted by participant involvement	XM-Customer	MO-Production
Involvement process	Build customer network as outlets	Design innovative leather accessory products
Result & effect of impact on function	Positive – network of outlets for products	Positive – can produce and market new products
Participant4 in change process	C-Manager	
Function impacted by participant involvement	XM-Partner	
Involvement process	Disagree on future of product	
Result & effect of impact on function	Negative – manager exits	

Table A3.3 Example of coded form for case study in Table A3.2

Appendix 4: Analysis of Roles and Relationships of Functions within Organisations

A full electronic dataset of the data captured from the research and used in the analysis of findings is available.

Requestors versus driver categories

Count of ID	Driver_Cat													
	Requestor	Communica	C-Decide	M-Decide	M-Market	M-Operate	M-Perceive	M-Train	Communica	V-Decide	V-Obtain	X-General	X-Wider	Grand Total
All									1	2				3
C-Mgr	3	89	40	1						5	3			141
C-Strategy		4												4
M-Develop			1											1
M-Mgr		4	83	4	1	1	1			9	2			105
M-Operations		2	9	1						3				15
M-Research			2							1				3
M-S&M		2	4	1										7
VCtl-Filter										2				2
V-Perceive										2				2
V-SuppEquip			1											1
XC-Economic		1												1
XC-Labour			1											1
XC-Peergroup		1												1
XC-Pressure	1	7	1											9
XC-Regulatory	1	25												26
XC-Sponsor		11	4										2	17
XM-Customer	1	5	14		1									21
XM-Partner		1	1											2
XX-Consultant										1		1		2
Grand Total	6	152	161	7	2	1	1	1	1	25	5	1	2	364

Drivers versus impacted function categories

Count of ID Driver/ decider	Impact_Cat													Grand Total
	All	Communic	C-Decide	C-Perceive	M-Decide	M-Market	M-Operate	M-Perceive	V-Enable	V-Obtain	V-Security	X-Market	X-Wider	
C-Mgr	7	5	19	1	21	7	71	2	2		4	3	7	149
C-Negotiation			1									1		2
C-PR	2						1						1	4
C-Strategy							2						1	3
M-Mgr					15	20	107	12		6		1		161
M-Operate							1			1				2
M-Research							1							1
M-S&M						4	1	1				1		7
M-Train							1							1
VC-Motivation	1													1
V-Mgr	5				1	3	11	1		1	3			25
V-SuppHR	1						4							5
XC-Sponsor			2											2
XX-Consultant			1											1
Grand Total	16	5	23	1	37	34	198	18	2	7	8	6	9	364

Participants versus recipient categories

Count of ID Participant	Impact Cat													
	All	Communic	C-Decide	C-Perceive	M-Decide	M-Market	M-Operate	M-Perceive	M-Train	Communica	-Distribute	V-Enable	V-Heal	V-Obtain
All														1
C-Mgr		1	2		4		6			2		2		1
C-Mgtinfo			3				3					3		
C-Negotiation							1							
C-PR						3	2							
C-Research			12			2	2	2						
C-Strategy		1	6		4	1	13	1						1
M-Custserv							4			1				
M-Develop		1	2			5	14	1						2
M-Mgr					2	4	10							
M-Monitor	2		3	1	11	3	53	1	1					1
M-Operations		1	3		5	6	1	2				2		4
M-Research		1	13		26	5	20	2				1		
M-S&M			4		3		13	1						
M-Train			1		5	7	52	2						1
V-AccAlloc	2		6		5	1	19	6		1				1
V-AccIn			2				4	1						
V-AccOut			2			1	2							4
VC-Growth	3	1	2		6	2	19					3		
VC-Motivate	6	2			11	10	74	2		4		4		2
VC-Productivity					3	4	23	1		1	1			1
VC-ResMgt	2				4	4	39	2		1		1		1
VCI-Filter		1	4		3	2	10					2		1
VCI-Heal	1				2		5							
VCI-Process	1		2				4						1	2
V-Distribution						3	3					1		
V-Maintenance					1	2	10							1
V-Perceive			2				1							1
V-SuppEquip							3							
V-SuppHR	3		4		1	6	49							1
V-SuppMaterial			1		2		12	1			1	1		
V-SuppSystems			1				13							
XC-Economic								1						
XC-Labour					2		3							
XC-Media			1											
XC-Peergroup		1	2											
XC-Pressure			4				1							
XC-Regulatory		2	12		4	1	2					4		
XC-Sponsor		1	10			1	3			2		2		
XM-Competitor			2			2	3	3		1				
XM-Customer			1		5	5	14	1						
XM-Partner			2		1	2	3					1		
XM-Supplier					1	1	2	1						
XX-Consultant		1	5	1	3		1			1	1			
Grand Total	20	14	114	2	114	83	516	31	1	14	3	28	1	25

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