University of Pretoria

Building Career Capital in High Technology Research and Development Organisations

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Abstract

Knowledge workers build their career capital through learning experiences throughout their careers. How this occurs for the R&D knowledge worker has not been previously documented. The loss of key R&D personnel in the high-technology (high-tech) industry contributes to a loss of tacit knowledge and increased costs. A greater understanding of why and how career capital is accumulated by R&D knowledge workers will facilitate the design of career management practices that could reduce voluntary employee turnover.

A qualitative investigation into the applicability of eight widely recognised career capital components revealed a new component that is relevant to the high-tech R&D environment. These applicable career capital components and associated accumulation methods were used to build a quantitative questionnaire that measured the perceptions of 59 knowledge workers in the R&D environment.

This research has, for the first time, explicitly defined tangible career capital constructs that are relevant to knowledge workers in the high-tech R&D environment. The findings have been used to develop a model to help organisations understand the career needs of the R&D knowledge worker within the context of the business environment. Recommendations are presented to allow organisations and R&D knowledge workers to leverage off this research.

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Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Garsen Naidu

11 November 2009

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I dedicate this research to my parents who are both former school teachers that have always held a passion for learning, new knowledge and people development. To my mother, Vigie Naidu the academic, thank you for teaching me the importance of structured learning. To my father Krish Naidu, the pragmatist, thank you for teaching me the importance of contextualising academia within pragmatism. To both of you, thank you for teaching me the importance of continual personal growth and development, and thank you for affording me the opportunity to develop through theory and pragmatism.

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CHAPTER 1: INTRODUCTION TO THE RESEARCH PROBLEM

Increasing employee turnover rates in the high technology (high-tech) industries have lead to discontinuities in development programmes that negatively impact on schedule, cost and the tacit knowledge that are essential for high-tech development projects; a causal link proved by Chang, Choi, and Kim's (2008) research into the turnover of highly educated R&D professionals. These professionals, or knowledge workers, are participants in the new world of work where knowledge is the commodity traded between the individual and the employing organisation (Drucker 1994).

The high-tech R&D environment is characterised by high levels of individualism, an essential characteristic that encourages creativity and supports the journey into unchartered territory typical of R&D work. A knowledge worker's turnover intentions are impacted on by the desire for high levels of individualism, need for challenge and focus on personal development. In particular, Chen, Chang and Yeh (2003) found that R&D knowledge worker turnover can be linked to career development needs which suggests that the high-tech R&D knowledge worker's turnover intentions are most likely driven by the desire for superior career development opportunities.

The new world of work is characterised by a dynamic business environment that encourages knowledge worker mobility across organisations' boundaries and have given rise to the boundaryless career (Arthur and Rousseau, 1996) where knowledge workers strive to develop their skills, capabilities and competencies to

accumulate a career capital that may be traded to organisations in the new world of work. Career capital typically grows through transfer, experience and exposure as knowledge workers move through and across organisations accumulating experiences in their boundaryless careers (Lamb, 2007) and recent surveys indicates that workers are now looking for a 'life of jobs' instead of a 'job for life' (Farley, Malkani and Smith, 2008, p 11). The mobility of knowledge workers and the boundaryless career provide challenges for the organisations that participate in the knowledge economy as there is increased competition for skilled, capable and competent people. Exacerbating the situation is the poor supply of appropriate skills that is evident in the South African defence and aerospace industry where manufacturers are challenged by the lack of available skills that is hindering the industry players in meeting their contractual obligations (Engelbrecht, 2008). The skills shortage severely impacts on an organisation's capacity to seize opportunities as they arise and therefore places pressure on the long term sustainability of the organisations.

The new world of work represents an environment where companies cannot offer individuals jobs and careers for life and the responsibility to manage careers is believed to no longer rest with the organisation (Sturges, 2003). This does not abdicate the responsibilities of organisations as Mallon and Walton (2005) find that although individuals believe that they are responsible for their own learning and career development, they are uncertain in the process to acquire the learning. Evidence of this scenario within the aerospace industry is given by Ahmed,

Wallace and Blessing (2003) who find, in a study of engineering designers, that designers are not always aware of their knowledge needs. This situation highlights the importance of organisational signals as mechanisms to guide knowledge workers toward appropriate learning (Mallon and Walton, 2005). Organisations can therefore play a key role in guiding individuals in their learning and career development.

1.1 Research Objective

An improved organisational understanding of how career capital is built will aid in designing an attractive environment for highly talented individuals as well as creating an enticing reason for existing employees to remain within the organisation. This could potentially impact on voluntary turnover statistics in R&D organisations that will reduce the loss of the essential tacit and explicit knowledge.

The literature review that follows explores the causal links identified above to reveal research questions. The research investigated the concept of knowledge workers and career capital within the context of high-tech R&D industries with the purpose of:

- Understanding what contributes to career capital in a high-tech R&D environment;
- Understanding the process of building career capital through the lens of different stakeholders.

- Discovering if different cohorts use different methods in accumulating their career capital.

The research will contribute to improving career management in R&D organisations by investigating factors that are of concern to R&D knowledge workers. Improved career management can positively impact on a knowledge worker's job satisfaction resulting in the improved retention of key knowledge workers (Chen, Chang, and Yeh, 2003). The retention of critical R&D skills is a managerial challenge for many high-tech R&D organisations especially during long development projects (Chang, Choi, and Kim, 2008; Chien and Chen, 2008).

1.2 Research Scope

The study investigates the perceptions of knowledge workers within the high-tech R&D industry and as a result may not necessarily describe the reality. The study investigates the perceptions of two cohorts involved in the high-tech R&D environment, those below 40 years of age and those equal to and above 40 years of age.

The Organisation for Economic Co-operation and Development (OECD) has developed a classification for industries and the following industries are defined as high-technology (high-tech) industries:

- aerospace
- pharmaceuticals

- computers and office machinery
- communication equipment
- scientific instruments

The high-tech industry broadly covers enterprises that are knowledge-intensive and technology-intensive. The OECD definition for high-tech industries defines the scope of the applicable organisations in this study.

1.3 Conclusion

The “war for talent” (Tulgan, 2000, in Jordan and Sutherland, 2004), the skills shortage and the knowledge workers’ desire to accumulate career capital contributes to the mobility of knowledge workers. The skills shortage is exacerbated in the current global economic crisis and all economies, both old and new, have to define a “brain based” competitive advantage and be hubs of innovation to remain ahead of the pack (Cho, 2009). The knowledge based competitive advantage is especially important to high-tech R&D organisations and it is imperative that these organisations focus on their ability to attract and retain the best engineers and scientists. The results of this study serve to enlighten high-tech R&D organisations on the behaviours, intentions and requirements of the mobile knowledge worker. An improved understanding of the desires of the knowledge worker affords the organisation an opportunity to design innovative career management solutions that will brand them as an attractive employer and position them as the employer of choice in the “war for talent”.

CHAPTER 2: LITERATURE REVIEW

The literature review to follow consolidates relevant academic literature to reveal the need for understanding how knowledge workers in high-tech R&D environments accumulate career capital. The review begins with a discussion on the knowledge based economy and the knowledge worker; this theory creates a foundation for a discussion on human capital and its importance to high-tech R&D companies. Next, generational theory is discussed to determine the needs of different knowledge workers and a review of career capital in the new world of work follows. The review then highlights previous work on career capital, its components and how knowledge workers build their career capital. A discussion on the high-tech R&D environment follows to illustrate the nuances of the high-tech R&D environment that should be acknowledged in a study of this nature; and the review concludes with a brief summary revealing the need for this research.

2.1 The knowledge based economy, the knowledge worker and the organisation's knowledge assets

The knowledge economy, discussed as early as the 1960's by Drucker (1994), describes the use of knowledge as a means of production and more recent discussion on knowledge economics suggests an extensive market for knowledge in the current day economy (Edvinsson, 2002; Raspe and Van Oort, 2006). This market for knowledge represents the knowledge economy which is characterised by intangible knowledge assets that hold value for both the organisation and the individual (Edvinsson, 2002). A key participant in this knowledge economy is the

individual and their intangible knowledge assets, identified by Drucker (1994) as the knowledge worker.

Knowledge workers possess a high level of job specific knowledge and skills including general business acumen (Drucker, 1994). Their willingness to learn and their ability to continually reinvent themselves to their business context is characteristic of the knowledge worker (Drucker, 1994). The knowledge worker's intangible assets, collectively represented by the employee's experience, skills and creativity, play a key role in the current day organisations' competitive advantage (Meisinger, 2006). The knowledge worker is therefore a key organisational resource that becomes increasingly scarce as current day organisations continually enhance their knowledge base in order to create unique knowledge based assets (Mrinalini and Nath, 2008).

2.2 Organisational human capital and high-tech companies

An organisation's competitive advantage in the knowledge economy is dependent on the organisation's intellectual capital (Mrinalini and Nath, 2008; Tai and Chen, 2009); and the quality of human capital is essential for high-tech companies to maintain competitive advantages in the knowledge economy. Several Intellectual capital models have been provided in literature by Kaplan and Norton (1992), Brooking (1996), Edvinsson and Malone (1997) and Stewart (1998); with an international acceptance of the three components of intellectual capital being (de Castro and Sáez, 2008):

- human capital
- structural capital
- relational capital

Human capital is a reference to the individual's tacit and explicit knowledge that is useful to their organisation's mission and it includes the experience, creativity and team work of the employees (de Castro and Sáez, 2008). De Castro and Sáez (2008), in an empirical study, find human capital to be the most influential of the three components in their sample of high technology firms; with the knowledge workers experience in industry being the element that best characterises human capital. The literature therefore reveals that, for high technology firms, human capital is the most influential component of intellectual capital.

2.3 Generational theory, career stage and age

Many concepts have been used to classify or describe the sequences of periods that individuals pass through during their working lives. Generational groups, often referred to as cohorts (Smola and Sutton, 2002), describe an "identifiable group that shares birth years, age location, and significant life events at critical developmental stages" (Kupperschmidt, 2000, p. 66). Each group is thought to have differentiating characteristics from the groups that precede and the groups that follow; and the characteristics impact on work values, attitudes and motivations to work (Kupperschmidt, 2000; Smola and Sutton, 2002).

Macky, Gardner and Forsyth (2008), in their review of generational group literature, find that generational theory is more a popular hype than a theory that can contribute to the development of management policies. This view of generational theory being a popular hype is supported by Giancola (2006 in Macky, Gardner and Forsyth, 2008) who observes the lack of published research in academic journals. Macky, Gardner and Forsyth (2008) recommend that employee needs should rather be considered from the perspective of age, life cycle or career stage differences.

The career stages concept has been the concept most often used to describe the phase that individuals pass through during their working lives (Yeh, 2008). Cron (1984) identified four career stage categories that were linked to an individual's age. The career stages, confirmed to exist in work on technical professionals (Veiga, 1983, in Finegold, Mohrman, and Spreitzer, 2002), are defined as:

- the 'exploration stage' that is equal to or less than 30 years of age,
- the 'establishment stage' that is between 30 and 45 years of age,
- the 'maintenance stage' that is between 46 and 65 years of age and
- the 'disengagement stage' that is above 65 years of age.

At different career stages individuals encounter diverse career developmental 'duties' and 'goals' related to the role that they fulfil (Schein, 1987 in Chen, Chang and Yeh, 2003) which shapes the different needs and expectations of employees

(Finegold, Mohrman, and Spreitzer, 2002). Career stages can therefore be used to classify individuals that have similar job related requirements and concerns.

2.4 Organisational human capital, firm performance and innovation

Hsu (2008) defines organisational human capital as the competencies of an organisation's employees that are created through synergies of the organisation's human capital. The organisational human capital consists of a collection of unique resources that are valuable and rare; valuable because human resources differ in their knowledge, skills and capabilities; rare because it is difficult to find human resources that can ensure high performance levels for an organisation (Hsu, 2008). Hsu (2008) finds that organisational human capital is positively associated with organisation performance. Harris (2001) discusses how theory uses human capital as a proxy for knowledge; so the human capital, that is the knowledge worker, is valuable because it is positively related to an organisation's performance; and because this organisational resource is rare, organisations should be concerned with retention of the human capital which is actually their knowledge workers.

The high-tech R&D organisation is dependent on its ability to innovate; and innovation is a core competence from which it derives its competitive advantage. An organisation's ability to innovate is widely accepted as being closely tied to the organisation's intellectual capital (Subramaniam and Youndt, 2005) and the innovation capability of an organisation is dependent on the integration or synergy of organisational activities (Huang and Lin, 2006; Davenport, Thomas and Cantrell,

2002). Subramaniam and Youndt (2005) state that innovation requires critical knowledge and skills that resides within the individual and find that human capital positively influences an organisation's radical innovative capability; where radical innovative capability is the organisational capability that generates innovations that significantly transform an organisation's existing products and services (Subramaniam and Youndt, 2005). The knowledge worker therefore plays a pivotal role in an organisation's ability to innovate.

FIGURE 1: LEVELS OF KNOWLEDGE WORKER (BRELADE AND HARMAN, 2007)

Brelade and Harman (2007) state that as the knowledge economy grows, knowledge workers now exist at different levels within the organisation, as shown in Figure 1, and are not characterised by a homogenous group; that is they argue that knowledge workers exist at different levels with different requirements. Brelade and Harman (2007) identify knowledge creators as the developers of new ideas and innovations. Knowledge creators create the competitive advantage in

organisations and the retention and development of these knowledge workers is where organisations will derive benefit (Brelade and Harman, 2007). The generation of new ideas and innovations within high-tech R&D environments is the responsibility of engineers and scientists. The research was therefore focused around the engineers and scientists as the knowledge workers in the high-tech R&D environment.

2.5 Knowledge workers and career capital in the new world of work

The knowledge economy represents a marketplace with the key actors being the knowledge worker and the organisation that requires the knowledge (Edvinsson, 2002). Bourdieu (1986, in Lamb, 2007) explores this economic system with knowledge being a concept that is created through investment and has the ability to be traded. Harris (2001) describes that the primary implication of the knowledge based economy to the new world of work is that the process of obtaining knowledge takes on the characteristics of an investment activity, an investment activity that increases the capacity to generate additional capital. In the knowledge economy the organisation becomes the purchaser of the individual's tacit and explicit knowledge which is represented by the individual's human capital (Hsu, 2008).

McFadyen and Cannella (2004) state that the know-how and information that individuals gain over time forms their knowledge stocks; a view reinforced by Harris (2001) who states that knowledge accumulates over time. Knowledge within a

particular career field will accumulate with time and experience within that career field and therefore contributes to an individual's tradable capital in that career field. This career capital is valued within the career field and represents a unique portfolio of capital (Bourdieu, 1986, in Lamb, 2007) that can be described as the overall set of non-financial resources that an individual is capable of bringing to their work (Arthur, DeFillippi, Jones, 2001).

2.6 The components of knowledge workers' career capital

Early work by Bourdieu (1986) expands on the concept of capital beyond that which is used for material exchange to include non-economic forms of capital. Bourdieu (1986) describes two additional forms of capital that are social and cultural capital and defines career capital as a mix of the three types of capital:

- Economic capital

Economic capital represents the most efficient form of capital as it has the potential to be converted directly into money and may be institutionalised into property rights. An individual's income is therefore an important component of economic capital.

- Social capital

Social capital represents relationships, social connections and class membership that has the potential to be converted into economic capital. The individual's social

capital with reference to career capital represents those networks that are relevant to industry or environment of the individual's career.

- Cultural capital

Bourdieu (1986) describes cultural capital as existing in three states; the embodied state, the objectified state and the institutionalised state. The embodied state represents durable dispositions of the mind and body or the attitude and demeanour of the individual (Mayrhofer, Meyer, Iellatchitch and Schiffinger, 2004). The objectified state represents the individual's means of making use of cultural goods like books, dictionaries, instruments and machines which essentially is the knowledge and ability to use various cultural goods (Mayrhofer, Meyer, Iellatchitch and Schiffinger, 2004). The institutionalised state describes those objects that represent a certificate of cultural competence that is academically sanctioned by a recognised institution (Mayrhofer, Meyer, Iellatchitch and Schiffinger, 2004) and may therefore be regarded as an individual's educational qualifications.

Recent research has acknowledged career capital to comprise of three dimensions of knowing (Suutari and Mäkelä, 2007; Dickmann and Harris, 2005; Inkson and Arthur, 2001; DeFillippi and Arthur, 1994). DeFillippi and Arthur (1994) first defined the three dimensions to be: knowing whom, knowing why and knowing how

- Knowing whom

The knowing whom consist of social relations within the organisation, external to the organisation and social relations within a professional network that is relevant

to the career (DeFillippi and Arthur, 1994). The knowing whom dimension is related to the concept of social capital and refers to assets that are accessed and available through a network of relationships (Suutari and Mäkelä, 2007) and is therefore associated to Bourdieu's (1986) concept of social capital.

- Knowing how

The knowing how dimension of career capital represents the individual's work related skills, knowledge and competencies (DeFillippi and Arthur, 1994); where knowledge represents both tacit and explicit knowledge (Dickmann and Harris, 2005). The knowing how capital represents the more technical and conceptual aspects and is therefore more tangible than the other two capitals (Lamb, 2007) making the knowing how component similar to the institutionalised and objectified components of Bourdieu's (1986) cultural capital.

- Knowing why

The knowing why relates to the alignment between the individual's identity and career related choices and the motivation and energy the individual brings to their careers (DeFillippi and Arthur, 1994; Inkson and Arthur, 2001). Knowing why is the source of the energy that drives individuals along their desired career paths and creates a sense of personal meaning as their career progresses (Suutari and Mäkelä, 2007). DeFillippi and Arthur's (1994) knowing why therefore represents Bourdieu's (1986) cultural component, specifically the embodied component.

Jones and DeFillippi (1996) built on DeFillippi and Arthur's (1994) work in career capital to include three additional components knowing when, knowing what and knowing where:

- Knowing what

The knowing what component revolves around an understanding of industry opportunities, threats and requirements that will maximise efforts within the environment to produce quality work and build a formidable reputation.

- Knowing when

The knowing when represents an understanding of the best timing or scheduling of roles, activities and choices to prevent being trapped in single roles. The knowing when also incorporates the art of moving quickly to exploit opportunities within the relevant industry.

- Knowing where

The knowing where component involves understanding where to enter the industry, where to train to remain within the industry of choice and where to advance through identification and exploitation of relevant opportunities.

Lamb (2007) expands on DeFillippi and Arthur's (1994) as well Jones and DeFillippi's (1996) existing work in the field of career capital to identify two new components of career capital that are relevant to knowledge workers:

- Emotional maturity and intelligence (EQ)

EQ is the ability of the individual to understand themselves or “knowing-oneself”, it is the awareness of one’s strengths and weaknesses; an ability to acknowledge ones level of emotional awareness, self, where spiritual intelligence is defined as the individual’s inner wisdom and intuition and complements EQ.

- Action orientation

Action orientation refers to the ability to use initiative and business acumen within the business context to exhibit decision making appropriate for the situation. It represents an inherent entrepreneurial nature to solve business challenges in innovative ways that achieve results.

Lamb (2007) reinforces earlier work by identifying components previously discovered that are:

- context management and adaptability to the environment
- cultural, organisational and functional fit
- qualification and calibre of education
- opportunism and future possibility identification
- network of peers, colleagues and leaders
- driving execution and delivery

TABLE 1: A HISTORY OF THE THEORY DEVELOPMENT IN CAREER CAPITAL COMPONENTS

Bourdier (1986)		**DeFillippi and Arthur (1994)**	**Jones and DeFillippi (1996)**	**Lamb (2007)**	**8 Components of Career Capital (2009)**
Economic capital					Economic capital
Social capital		Knowing whom		Network of peers, colleagues and leaders	Knowing whom
Cultural capital	Embodied component	Knowing why			Knowing why
	Objectified component	Knowing how		Drive execution and delivery	Knowing how
	Institutionalised component			Qualification and calibre of education	
			Knowing What	Context Management; Fit	Knowing What (Context Management)
			Knowing When	Opportunity Identification; Fit	Knowing When and Knowing Where
			Knowing Where		
				Knowing oneself EQ and Social Intelligence	Knowing oneself EQ
				Action orientation (Initiative in the business context)	Action orientation (Initiative in the business context)

The links between the above components and earlier theory is illustrated in Table 1 that shows the history of the how the career capital knowledge base has developed over the years. Table 1 reveals links between the various career capital concepts and lists the eight components of career capital that are now relevant to the knowledge worker.

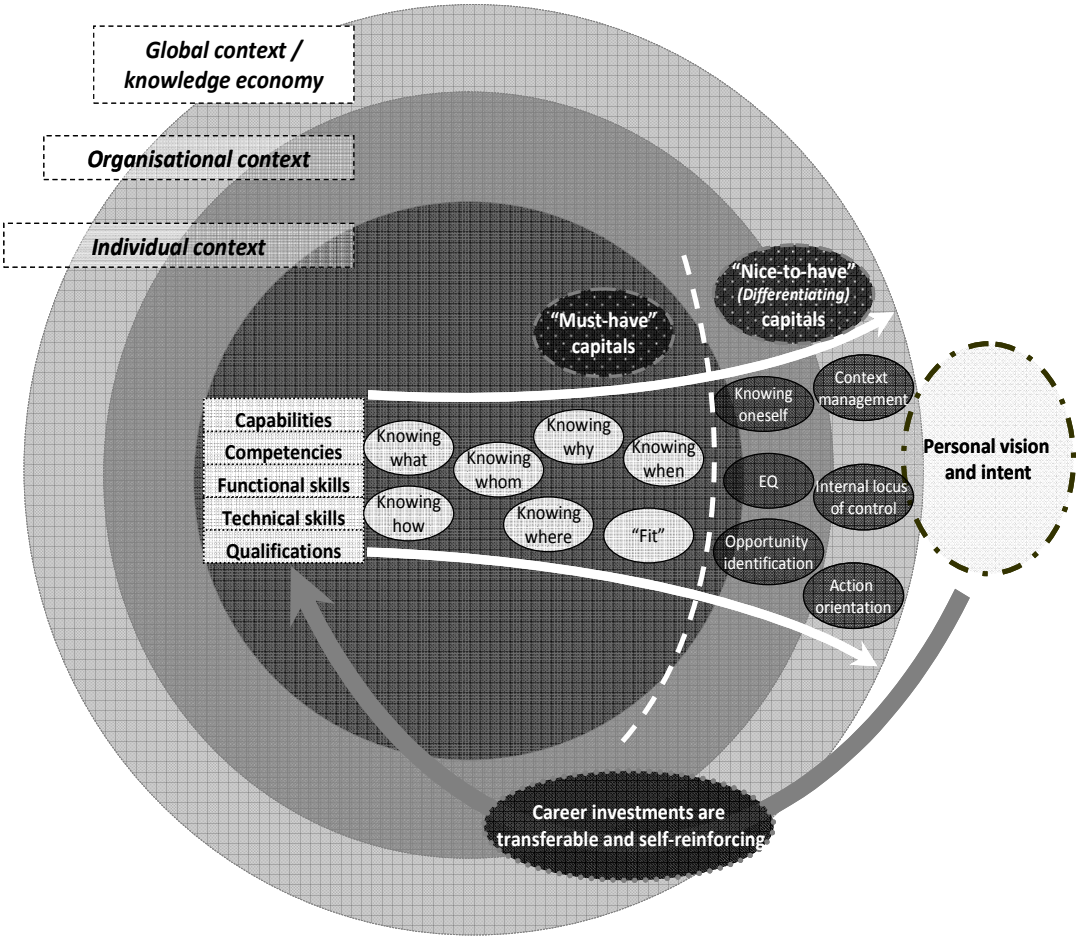


FIGURE 2: LAMB'S (2007) *DE FACTO* MODEL OF CAREER CAPITAL

Lamb's (2007) work on career capital resulted in a *de facto* model career capital illustrated in Figure 2. Lamb's (2007) model, developed through an empirical

exploratory study, shows how career capital exist in three contexts which are the individual, organisational and global context. The model further illustrates two different groups of career capital which are the “must have” capitals and the “nice to have” capitals where the “nice to have” capitals represent career differentials that add marginal value to a knowledge worker (Lamb, 2007). As the knowledge worker continues through their career they build career capital by moving from the inner circle towards the outer circle encouraged and directed by a personal vision and intent; and the process of enhancing and accumulating career capital has a reinforcing effect that is transferable across all three contexts. Lamb’s (2007) model, shown in Figure 2, is useful mechanism for contextualising the existence of the eight career capital components that are shown in Table 1.

2.7 How knowledge workers build career capital

Baruch (2006) describes the boundaryless career as career that is not constrained to a single career path within a single employer. The boundaryless career then encompasses many jobs external to a single organisation where the knowledge worker determines their chosen career path (Arthur and Rousseau, 1996, in Lamb, 2007). The knowledge based economy, with its emphasis on human capital, encourages knowledge workers to develop their capital and therefore drives career capitalistic (Inkson and Arthur, 2001) behaviour. In an examination of the changing nature of the work and organisations, Burke and Ng (2006) find that as industries have become more knowledge based, more emphasis has been placed on employees to continuously learn and update their knowledge and skills, essentially

growing their career capital. Inkson and Arthur (2001) recommend that career capitalists should think like financial capitalists in building career capital by understanding the marketplace, reinvesting their capital to seek higher returns and striving to accumulate fresh capital. The desire to build career capital and the boundaryless career creates a trend for the knowledge worker to move between organisations in the pursuit of opportunities that contribute to their personal and professional growth (Stahl, Miller and Tung, 2002).

Baruch and Hall (2004) describe a change in the traditional single lifelong career cycle to multiple shorter learning cycles that are driven by a changing environment as a result of technological, market and social/political change. Lamb's (2007) study revealed that individuals primarily accumulate career capital through developing a broad and deep level of experience in a diverse set of industries and organisations, a theory that is supported by Lazarova and Taylor (2009) who state that career capital is amassed through selecting and participating in activities that allow the accumulation of diverse knowledge, the opportunity to develop extensive professional networks and maintain high visibility, concepts that also surfaced in Lamb's (2007) findings. Knowledge workers therefore build career capital using the following key methods (Lamb, 2007):

- continual learning from experience and application of the learning into a new business context

- an effort to understand the political environment or the dynamics of the playing field within the organisation

- a concerted effort to build a social network and visibility within the industry

- continual challenging complacency by establishing a personal vision and establishing stretch goals that inspire, motivate and drive superior performance

2.8 The high-tech R&D industry and impacts of voluntary turnover

The high-tech R&D industry is characterised by long product development cycles and organisations employ a high level of technical capability to complete customised projects and solutions of a longer time frame (Farr and Beude, 2003). Examples are typical government projects such as communications satellites, launch vehicles, aircraft, deep space probes and military aerospace projects; representing systems with high complexity that are characterised by high technological risk and extreme design constraints (Farr and Beude, 2003). A key concern of the 21st century technical organisation is to keep a highly qualified and trained staff of engineers, scientists and technicians in a rapidly changing technological environment (Farr and Buede, 2003).

Abassi *et. al.* (2000, in Ongori, 2007) defines employee turnover as the rotation of workers around the labour market; between firms, jobs and occupations. Turnover of highly skilled employees is likely to be costly and disruptive for high-tech organisations (Reichheld, 1996, in Niederman, Sumner, and Maertz, 2006) as the

loss of highly skilled staff incurs explicit cost like the recruiting and re-skilling new employees to the hidden costs associated with difficulties associated with project completion in team based environments (Niederman and Sumner, 2003). Employee turnover has therefore both financial and non-financial costs associated with it. Sutherland and Jordaan's (2004) review of assumptions of cost impact of turnover reveals that the total costs associated with the loss of a single knowledge worker may be as high as 18 months salary.

Employee turnover brings discontinuities to project progress as team members leave the organisation. In addition to discontinuities, voluntary turnover contributes to the loss of tacit knowledge in the organisation as employees leave and it is the loss of tacit knowledge that is especially crucial in high-tech firms (Droege and Hoobler, 2003). Knowledge worker turnover affects an organisations' tacit R&D knowledge that is essential for new product development (Kazanjian, Drazin, & Glynn, 2000) and new product development is a critical competitive capability for high-tech R&D organisations.

The boundaryless career (Baruch, 2006) and the knowledge workers as career capitalists (Inkson and Arthur, 2001) are certain to contribute to voluntary turnover as knowledge workers pursue the accumulation of experience, knowledge and skills. The resulting mobility of the knowledge worker in the new economy presents challenges for organisations since the departure of key knowledge workers brings with it a loss of both tacit and explicit knowledge that is potentially coupled to an

erosion of the organisation's competitive advantage (Kinnear and Sutherland, 2000).

Many technology based companies are challenged with the retention of key R&D experts that are critical organisational resources (Chang, Choi, and Kim, 2008). An organisations R&D function is responsible for the application and creation of new knowledge; it is a team function which requires highly interactive team activities (Miller 1986, in Chang, Choi, and Kim, 2008). When R&D workers collaborate on projects a significant amount of knowledge sharing occurs (Oh, Choi, & Kim, 2006). The tacit knowledge inherent in the team interactions is vital to the success of the development project and turnover of R&D employees can result in discontinuities that negatively impact on schedule and ultimately cost (Chang, Choi, and Kim, 2008). Kochanski and Ledford (2001, in Chang, Choi, and Kim, 2008) estimate that the cost incurred in losing a R&D knowledge worker is three to six times that of loosing administrative personnel. So, voluntary turnover of R&D knowledge workers results in discontinuities in the development process that incurs costs for the high-tech R&D organisation.

Commitment-based human resource (HR) practices are based on the implementation of HR practices that demonstrate an organisation's long term investment in their employees (Tsui, Pearce, Porter and Tripoli, 1997, in Collins and Smith, 2006). The commitment based approach encourages the development of HR practices to influence an organisation wide social climate that encourages exchange and combination of knowledge amongst knowledge workers (Collins and

Smith, 2006). Collins and Smith (2006), in their investigation into 136 technology companies find that the leaders of high-tech firms should carefully choose the human resource practices used to manage their knowledge workers, because the practices are likely to shape the firms social contexts, which in turn affect the firm's ability to create the new knowledge necessary for high performance and growth. It is therefore extremely important that HR related employees are aware of the needs of knowledge workers in their organisations since it is the HR practitioners that have influence on the organisational policies that create the organisational climate.

Gaertner's (1999) review of turnover models reveals that job satisfaction and organisational commitment are commonly viewed as intervening variables in the turnover process. Chen, Chang, and Yeh (2003) find that, for R&D employees, the discrepancy between employee's career needs and the organisation's career development programmes is an important determinant of job satisfaction. Career capitalists (Inkson and Arthur, 2001) in the knowledge economy have specific needs for development of their career capital and the inability of the organisation to provide appropriate development impacts on job satisfaction which results in employee turnover. Sutherland and Jordaan's (2004) study that investigates the retention cognitions of knowledge workers finds that turnover intentions are typically impacted on by a knowledge workers desire for high levels of individualism, need for challenge and focus on personal development. The literature therefore suggests that organisations are likely to positively influence

employee turnover through improved career management policies that fulfil the needs of their employees.

As Hsu (2008) finds that organisational human capital is positively associated with organisation performance, human capital must therefore hold a degree of value for an organisation. Gardner (2005) describes human capital as consisting of both specific skills and general skills and states that the general skills become more relevant in the broader labour market. In contrast, with technological change proceeding at a relentless pace it would seem that R&D and high-tech workers should focus on the specific skills for their environment; and with Baruch (2006) highlighting the increased importance for knowledge workers to focus on building relevant and recognisable career capital, the question is what is most relevant to the R&D knowledge worker.

Examining the opinion of HR professionals, the young R&D knowledge workers and old R&D knowledge workers within the high-tech R&D environment will generate insight into both marketplace and organisational driven requirements. Investigating the opinions of the R&D knowledge worker creates an understanding of the knowledge workers requirements. The research therefore searched for an understanding of the perceptions of HR practitioners and the R&D knowledge workers.

2.9 Conclusion

The new world of work is characterised by a knowledge based economy where the key participants are knowledge workers (Drucker, 1994). The knowledge worker represents a key organisational resource that is part of the organisations intellectual property, the characteristic from which organisations in the knowledge based economy derive their competitive advantage (Meisinger, 2006). The knowledge worker contributes to the quality of an organisation's human capital (de Castro and Sáez, 2008) and human capital has been shown to positively influence organisation performance (Hsu, 2008).

R&D organisations ability to innovate defines the organisations competitive advantage, and its ability to innovate is determined by the quality of the organisation's intellectual property (Subramaniam and Youndt, 2005). Recent work in the area of knowledge workers reveals that knowledge workers do not exist in a homogenous group and knowledge creators provide the most value to an organisation (Brelade and Harman, 2007). Engineers and scientists are the predominant knowledge creators in high-tech R&D organisations and therefore compose the mass of the organisations intellectual property which impacts on the organisation's competitive advantage through its ability to innovate.

The new world of work represents a market place where knowledge is the commodity being traded between the knowledge worker and the organisation. The knowledge worker is therefore encouraged to accumulate knowledge in a manner that represents an investment activity (Harris, 2001). The accumulation of

knowledge within a career field builds the knowledge workers career capital that consists of the eight components identified through a consolidation of past literature as illustrated in Table 1. The pursuit of career capital spawned a new form of career, the boundaryless career, which is characteristic of knowledge workers moving between organisations in the search of experiences to accumulate career capital. The lifelong career has found a new form in a collection of learning cycles (Baruch and Hall, 2004) that is supported by the boundaryless career (DeFillippi and Arthur, 1994).

The high-tech R&D industry, characteristic of long product development cycles, is negatively impacted by the voluntary turnover of employees through project discontinuities that are created with the departure of knowledge workers (Chang, Choi, and Kim, 2008). Developing an understanding of how knowledge workers build career capital will give management a greater insight into the drivers of knowledge worker mobility. The improved insight may assist in retaining the highly valued knowledge workers that have become a scarce resource in the new world of work.

Lamb's (2007) study built on previous work to investigate the ways in which knowledge workers build career capital and results in four key concepts defining how knowledge workers build career capital. Lamb's (2007) concepts are a result of an exploratory research design with non probabilistic sampling and a relatively small sample of 18 (Lamb, 2007). The direct application of the model to the high-tech R&D environment has two shortcomings. Firstly, the implication of non –

probabilistic sampling is that the outcomes of the study cannot be generalised to a population with any level of confidence (Zikmund, 2003). Secondly, whilst the research attempted to generalise across all knowledge workers, the ability to draw generalisations from the exploratory study was not determined (Lamb, 2007). It would not be appropriate to generalise as there are indications that knowledge workers should be segmented (Brelade and Harman, 2007; Currie, Galliers and Galliers, 1999).

There has been significant depth of work on the knowledge worker in the knowledge economy and their pursuit of career capital accumulation to reveal key components of career capital. The area of work around how knowledge workers build career capital is growing and this study aims to build on previous exploratory studies to provide empirical evidence on the methods that knowledge workers in the high-tech R&D industry accumulate their career capital.

CHAPTER 3: THE RESEARCH QUESTIONS

This study aimed to clarify the career capital components that are relevant to the high-tech R&D industry and investigated how knowledge workers in this industry accumulate career capital by measuring the perceptions of key stakeholders in the environment.

Research Question 1. What are the components of career capital in a high-tech R&D industry and how are the components ranked in terms of importance?

Research Question 1 investigated the relevance of existing career capital literature, including Lamb's (2007) model, to the high-tech R&D environment. The existing literature, summarised in Table 1, has defined concepts related to career capital components but has not explicitly defined the components. This research question identified the explicit components that are used by R&D knowledge workers in the high-tech R&D environment and ranked the components in order of perceived importance. As management develops a better contextual understanding for career capital they will be better able to develop management practices that help retain valued knowledge workers and also to build a desired organisational brand that attracts scarce talent.

Research Question 2. **How do you build career capital in a high-tech R&D environment and how are the methods ranked in terms of importance?**

Research question 2 focused on the processes used by R&D knowledge workers to build career capital in the high-tech R&D environment. An improved understanding of how R&D knowledge workers perceive the importance of the different career capital accumulation methods will facilitate the design of improved career development strategies. With an improved understanding, HR practitioners will be better informed to tailor solutions that fit the requirements of the R&D knowledge worker.

Research Question 3. **What are the perceived differences in importance of career capital components and accumulation methods between R&D knowledge workers younger than 40 and R&D knowledge workers that are equal to and older than 40?**

Chen, Chang, and Yeh's (2003) review of career stage literature and age suggest that age can be effectively used to measure career stage. Career literature reveals a distinct turning point at the age of 40 (Super and Hall, 1978). The age of 40 is in the range of Cron's (1984) second career stage known as the career establishment stage and it is understandable that a turning point should surface before entrance into a new stage. Yeh (2008) suggests that this turning point may be more relevant to engineers than other professionals and since high-tech R&D knowledge workers are typically engineers and scientists, the population segmentation criteria will be defined by the age 40. Research Question 3 therefore investigated differences

between two distinct categories of R&D knowledge workers; those under 40 years of age and those equal to and above 40 years of age.

Research Question 4. In the high-tech R&D environment, are the perceptions of human resource practitioners different to the R&D knowledge workers?

Collins and Smith (2006), in their investigation into 136 technology companies, found that the leaders of high-tech firms should carefully choose the human resource practices used to manage their knowledge workers because the practices are likely to shape the firms social contexts, which in turn affect the firm's ability to create the new knowledge necessary for high performance and growth. The creation of new knowledge drives an organisation's R&D capability and ultimately determines the high-tech R&D organisation's competitive advantage through success of the projects (Chang, Choi, and Kim, 2008). The perceptions of HR practitioners shape the design of organisation wide policies and it is important that the perceptions of HR practitioners be aligned to the knowledge workers since policy design impacts on the quality of the working environment. Research Question 4 investigated if there are any differences in perceptions between R&D knowledge workers and HR practitioners in the high-tech R&D environment.

CHAPTER 4: RESEARCH METHODOLOGY

Lamb's (2007) model identifying the components of career capital was the result of an exploratory research design with non probabilistic sampling (Zikmund, 2003) and a relatively small sample of 18 (Lamb, 2007). The direct application of the model to the high-tech R&D environment has two shortcomings. Firstly, the implication of non-probabilistic sampling is that the outcomes of the study cannot be generalised to a population with any level of confidence (Zikmund, 2003). Secondly, whilst the research attempted to generalise across all knowledge workers, the ability to draw generalisations from the exploratory study was not determined (Lamb, 2007). It would not be appropriate to generalise as there are indications that knowledge workers should be segmented (Brelade and Harman, 2007; Currie, Galliers and Galliers, 1999).

The first phase of the research clarified Lamb's (2007) model through Research Question 1 in a qualitative study focused on knowledge workers in the high-tech R&D environment. Research phase two had a quantitative focus, that tested constructs identified in research phase one. This study was designed and implemented to build on Lamb's (2007) work by using a larger sample and to also be more specific by targeting the high-tech R&D industry.

4.1 Population and sampling frame

The research unit of analysis was defined as the perceptions of the individuals and the sampling frame was defined as those individuals that are in the employ of Denel Dynamics, that are involved in high-tech R&D related activities and that are

perceived to be high achievers in the organisation. Denel Dynamics is a supplier of aerospace products to both global and local niche market and generates revenues through the following three groups of activities:

- Research and Development (R&D) (50%)
- Production (40%)
- Support (10%)

Research and development is the predominant activity in the organisation with engineers, technicians and scientists comprising approximately 70% of the 800 employees. The sampling frame (Zikmund, 2003), defined by those in the employ of Denel Dynamics that are specifically involved in R&D activities is therefore suitable for the research into high-tech organisations as Denel Dynamics complies with the OECD definition.

Non-probability (Zikmund, 2003) sampling was used which means that any results cannot not be generalised to a population with any confidence. The sampling methodology was selected to suit the research objectives, methodology and focus for the different phases.

4.2 Research phase one

A qualitative investigation (Zikmund, 2003) formed the basis of phase one of the study. The qualitative research in phase one was used to develop constructs that were used in phase two. The constructs identified in phase one were used as

inputs to the questionnaire design phase, with the intention of creating a valid data collection instrument. This process ensured that the questionnaire was applicable to the population that was targeted in phase two of the research. Qualitative research is capable of producing large amounts of rich data and there must be a systematic and logical fashion in the manner in which the data is analysed (Miles and Huberman, 1984). Miles and Huberman (1994) describe data reduction as a process of selecting, focusing, simplifying, abstracting and transforming the data while the researcher elicits meanings and insights from the information communicated by the respondent (Appelton, 1995). The qualitative research in phase one was used to develop constructs that were used in phase two.

Phase one of the research took the form of a qualitative study where experience surveys (Zikmund, 2003) were used as the qualitative research technique. As exploratory information from an experience survey is not expected to be conclusive (Zikmund, 2003), research phase two followed with a quantitative descriptive study that further developed the understanding of the population of interest.

4.2.1 Population

The population was defined as knowledge workers within the high-tech industry and the sampling frame was the individuals within the employ of Denel Dynamics that were specifically involved in R&D activities and were perceived to be high achievers in the organisation.

4.2.2 Sampling

For the first phase a judgment sample (Zikmund, 2003) was used with the researcher identifying individuals that are capable of contributing to the understanding of the research problem. The judgement sample was selected to ensure that perceptions from diverse role players across the population were investigated to develop a more comprehensive understanding of career capital components and accumulation methods within the high-tech R&D environment. The sample size was ten and the details of the individuals that made up the sample are listed in Table 2.

TABLE 2: SAMPLE CHARACTERISTICS OF QUALITATIVE INTERVIEW RESPONDENTS

NUMBER OF RESPONDENTS	INDIVIDUAL TYPES
1	HR consultants
2	HR executives/managers
3	Line-management/Engineering Group Managers
2	Engineers below 40 years of age
2	Engineers above 40 years of age

4.2.3 Data collection

Data was collected through expert interviews that were guided by the interviewer schedule, shown in Appendix C.1., detailing the introduction and open ended questions that were applied. A total of ten interviews were held with each interview lasting approximately one half hour.

Exploratory interviews demand high interpersonal skills of the interviewer. Skills like putting the respondent at ease, asking questions in an interested manner, recording responses without interrupting the conversational flow and giving support without introducing bias must be used during the interviews (Oppenheim, 1992). In order to maintain consistency and increase the reliability of the data collection process, the same process was followed with each participant. The interviews began with the researcher introducing the participant to the concept of career capital by giving participants the opportunity to read through an introductory paragraph on career capital, shown in Appendix C.1.

Interviews began by placing the respondent at ease by speaking about general issues like sport and recent news events. Data collection during the interviews was accomplished by the researcher drawing mind maps of the conversation and using shorthand to record comments. This not only facilitated the conversational flow but also allowed the interviewer to build an understanding of what the respondent was attempting to communicate. The interviews proceeded with careful interaction from the researcher to limit interviewer bias (Zikmund, 2003) by limiting probing questions to:

- Why do you think that is a component?
- What else would you consider to be components?
- If you think back along your career what do you think you have developed along your career? How have you developed it?

- If you look at your colleagues, can you identify any other components of career capital? How have they built it?

Experienced researchers acknowledge that the key to coding the responses of open ended questions is to base the code building on thoughts and not just words (Zikmund, 2003); so the key task of an interviewer is to record ideas and not just data (Oppenheim, 1992). The recording of thoughts with mind maps greatly facilitated the analysis process where ideas were analysed to reveal common themes across the interviews.

4.2.4 Data analysis

Phase one of the research was designed and planned to reveal those career capital components and accumulation methods that are perceived to be essential in the high-tech R&D industry. The data analysis needed to reveal the career capital components and accumulation methods that were relevant to R&D knowledge workers. The analysis proceeded by identifying common themes in the primary data that was collected during the expert interviews. The perceived importance of common themes in qualitative primary data was determined through content and frequency analysis (Miles and Huberman, 1994). Data analysis comprised of first coding the data, then performing content analysis and finally performing a frequency analysis.

The coding of the data began with the researcher becoming familiar with all the mind maps by repeatedly studying them and building codes that represents

common themes of career capital components. The process began with the creation of a summary table, Appendix B, which listed themes and thoughts per participant. The next step involved coding the data by carefully analysing and internalising the thoughts of the participants to reveal the common themes across the participants so that similar thoughts could be collated.

The coding revealed career capital components that were more defined than the abstract constructs identified during the literature review. The next stage of the analysis involved cross referencing the more defined components to the more abstract components from the literature review. The cross referencing allowed the creation of links between the more defined or explicit components and the literature review constructs. Methods used to build or accumulate career capital were also identified through a similar coding process that examined the perceptions of the interview participants.

This process was used to determine the constructs most applicable to the high-tech R&D environment. The identified constructs were used to focus the data extraction in phase two of the research through customisation of the data collection instrument to the high-tech R&D environment.

4.2.5 Assumptions and limitations

The respondents were selected by the researcher and the key selection criteria were the researcher's accessibility to the respondents as well as the researcher's assessment of the individuals that will be suitable. The mix of convenience and

judgment sampling methodology is non-probabilistic in nature which means that any results cannot be generalised to a population with any confidence (Zikmund, 2003).

The qualitative interview process has the potential to introduce a systematic error in terms of response bias and interviewer bias (Zikmund, 2003). In order to begin each interview from a similar baseline, a brief written introduction, available in Appendix C, was prepared as an introduction for each participant to ensure that they have the relevant background knowledge to understand the concepts being investigated. It was assumed that each participant would have interpreted the passage in the same way.

4.3 Research phase two

4.3.1 Research method

The research phase took the form of a quantitative descriptive study implemented through survey research with the use of self-administered questionnaires (Zikmund, 2003). Research phase two began with design of a questionnaire based on career capital constructs that were identified in the literature review as well as those constructs revealed through the qualitative phase one study. The questionnaire design was pre-tested in a pilot phase; the design was then modified accordingly and then distributed to the research sample. The following two sections elaborate on the questionnaire design and the pre-testing.

4.3.1.1 Questionnaire design

The key purpose of the questionnaire was to determine attitudes of respondents towards the constructs identified in the literature review and the qualitative interviews. This would reveal a ranking of the perceived importance of the various constructs in the population of interest. Attitudinal scales are used to determine the attitudes of respondents to a particular issue (Kumar, 2005; Zikmund, 2003; Oppenheim, 1992). In an early study, Kassarjian and Nakanishi (1967) compared the efficacy of seven methods typically used in marketing research to measure attitudes, opinions and beliefs and showed that the Likert type scale was as effective as other popular methods to measure and rank attitudes. The Likert scale, a summated ratings method, is popular for measuring attitudes (Gob, McCollin, and Ramalhoto, 2007; Zikmund, 2003) and was used to measure the attitudes of respondents to the career capital constructs of interest.

A questionnaire's relevancy is determined by the necessity of the information that is collected (Zikmund, 2003). The questionnaire design was constrained to the information that was required for the specific research questions and was reviewed by three experts to highlight flaws and suggest recommendations. This ensured that no unnecessary information is collected and that the research questions will be answered by the data collected through the questionnaire.

The questionnaire design process proceeded with the following guidelines to improve the quality of the questionnaire (Oppenheim, 1992; Zikmund, 2003):

- words were carefully selected to eliminate ambiguity
- burdensome complex words were not used
- double barrelled statements covering more than one issue were avoided
- complexity was minimised by using simple conversational language that was relevant to the population of interest
- leading or loaded questions were avoided

In addition to specifying constructs, the questionnaire design incorporated open areas for respondents to specify constructs they felt were not addressed. This design was incorporated to improve the quality of the data since there could have been constructs that did not surface in the literature review or phase on qualitative interviews, especially considering the limited sample of qualitative interviews that was inevitable due to time and resource constraints.

4.3.2 Questionnaire pre-testing

The questionnaire design phase was followed by a pilot phase that tested the efficacy of the questionnaire to extract the data of interest. The pilot phase involved subjecting the designed questionnaire to pretesting by carrying out trial runs with a group of six typical respondents selected on a convenience basis. Pretests allow the researcher to detect problems with the questionnaire instructions and design (Zikmund, 2003). During the pretesting phase the researcher searched for evidence of ambiguous questions, evidence that questions have the same

interpretation to all respondents, evidence of potential misunderstanding and signs of participant fatigue and loss of interest.

The pretests identified constructs that were ambiguous, incomprehensible and were absent from the vocabulary of the population of interest. Synonyms were identified through discussion of the constructs with pretest participants and were added for greater clarity and understanding. There was often no unique manner to express the idea behind a construct to all participants in a single term so potentially ambiguous constructs were defined by using multiple terms to correctly define the construct.

Respondents also considered the questionnaire to be lengthy and commented that the long lists of concepts suggested a lengthy questionnaire. The daunting task of completing a lengthy questionnaire discouraged enthusiastic participation and left some pretest participants unwilling to give the survey questions their undivided attention. Respondents tend to be more cooperative if the questionnaire is not lengthy and difficult to understand which leads to a higher probability of obtaining unbiased answers (Zikmund, 2003). The questionnaire structure was revised to group questions into categories so that the impression of a lengthy exhaustive questionnaire was minimised for increased accuracy in the data collection process. The outcome of the pretesting process was the final questionnaire that was used as the data collection instrument for phase two of the study and is shown in Appendix C.2.

4.3.3 Evaluating the measuring instrument

Measuring instruments, like questionnaires, may be evaluated in terms of reliability, validity and sensitivity (Zikmund, 2003). The content validity of the questionnaire was verified by subjective agreement by an expert in the field that has experience in the theoretical concepts as well as experience in conducting research in the field of interest.

The reliability of the questionnaire refers to the ability of the questionnaire to provide consistent results and may be determined using the test-retest method that involves administering the questionnaire to the same respondents at two different times to test for stability (Zikmund, 2003). The questionnaire was subjected to the test-retest method using two participants that completed questionnaires one week apart. The testing revealed that where respondents felt strongly toward a particular attitude, i.e. their response was either one or five on the Likert scale, their response did not change. Where changes were measured, the changes varied by a single increment from the original response and did not change drastically. The small changes in attitude did not warrant a change in the design of the questionnaire as attitudes of respondents are likely to change to a small degree over a period of time (Zikmund, 2003).

4.3.4 Population

The target population is the complete group of specific population elements relevant to the research project (Zikmund, 2003) and was defined as all knowledge workers within the high-tech R&D industry. The sampling frame defines the list of

elements from which the research sample must be drawn within the target population (Zikmund, 2003). Denel Dynamics is an organisation that operates in the high- tech R&D industry with high numbers of R&D knowledge workers in its employ. The sampling frame for the research was therefore defined as the R&D knowledge workers within the employ of Denel Dynamics with the sampling unit being the individual or employee.

4.3.5 Sampling

The second phase was characterised by a non-probability (Zikmund, 2003) sample generated through a quota sampling (Zikmund, 2003) technique that introduces a stratification of the population. The population was stratified, using age as a key criterion, into two groups:

- knowledge workers under 40 years of age
- knowledge workers equal to and over 40 years of age

An additional stratification was designed to investigate perceptions of the HR personnel within the high-tech R&D environment.

The target quota sample size was 20 participants from each age group. In addition to the R&D knowledge workers, the data collection instrument was applied to HR practitioners within the high-tech R&D environment. The small number of HR employees within the organisation imposed restrictions and limited the sample size. The sample demographics that were achieved are listed in Table 3.

TABLE 3: SAMPLE CHARACTERISTICS FOR QUANTITATIVE STUDY

Number of Respondents	Individual types
5	HR practitioners (consultants/ executives/managers)
29	Engineers below 40 years of age
25	Engineers equal to and above 40 years of age

The targeted quota size of 20 participants for each of the two groups represented a small sample and in an attempt to increase data quality it was initially decided to target only those individuals that were perceived as high achievers or high performers in the sampling frame. Snowball sampling is useful in locating members of rare populations (Zikmund, 2003) and was used to yield the achieved quota in each stratified group as recorded in Table 3. Initial respondents in a snowball sample are typically selected by probability samples (Zikmund, 2003) but the requirement of targeting high achievers did not support the use of a probability sample within the sampling frame as the methodology did not allow for the selection of high performers only.

To ensure that only high performers were selected the initial respondents were identified using a judgement sampling methodology and were selected using the following process:

- a candidate list of high achievers was identified using senior managers recommendations at the highest level in the organisation's structure
- a second candidate list of high achievers was identified by searching for R&D knowledge workers that assume positions at the highest level in the organisation's structure

- candidates that were common in the two lists were targeted for the initial participants of the snowball sample

The selection process that was used increased the probability of identifying and targeting the high achievers within the sampling frame.

4.3.6 Data collection

Primary data for phase two was collected by means of a self administered questionnaire first distributed by hand delivering paper copies and then distributed electronically via email. The decision to add the email option was made as result of potential respondents preferring an electronic version of the survey to paper copies. Although email distribution has the advantages of speed and quick response but response rates may be affected by respondents concerns over anonymity (Zikmund, 2003). To allay fears of anonymity an electronic channel was setup to allow respondents anonymously upload data to a secure location. To further enhance response rates, data collection was supported by an anonymous return channel in the form of an organisation wide internal physical mail system that did not track or record the sender. Respondents could address mail to the researcher and drop off at various mail collection points within the organisation. The best response rates were achieved when the interviewer personally introduced himself to potential participants and then distributed the questionnaire via email.

4.3.7 Data analysis

The data analysis phase in a research study transforms raw data into information and typically includes 4 phases (Zikmund, 2003):

- Editing
- Coding
- Data Entry
- Data Analysis

The following sections describe the activities for the various phases.

4.3.7.1 Editing, coding and data entry

The collected data was subjected to an editing process in order to check and adjust data for omissions, legibility and consistency. Completed questionnaires were checked for omissions to summative scores for each construct and consistency between years of experience in high-tech R&D environment and the age of the individual. Three questionnaires included an item nonresponse (Zikmund, 2003) where the respondent did not specify a response for a construct. The decision rule for item nonresponse was to use a neutral plug value (Zikmund, 2003). It was assumed that this omission was unintentional and midpoint Likert response, response three (3), was assumed for these entries as a neutral plug value.

The editing phase was followed by a coding phase where the categorical data was allocated a numerical score to facilitate transfer of the data from survey to computer (Zikmund, 2003). The respondent demographic data codes and the Likert response codes are defined in the questionnaire shown in Appendix C.2. The open ended responses were coded in order to extract information from the responses and facilitate data capture. Open ended questions must be coded to reduce the large number of individual responses to a few general categories in order to identify common themes (Zikmund, 2003).The common themes were stored as fields. On completion of the coding process, data was captured onto a computer spreadsheet to facilitate further processing and analysis.

The final stage in the coding process was an error checking and verification or “data cleaning” (Zikmund, 2003) stage. The purpose of this stage was to ensure that all codes were legitimate. All codes were checked to ensure that the codes associated with particular fields were within the expected range. For example, all responses to the construct were checked to ensure that entries fell within the 1 to 5 interval range. The data analysis stage then followed and is described in the section that follows.

4.3.7.2 Descriptive statistics

The data analysis was accomplished by means of a descriptive analysis (Zikmund, 2003) of the collected data with the purpose of answering the research questions defined in chapter three. The first stage of the analysis resulted in a simple tabulation of the frequencies of the different Likert responses that resulted in the

frequency table (Zikmund, 2003) that is shown in Appendix D.1. The table reflects the responses from the R&D knowledge workers in the organisation, of all ages, and excludes the responses of the HR respondents. The HR respondents were treated separately and the frequency table is shown in Appendix D.2.

Zikmund (2003) describes data transformation as the process of changing data from their original form into a format that is more suitable to perform data analysis. The data analysis stage continued to facilitate extraction of information from the data in an attempt to answer the defined research questions and explore the data. The mode (Albright, Winston, and Zappe, 2006) for each set of Likert responses was calculated to reveal the Likert response that was most popular for each construct. The median (Albright, Winston, and Zappe, 2006) of all responses for a particular construct was also calculated to reveal the middle point on the responses. Both the mode and median were used as measures of the central tendency (Albright, Winston, and Zappe, 2006) of the response for a particular construct.

4.3.7.3 Ranking the constructs

The need to rank the perceived importance of career capital constructs to the population of interest stemmed from the information required to answer the research questions defined by this study. The ranking procedure required a weight to be assigned to each construct in order to determine the respective importance of each construct. The Likert scale allows researchers to measure attitudes by assigning weights to the possible responses on the scale. If the items on the Likert

scale are assigned numerical values, the numerical values of the items on the Likert scale can be summed to arrive at an overall score (McCall, 2001) that represents their weight, or importance within the defined set of constructs.

Each construct's weight was calculated by multiplying the integer value allocated to the scale response by the total number of responses for that scale value. The calculation used is described by the following formula:

$$ConstructWeight = \sum_{k=1}^{5} k.(\text{Total number of response for item k})$$

Where: Total number of responses for item k: The number of responses for each Likert scale value was determined; i.e. the number of respondents that selected each possible response (k=1, 2, 3, 4, and 5).

The calculation revealed a weight for each construct, called the weighted sum, which indicated the level of importance by the magnitude of the value. This meant that the higher the weighted sums value, the greater constructs importance. The weighted sum was used as a primary criterion for ranking the constructs and where construct weighted sums were equal, the scale mode was used as a secondary ranking variable or criteria. The scale mode was defined as the Likert scale response (*k* in equation above) that occurred the most frequently in all the responses for a particular construct. If two constructs had an equal weighted sum

then the scale mode was used, with a higher scale value giving the construct a greater rank.

The method used in ranking the constructs is relevant and applicable to the primary data because the questionnaire design only incorporated statements that were positive toward attitude. Strong agreement toward a statement, or construct, was indicated by the most favourable attitudes on the Likert scale and was assigned the maximum weight of five on the Likert scale, where five represents the highest possible value.

4.3.7.4 Testing the difference between groups

The Research Question 3 required investigating differences in perceptions between two groups, those under 40 and those equal to and above 40 years of age. Additional statistical methods were required to analyse the data in order to provide information for investigating the research problem. The collected data was analysed for differences by comparing the median value of responses for each construct in the age groups of interest. Differences between the two groups were tested using the Mann-Whitney U test (Zikmund, 2003).

Statistical procedures can be classified into two major groups, the parametric and nonparametric methods (Zikmund, 2003). The Mann Whitney U test falls in the nonparametric group (Zikmund, 2003). The major distinction between the two groups lies in the assumptions about the data that is analysed, specifically about the normality of the sampling distribution(Zikmund, 2003). Nonparametric methods

avoid the error caused by assuming that a population is normally distributed when it is not (Zikmund, 2003). The Mann Whitney U test was used because the sampling methodology used did not allow any concrete assumptions about the sample data and also because of the small sample size.

Research Question 4 required studying the perceptions of the HR practitioners and comparing it to the sample of engineers and scientists. A Kruskal-Wallis Z test (Dunn's Test) (Dunn, 1964) was used to test for differences in central tendency between the three different groups that were defined as:

- those under 40 years of age
- those equal to and over 40 years of age
- those involved in the HR function within the high-tech R&D environment

The one-way analysis of variance (ANOVA) compares the means of two or more groups to determine if at least one group's mean is different from the other (Hintze, 2007). Multiple comparison methods can be used to determine how the groups differ in their measures of central tendency (Hintze, 2007).The Kruskal-Wallis Z test is a method for multiple comparisons and is a non-parametric test that does not use the normality assumption and requires a minimum of five samples (Hintze, 2007). The minimum sample size requirement of five was achieved since the group with the smallest sample was the HR group with five samples. The Kruskal-Wallis Z test was therefore used to facilitate multiple comparisons for data that was not guaranteed to have a normal sampling distribution.

4.3.8 Assumptions and limitations

The questionnaire reliability test was conducted using a small test set of respondents. A greater number of test participants will provide greater insight into the reliability of the measuring instrument. A more comprehensive test was not conducted due to time constraints. Validity was assumed to be of greater importance than reliability as a reliable but invalid instrument will yield consistently inaccurate results (Zikmund, 2003).

The research design made provision to collect demographic data that would facilitate stratification and identify those respondents that were involved in management. This was done with the intention of comparing managements' perceptions with those of the engineers and scientists involved in the R&D work. All respondents that could be classified as management were either engineers or scientists that were still involved in technical development activities. For this reason it was assumed that these respondents could be classified as either engineers or scientists and therefore R&D knowledge workers.

Snowball sampling formed the main sampling philosophy for phase two of the research and has the disadvantage of introducing a high bias as sample units are not independent (Zikmund, 2003).The quota, judgment and snowball sampling techniques are non-probabilistic in nature which means that projecting the data beyond the sample is inappropriate (Zikmund, 2003).

CHAPTER 5: RESULTS

This section presents the results obtained from the data collection and analysis phase. The first phase of the research involved a qualitative study that investigated the constituent components of career capital and the methods with which knowledge workers accumulate career capital in the high-tech R&D environment. Research phase two had a quantitative focus that tested the constructs identified in phase one of the research. A detailed discussion of the data analysis methodology is presented in the preceding chapters. The data analysis was designed with the intention of answering the research questions described in Chapter three. An overview of the consistency of the study showing relationships between research questions, relevant literature, data collection methodology, data analysis methods and results are shown in Appendix A.

This chapter consists of two major sections; the first section reveals the results of the qualitative study and the second section shows the results of the quantitative descriptive study that used questionnaires as a data collection instrument.

5.1 Results of qualitative interviews

The qualitative research in phase one developed constructs that were used in phase two as inputs to the questionnaire design phase. This process created a valid data collection instrument that was applicable to the targeted population. The interview participants were identified through a judgment sampling methodology (Zikmund, 2003) that achieved a sample size of ten with demographics as shown

in Table 4. The sample was selected to study perceptions from a diverse group of role players within the high-tech R&D environment.

TABLE 4: SAMPLE CHARACTERISTICS OF QUALITATIVE INTERVIEWS RESPONDENTS

Number of respondents	Individual types
1	HR consultants
2	HR executives/managers
3	Line-management or Engineering group managers
2	Engineers below 40 years of age
2	Engineers above 40 years of age

The qualitative interviews focused on collecting data to address the following research questions:

- Research Question 1: What are the components of career capital in a high-tech R&D industry and how are the components ranked in terms of importance?

- Research Question 2: How do you build career capital in a high-tech R&D environment and how are the methods ranked in terms of importance?

The data recorded during the interviews was analysed for common themes across the interviews. The analysis began by creating a raw data table which contained all the individual responses so that all the data could be easily and collectively viewed to facilitate the extraction of common themes. The raw tabulated data was then examined for common themes and the table was modified by replacing similar

themed responses with a specific construct. For example interviewees' responses of "Understanding of cost versus performance" and "Pragmatic understanding" was grouped into the construct "Understanding of the bigger picture/Systems view/ Pragmatic Understanding".

The next section presents the findings related to the components of career capital while the findings related to career capital accumulation methods are presented in the subsequent section.

5.1.1 Career capital components

The answer to Research Question 1 required the identification of those career capital components that are relevant to the high-tech R&D environment. A clear understanding of the relevant career capital components also creates a base from which to examine if there were any differences between knowledge workers in general and those that were involved in the high-tech R&D industry.

Table 5 lists all the career capital components that were identified and an example of the raw data table is shown in Appendix B. The components of career capital uncovered in the literature review included the economic capital component but this component did not surface during the interviews.

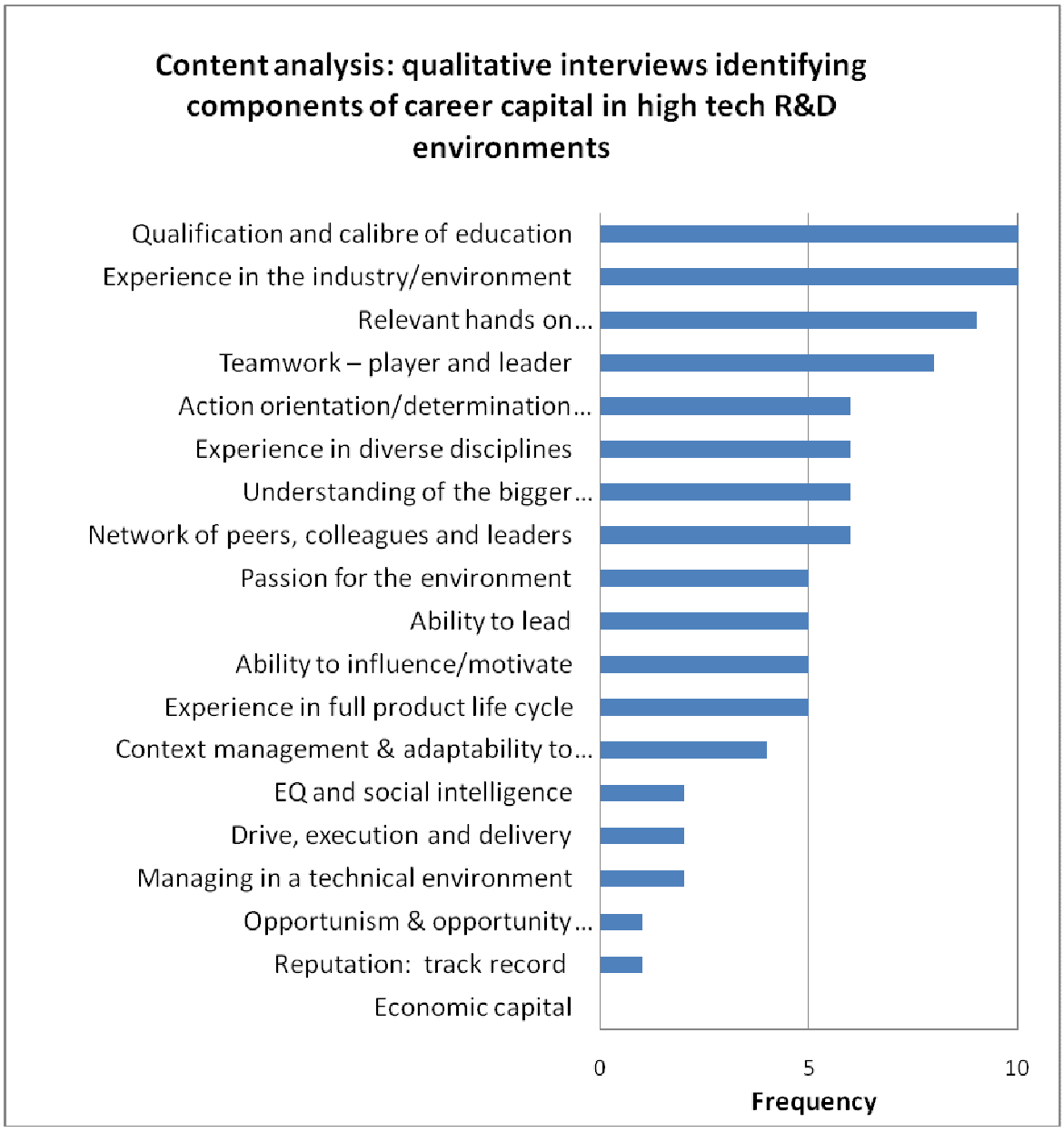
Passion for the environment was a component that did not appear in the literature but did reveal itself in the qualitative study. Table 5 also shows each career capital component's frequency of occurrences which gives an indication of the popularity of the various components within the high-tech R&D environment.

TABLE 5: CAREER CAPITAL COMPONENTS IDENTIFIED DURING INTERVIEWS

Literature review 9 components of career capital	**Identified in interviews**	**Frequency**
Economic capital	Economic capital	0
Knowing whom	Network of peers, colleagues and leaders	6
	Teamwork – player and leader	8
	Reputation: track record – as their track record grows within the organisation, their networks broaden (Lamb, 2007)	1
Knowing why	Experience in the industry/environment	10
	Experience in full product life cycle	5
	Understanding of the bigger picture/systems view/ pragmatic understanding	6
	Experience in diverse disciplines	6
Knowing how	Managing in a technical environment	2
	Drive, execution and delivery	2
	Relevant hands on knowledge, applicable skills	9
	Qualification and calibre of education	10
Knowing what	Context management & adaptability to environment	4
Knowing when & where	Opportunism & opportunity identification	1
Knowing oneself	EQ and social intelligence	2
	Ability to influence/motivate	5
	Ability to lead	5
Action orientation	Action orientation/determination perseverance	6
Not identified in literature review	Passion for the environment	5

The frequencies of occurrences were ranked and plotted on a bar graph, shown in Figure 3, to present a visual report that would facilitate the comparison of the different career capital components. The quality and calibre of education as well as experience in the industry rank amongst the components of highest importance.

FIGURE 3: OCCURRENCES OF CAREER CAPITAL COMPONENTS IN QUALITATIVE INTERVIEWS



Note: Full text of constructs is visible in Table 5.

The career capital components that were identified during the interviews were more specific than those identified in the literature review. For example, respondents referred to “Teamwork” and “Network of peers” as specific

components of career capital; these components can be grouped into the "Knowing whom" category of career capital as found in the literature review. Table 5 shows the link between the specific components identified during the interviews and the more abstract definitions of career capital components that were identified through the literature review. The frequency of occurrence of the abstract definitions as well as the rank relative to each other is illustrated in Figure 4.

FIGURE 4: OCCURRENCES OF CAREER CAPITAL COMPONENTS CATEGORIES THAT WERE IDENTIFIED IN THEORY

This section has identified career capital components that are relevant in the high-tech R&D environment. The following section discusses the typical methods used to accumulate career capital in the high-tech R&D environment.

5.1.2 Methods used to build career capital

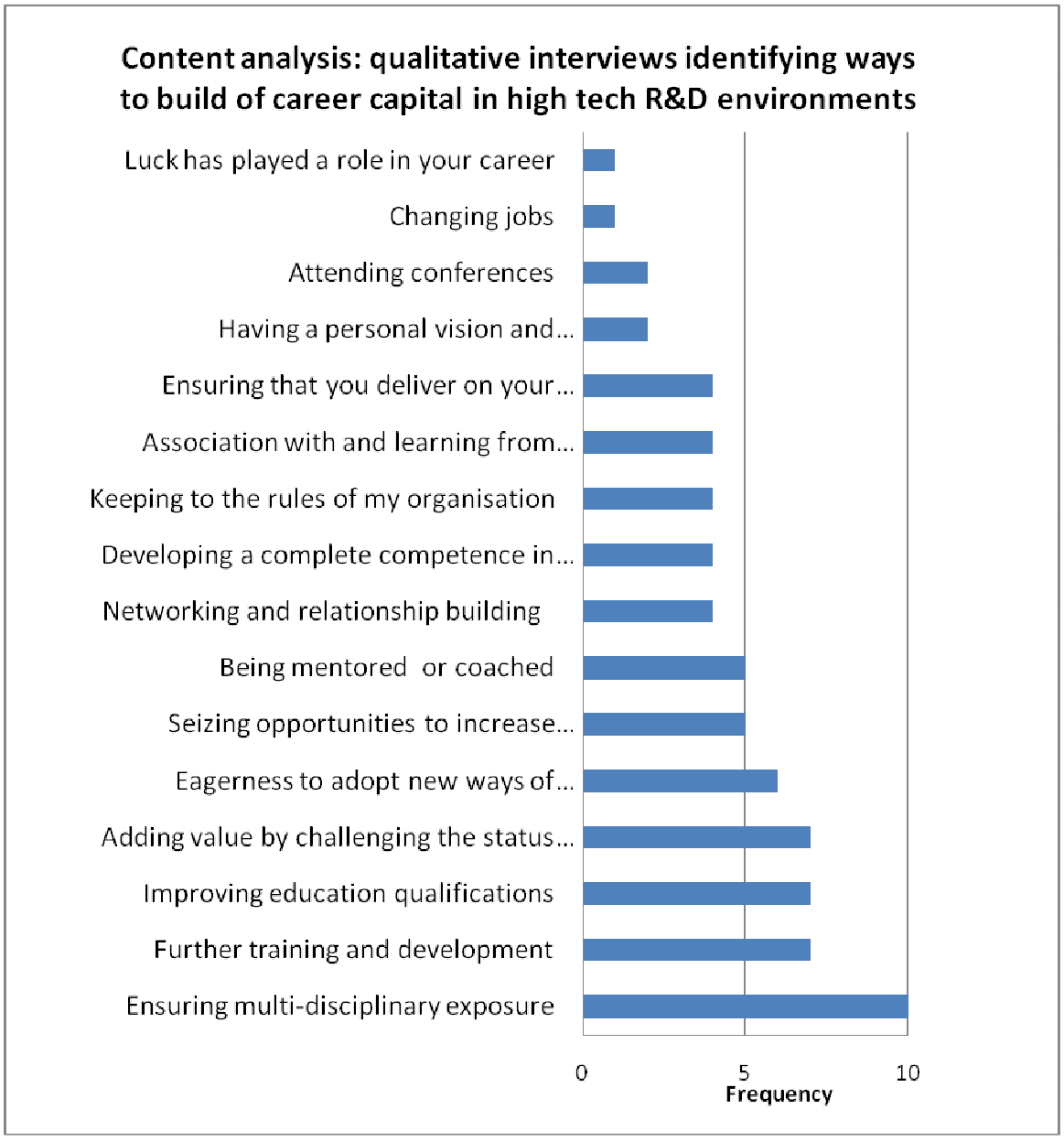
The ways in which career capital is accumulated was also investigated for the purpose of answering Research Question 2 that queried the methods used in the accumulation of career capital. The qualitative data was analysed with the same methodology used to identify the constitute components of career capital, described in section 5.1.1), and the ranked results are shown in Table 5.

TABLE 6: CAREER CAPITAL ACCUMULATION METHODS IDENTIFIED DURING INTERVIEWS

Rank	Ways to accumulate career capital	Frequency
1	Ensuring multi-disciplinary exposure	10
2	Further training and development	7
3	Improving education qualifications	7
4	Adding value by challenging the status quo	7
5	Eagerness to adopt new ways of working; innovation in the way you work	6
6	Seizing opportunities to increase visibility	5
7	Being mentored or coached	5
8	Networking and relationship building	4
9	Developing a complete competence in your role before seeking new opportunities	4
10	Keeping to the rules of my organisation	4
11	Association with and learning from successful individuals	4
12	Ensuring that you deliver on your promise	4
13	Having a personal vision and development plan	2
14	Attending conferences	2
16	Changing jobs	1
17	Luck has played a role in your career	1

Table 5 lists the accumulation methods and ranks the level of importance as perceived by individuals in the high-tech R&D environment. A graphical representation of the results is shown in Figure 5.

FIGURE 5: OCCURRENCES OF THE METHODS USED TO BUILD CAREER CAPITAL THAT WERE REVEALED IN QUALITATIVE INTERVIEWS



Note: Full text of constructs is visible in Table 6

The results suggest that for knowledge workers involved in the high-tech R&D environment, ensuring that one has a multidisciplinary exposure and ensuring that one adds value through challenging the status quo is amongst the most popular ways in which to accumulate career capital.

The qualitative study formed phase one of the research and the constructs identified during the interviews were used as a foundation for building the questionnaire that was used for data collection in phase two of the research. The results of phase two is presented in the following section.

5.2 Results of research phase two

Phase two of the research took the form of a quantitative descriptive study implemented through survey research with the use of self-administered questionnaires (Zikmund, 2003). Research phase two began with the design of a questionnaire based on the career capital constructs that were uncovered in literature review and the qualitative phase one study. The initial questionnaire design was pre-tested on six respondents in a pilot phase, modified then completed by a total of 59 respondents with demographics as detailed in Table 7.

TABLE 7: SAMPLE CHARACTERISTICS FOR QUANTITATIVE STUDY

Number of Respondents	Individual groups
5	HR practitioners (consultants/ executives/managers)
29	Engineers below 40 years of age
25	Engineers equal to and above 40 years of age

Phase two of the research was targeted at answering the following research questions:

- Research Question 1: What are the components of career capital in a high-tech R&D industry and how are the components ranked in terms of importance?
- Research Question 2: How do you build career capital in a high-tech R&D environment and how are the methods ranked in terms of importance?
- Research Question 3: What are the perceived differences in importance of career capital components and accumulation methods between R&D knowledge workers younger than 40 and R&D knowledge workers that are equal to and older than 40?
- Research Question 4: In the high-tech R&D environment, are the perceptions of human resource practitioners different to the R&D knowledge workers?

The data was analysed with descriptive statistical methods and the results are presented in the following sections.

5.2.1 Components of career capital in the high-tech R&D industry

The survey questionnaire collected data on 27 variables that measured the perceived importance of certain career capital components that are relevant in the high-tech R&D industry. Research Question 1 queried the ranking of the components and required the examination of the variables with respect to each other with the purpose of measuring the popularity of the constructs amongst respondents. The ten most popular career capital components are shown in Table 8 as perceived by the total sample of 59 respondents.

TABLE 8: TOP TEN RANKED CAREER CAPITAL COMPONENTS OF THE ENTIRE SAMPLE

		All Data (ex HR)							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
1	Self motivation and drive	242	5.0	5	0	0	3	22	29
2	Technical ability (To know how)	239	5.0	5	0	0	6	19	29
3	Determination and perseverance	239	4.5	5	0	0	4	23	27
4	A comprehensive technical understanding. (To know why)	237	4.0	4	0	0	4	25	25
5	A practical or pragmatic understanding of the technical and working environment	230	4.0	4	0	1	2	33	18
6	Ability to participate in a team (team player)	224	4.0	4	0	1	9	25	19
7	People skills; having good working relationships	223	4.0	4	1	1	7	26	19
8	Being known for delivery and execution	220	4.0	4	1	1	6	31	15
9	Educational qualifications	216	4.0	4	0	2	12	24	16
10	Passion for the industry environment	213	4.0	4	1	3	11	22	17

Colour Key:

	Modal response
	Top 10 ranked sums

The mode of each variable was examined to show the most popular response for the sample and the median was used to examine the central tendency of the responses. In order to facilitate comparison of the components of career capital, a

weighted sum was calculated for each variable using the method described in section 4.3.7.3. The calculated weighted sum allowed each construct to be ranked relative to each other. Table 8 lists the frequency of responses under each Likert scale value and a scale value of 5 indicates a high level of agreement of the importance of the construct. A total of 27 variables were tested and the components that ranked from 11 to 27 are listed in Table 9.

TABLE 9: RANKING OF THE PERCEIVED IMPORTANCE OF OTHER CAREER CAPITAL COMPONENTS OF THE ENTIRE SAMPLE

		All Data (ex HR)							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
11	Flexibility and adaptability; Ability to adapt to various environments	212	4.0	4	1	1	9	33	10
12	Relevant hands on knowledge	208	4.0	4	0	1	16	27	10
13	Action orientation	205	4.0	4	0	3	14	28	9
14	Knowing yourself or emotional Intelligence.	202	4.0	4	1	4	15	22	12
15	Ability to influence/motivate	201	4.0	4	1	7	10	24	12
16	Personal reputation	199	4.0	4	0	6	13	27	8
17	Knowledge and understanding of entire product life cycle or a system view	196	4.0	4	0	9	15	17	13
18	Ability to lead a team (team leader)	186	3.5	4	0	10	17	20	7
19	Experience in industry	186	3.5	3	3	4	20	20	7
20	Understanding your reactions and feelings to different situations	186	3.0	3	2	4	24	16	8
21	Networking within the organisations	185	4.0	4	4	6	16	19	9
22	Multi disciplinary experience	183	3.0	3	1	8	21	17	7
23	Understanding challenges of managing in your industry and working environment	179	3.0	3	1	8	22	19	4
24	Business acumen; understanding of the business bigger picture	172	3.0	3	2	12	21	12	7
25	Networking with stakeholders like customers and suppliers.	156	3.0	3	9	13	13	13	6
26	Ability to identify new opportunities for the organisation	155	3.0	3	7	13	18	12	4
27	Networking external to the company	146	3.0	3	10	14	17	8	5

Colour Key:

	Modal response

The results above allowed the perceptions of the entire sample to be explored but the answer to Research Question 3 and Research Question 4 required separate data analyses for the different groups of respondents. The perceptions of the various groups were examined by grouping and separately analysing the data. The ten most important components as perceived by those respondents that were less than 40 years of age are listed in Table 10.

TABLE 10: TOP TEN RANKED CAREER CAPITAL COMPONENTS OF THOSE LESS THAN 40 YEARS OF AGE

		<40yr							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
1	Self motivation and drive	129	5.0	5	0	0	2	12	15
2	Technical ability (To know how)	129	4.0	4	0	0	1	14	14
3	Determination and perseverance	128	4.0	5	0	0	2	13	14
4	A comprehensive technical understanding. (To know why)	128	4.0	4	0	0	1	15	13
5	Educational qualifications	123	4.0	5	0	1	5	9	14
6	A practical or pragmatic understanding of the technical and working environment	123	4.0	4	0	1	2	15	11
7	People skills; having good working relationships	121	4.0	5	1	0	4	12	12
8	Ability to participate in a team (team player)	118	4.0	4	0	1	6	12	10
9	Flexibility and adaptability; Ability to adapt to various environments	114	4.0	4	1	0	5	17	6
10	Being known for delivery and execution	113	4.0	4	1	0	6	16	6

Colour Key:

	Modal response
	Top 10 ranked sums

Table 10 lists the frequency of responses under each Likert scale value and a scale value of 5 indicates a high level of agreement to the importance of the

construct. The table also shows the weighted sum, modes and medians of the sample response.

TABLE 11: RANKING OF THE PERCEIVED IMPORTANCE OF OTHER CAREER CAPITAL COMPONENTS OF THOSE LESS THAN 40 YEARS OF AGE

		<40yr							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
11	Passion for the industry environment	112	4.0	4	1	1	8	10	9
12	Action orientation	109	4.0	4	0	3	7	13	6
13	Relevant hands on knowledge	108	4.0	4	0	1	10	14	4
14	Knowing yourself or emotional Intelligence.	106	4.0	3	1	3	9	8	8
15	Personal reputation	102	4.0	4	0	5	8	12	4
16	Ability to influence/motivate	101	4.0	4	1	7	4	11	6
17	Understanding your reactions and feelings to different situations	101	3.0	3	2	2	11	8	6
18	Networking within the organisations	96	3.0	4	4	3	8	8	6
19	Multi disciplinary experience	96	3.0	3	0	6	12	7	4
20	Experience in industry	95	3.0	3	2	3	13	7	4
21	Knowledge and understanding of entire product life cycle or a system view	95	3.0	3	0	6	12	8	3
22	Ability to lead a team (team leader)	95	3.0	3	0	8	9	8	4
23	Understanding challenges of managing in your industry and working environment	92	3.0	3	1	6	12	7	3
24	Business acumen; understanding of the business bigger picture	84	3.0	3	1	7	16	4	1
25	Networking with stakeholders like customers and suppliers.	82	3.0	1	7	5	7	6	4
26	Ability to identify new opportunities for the organisation	74	3.0	3	7	6	11	3	2
27	Networking external to the company	73	2.0	2	7	9	7	3	3

Colour Key:

	Modal response

For the respondents that were less than 40 years of age “self motivation and drive” was perceived to be the component that was most important. Of the total 27 variables that were tested, the components that ranked from 11 to 27 are listed in

Table 11 which shows that "Networking external to the company" was not perceived to be very important for those respondents that were less than 40 years of age. The second group of interest were those knowledge workers that were equal to and above 40 years of age. The career capital components that were perceived to be the most important by respondents that are equal to and older than 40 years of age are displayed in Table 12. This group of respondents believe "Self motivation and drive" to be the most crucial component of career capital and mirrors the perceptions of those that are under 40 years of age.

TABLE 12: TOP TEN RANKED CAREER CAPITAL COMPONENTS OF THOSE GREATER THAN AND EQUAL TO 40 YEARS OF AGE

		>40yrs							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
1	Self motivation and drive	113	5.0	5	0	0	1	10	14
2	Determination and perseverance	111	5.0	5	0	0	2	10	13
3	Technical ability (To know how)	110	5.0	5	0	0	5	5	15
4	A comprehensive technical understanding. (To know why)	109	4.0	5	0	0	3	10	12
5	A practical or pragmatic understanding of the technical and working environment	107	4.0	4	0	0	0	18	7
6	Being known for delivery and execution	107	4.0	4	0	1	0	15	9
7	Ability to participate in a team (team player)	106	4.0	4	0	0	3	13	9
8	People skills; having good working relationships	102	4.0	4	0	1	3	14	7
9	Knowledge and understanding of entire product life cycle or a system view	101	4.0	5	0	3	3	9	10
10	Passion for the industry environment	101	4.0	4	0	2	3	12	8

Colour Key:

	Modal response
	Top 10 ranked sums

Of the total 27 variables that were tested, the components that ranked from 11 to 27 are listed in Table 13 which shows that "Networking external to the company"

was not perceived to be very important for those respondents that are equal to and greater than 40 years of age. This perceived lack of significance of the component is a sentiment that is also shared amongst the younger group of respondents.

TABLE 13: RANKING OF THE PERCEIVED IMPORTANCE OF CAREER CAPITAL COMPONENTS OF THOSE GREATER THAN AND EQUAL TO 40 YEARS OF AGE

		>40yrs							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
11	Relevant hands on knowledge	100	4.0	4	0	0	6	13	6
12	Ability to influence/motivate	100	4.0	4	0	0	6	13	6
13	Flexibility and adaptability; Ability to adapt to various environments	98	4.0	4	0	1	4	16	4
14	Personal reputation	97	4.0	4	0	1	5	15	4
15	Action orientation	96	4.0	4	0	0	7	15	3
16	Knowing yourself or emotional Intelligence.	96	4.0	4	0	1	6	14	4
17	Educational qualifications	93	4.0	4	0	1	7	15	2
18	Experience in industry	91	4.0	4	1	1	7	13	3
19	Ability to lead a team (team leader)	91	4.0	4	0	2	8	12	3
20	Networking within the organisations	89	4.0	4	0	3	8	11	3
21	Business acumen; understanding of the business bigger picture	88	4.0	4	1	5	5	8	6
22	Multi disciplinary experience	87	4.0	4	1	2	9	10	3
23	Understanding challenges of managing in your industry and working environment	87	4.0	4	0	2	10	12	1
24	Understanding your reactions and feelings to different situations	85	3.0	3	0	2	13	8	2
25	Ability to identify new opportunities for the organisation	81	3.0	4	0	7	7	9	2
26	Networking with stakeholders like customers and suppliers.	74	3.0	2	2	8	6	7	2
27	Networking external the company	73	3.0	3	3	5	10	5	2

Colour Key:

	Modal response
	Top 10 ranked sums

Respondents from both the old and young group seem to agree that the top 3 components of career capital are “Self motivation and drive”, “Determination and perseverance” and “Technical ability” but ranked them differently within the top three career capital components. The older group of respondents did not feel as

strongly about educational qualifications as the younger group where educational qualifications was included in the top ten career capital components.

TABLE 14: TOP TEN RANKED CAREER CAPITAL COMPONENTS OF HR PRACTITIONERS

		HR							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
1	Technical ability (To know how)	23	5.0	5	0	0	1	0	4
2	Being known for delivery and execution	23	5.0	5	0	0	0	2	3
3	Self motivation and drive	22	5.0	5	0	0	1	1	3
4	Relevant hands on knowledge	22	4.0	4	0	0	0	3	2
5	People skills; having good working relationships	22	4.0	4	0	0	0	3	2
6	Business acumen; understanding of the business bigger picture	21	4.0	5	0	0	1	2	2
7	Networking within the organisations	21	4.0	5	0	0	1	2	2
8	Networking with stakeholders like customers and suppliers.	21	4.0	5	0	0	1	2	2
9	Knowing yourself or emotional Intelligence.	21	4.0	5	0	0	1	2	2
10	Determination and perseverance	21	4.0	4	0	0	0	4	1

Colour Key:

	Modal response
	Top 10 ranked sums

To completely answer the research questions, the perception of HR practitioners was required. The perceptions of HR practitioners shape the design of organisation wide policies and it is important that perceptions of HR practitioners be aligned to the knowledge workers because of the impact that the policy design has on the working environment. The ten most important career capital components, as perceived by the HR practitioners are shown in Table 14. The results reveal that the HR practitioners perceive “technical ability” to be the most important career capital component, a component that was ranked second for the young group and third for the older group of respondents.

TABLE 15: RANKING OF THE PERCEIVED IMPORTANCE OF CAREER CAPITAL COMPONENTS OF HR PRACTITIONERS

		HR							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
11	Passion for the industry environment	21	4.0	4	0	0	0	4	1
12	Ability to influence/motivate	20	4.0	5	0	0	2	1	2
13	Understanding challenges of managing in your industry and working environment	20	4.0	5	0	0	2	1	2
14	Personal reputation	20	4.0	4	0	0	1	3	1
15	Action orientation	20	4.0	4	0	0	1	3	1
16	Flexibility and adaptability; Ability to adapt to various environments	19	4.0	4	0	0	2	2	1
17	A practical or pragmatic understanding of the technical and working environment	19	4.0	4	0	1	0	3	1
18	Ability to participate in a team (team player)	19	4.0	4	0	0	2	2	1
19	Understanding your reactions and feelings to different situations	19	4.0	4	0	0	2	2	1
20	A comprehensive technical understanding. (To know why)	19	4.0	3	0	0	2	2	1
21	Networking external the company	19	3.0	3	0	0	3	0	2
22	Ability to identify new opportunities for the organisation	18	4.0	4	0	1	1	2	1
23	Educational qualifications	17	4.0	4	0	1	1	3	0
24	Knowledge and understanding of entire product life cycle or a system view	17	3.0	3	0	0	3	2	0
25	Ability to lead a team (team leader)	17	3.0	3	0	0	4	0	1
26	Experience in industry	16	3.0	2	0	2	1	1	1
27	Multi disciplinary experience	15	2.0	2	0	3	0	1	1

Colour Key:

	Modal response

The top ten career capital components as perceived by HR practitioners, included components that were not in the younger or older groups ten most important career capital components, which were:

- Business acumen; understanding of the business bigger picture
- Networking within the organisations
- Networking with stakeholders like customers and suppliers.

- Knowing yourself or emotional intelligence.

The 17 components of career capital that were perceived to have the least importance for HR practitioners are listed in Table 15 with “Multi disciplinary experience” being perceived as the least important component.

TABLE 16: THE FIVE MOST POPULAR CAREER CAPITAL COMPONENTS

The 5 most popular career capital components				
Rank	**Entire Population**	**<40 years**	**>40 yrs**	**HR**
1	Self motivation and drive	Self motivation and drive	Self motivation and drive	Technical ability (To know how)
2	Technical ability (To know how)	Technical ability (To know how)	Determination and perseverance	Being known for delivery and execution
3	Determination and perseverance	Determination and perseverance	Technical ability (To know how)	Self motivation and drive
4	A comprehensive technical understanding. (To know why)	A comprehensive technical understanding. (To know why)	A comprehensive technical understanding. (To know why)	Relevant hands on knowledge
5	A practical or pragmatic understanding of the technical and working environment	Educational qualifications	A practical or pragmatic understanding of the technical and working environment	People skills; having good working relationships

The results obtained from the three different groups do not afford exactly the same levels of importance to each of the components of career capital. In order to compare the components that were perceived to have the highest significance and those that were perceived to have the least impact, a summary table of the most popular and least popular components was created. A summary table showing the five most popular component of career capital is shown in Table 16 .

TABLE 17: THE FIVE LEAST POPULAR CAREER CAPITAL COMPONENTS

The five least popular 5 career capital components				
Rank	**Entire Population**	**<40 years**	**>40 yrs**	**HR**
23	Understanding challenges of managing in your industry and working environment	Understanding challenges of managing in your industry and working environment	Understanding challenges of managing in your industry and working environment	Educational qualifications
24	Business acumen; understanding of the business bigger picture	Business acumen; understanding of the business bigger picture	Understanding your reactions and feelings to different situations	Knowledge and understanding of entire product life cycle or a system view
25	Networking with stakeholders like customers and suppliers.	Networking with stakeholders like customers and suppliers.	Ability to identify new opportunities for the organisation	Ability to lead a team (team leader)
26	Ability to identify new opportunities for the organisation	Ability to identify new opportunities for the organisation	Networking with stakeholders like customers and suppliers.	Experience in industry
27	Networking external to the company	Networking external to the company	Networking external to the company	Multi disciplinary experience i.e. experience in diverse disciplines e.g. different roles in the organisation

Abstracting to the groups of career capital identified in the literature review, it seems that the HR practitioners place more significance on the “knowing whom” component of career capital where as the engineers and scientists are more inclined to view “knowing how” as important in the high-tech R&D environment.

Continuing the comparison of perceptions amongst the groups, a summary of the least popular components is shown in Table 17. A brief analysis seems to suggest that the engineers and scientists, both young and old place less significance on the people skills in the high-tech R&D environment like, networking, understanding challenges of management but the HR practitioners believe that experience in the industry and multidisciplinary experience is least important.

The existence of differences in perceptions amongst the groups is visible by subjective analysis of the results from this section. To further understand the existence of differences a more comprehensive analysis was undertaken and the results are shown in sections 5.2.3 and 5.2.4 where differences in central tendency of the groups are tested using statistical methods. The following section shows the result of tests that measured the perceptions of career capital accumulation methods used in the high-tech R&D environment.

5.2.2 Methods used to build career capital in the high-tech R&D environment

The survey questionnaire used to measure perceptions of the career capital components was also used to collect data on 26 variables that measured perceptions of the methods used to accumulate career capital in the high-tech R&D industry. As with the case of career capital components, answering the relevant research questions, Research Question 2, required information that allowed the variables to be examined with respect to each other.

TABLE 18: TOP TEN RANKED METHODS OF BUILDING CAREER CAPITAL FOR THE ENTIRE SAMPLE (HR EXCLUDED)

		All Data (ex HR)							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
1	Willingness to learn	248	5.0	5	0	0	3	16	35
2	Ensuring that you deliver on your promise	239	5.0	5	0	3	2	18	31
3	Innovation in the way you work	211	4.0	5	0	5	13	18	18
4	Association with and learning from successful individuals inside the organisation	211	4.0	4	0	3	12	26	13
5	Further training and development	205	4.0	4	1	7	11	18	17
6	Networking and relationship building internal to the company	203	4.0	4	1	6	9	27	11
7	Ensuring multi-disciplinary exposure	197	4.0	4	2	8	11	19	14
8	Adding value by challenging the status quo	196	4.0	4	0	4	19	24	7
9	Reading to keep updated with current industry events and issues	195	4.0	4	3	6	15	15	15
10	Developing a complete competence in your role before seeking new opportunities	193	4.0	4	2	6	16	19	11

Colour Key:

	Modal response
	Top 10 ranked sums

The mode of each variable was examined to show the most popular response for the sample and the median was used to examine the central tendency of the responses. In order to facilitate comparison of the methods, a weighted sum was calculated for each variable using the method described in chapter 4.3.7. The calculated weighted sum allowed each construct to be ranked relative to each other and the ten most popular accumulation methods are shown in Table 18. Table 18 lists the frequency of responses under each Likert scale value and a

scale value of 5 indicates a high level of agreement of the importance of the construct.

TABLE 19: RANKING OF OTHER METHODS OF BUILDING CAREER CAPITAL FOR THE ENTIRE SAMPLE (HR EXCLUDED)

		All Data (ex HR)							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
11	Eagerness to adopt new ways of working	192	4.0	4	0	7	19	19	9
12	Having a personal vision and development plan	180	3.0	4	3	10	15	18	8
13	Keeping to the rules of my organisation	175	3.0	3	1	13	19	14	7
14	Depending on my original qualification	171	3.0	3	2	13	20	12	7
15	Being mentored or coached	161	3.0	2	8	15	10	12	9
16	Improving education qualifications	158	3.0	4	11	10	11	16	6
17	Identification of opportunities to improve visibility and reputation at higher levels in the organisation	152	3.0	4	7	15	14	17	1
18	Association with and learning from successful individuals outside the organisation	150	3.0	2	10	14	13	12	5
19	Networking and relationship building with stakeholders like suppliers and customers	145	2.5	2	9	18	10	15	2
20	Changing jobs within current company	137	3.0	1	20	4	15	11	4
21	Attending conferences	135	2.0	2	12	17	13	10	2
22	Networking and relationship building external to the company	126	2.0	1	20	9	14	9	2
23	Luck has played a role in your career	106	2.00	1	21	18	11	4	0
24	Changing jobs within current industry	105	1.00	1	32	4	8	9	1
25	Presenting at conferences	102	1.00	1	29	11	6	7	1
26	Changing jobs across industries	95	1.00	1	31	11	6	6	0

Colour Key:

	Modal response

The table also shows the weighted sum, modes and medians of the sample response. The knowledge workers willingness to learn was perceived to be the most popular method in which to accumulate career capital. A total of 26 variables

were tested and the components that ranked from 11 to 26 are listed in Table 19 which shows that “Changing jobs across industries” was not perceived to be very popular as a method for the sample that was tested.

The results above allowed the perceptions of the entire sample to be explored but the answer to Research Question 3 and Research Question 4 required separate data analyses for the different groups of respondents. The perceptions of the various groups were examined by grouping and separately analysing the data. The ten most important methods as perceived by those respondents that were less than 40 years of age are listed in Table 20.

TABLE 20: TOP TEN RANKED METHODS OF BUILDING CAREER CAPITAL FOR THOSE LESS THAN 40 YEARS OF AGE

		<40yr							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
1	Willingness to learn	135	5.0	5	0	0	2	6	21
2	Ensuring that you deliver on your promise	126	5.0	5	0	3	1	8	17
3	Association with and learning from successful individuals inside the organisation	118	4.0	4	0	1	5	14	9
4	Networking and relationship building internal to the company	111	4.0	4	1	3	5	11	9
5	Innovation in the way you work	109	4.0	5	0	4	10	4	11
6	Eagerness to adopt new ways of working	108	4.0	4	0	3	9	10	7
7	Further training and development	106	4.0	4	1	5	4	12	7
8	Adding value by challenging the status quo	106	4.0	4	0	3	10	10	6
9	Depending on my original qualification	105	4.0	4	0	3	10	11	5
10	Developing a complete competence in your role before seeking new opportunities	104	4.0	4	1	3	8	12	5

Colour Key:

	Modal response
	Top 10 ranked sums

Table 20 lists the frequency of responses under each Likert scale value and a scale value of 5 indicates a high level of agreement to the importance of the construct. The table also shows the weighted sum, modes and medians of the sample response.

TABLE 21: RANKING OF OTHER METHODS OF BUILDING CAREER CAPITAL FOR THOSE LESS THAN 40 YEARS OF AGE

		<40yr							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
11	Reading to keep updated with current industry events and issues	103	4.0	5	2	4	8	6	9
12	Ensuring multi-disciplinary exposure	102	4.0	5	2	5	6	8	8
13	Being mentored or coached	102	4.0	4	2	4	7	9	7
14	Having a personal vision and development plan	100	4.0	5	2	7	4	8	8
15	Keeping to the rules of my organisation	91	3.0	3	1	7	11	7	3
16	Improving education qualifications	86	3.0	2	5	8	4	7	5
17	Identification of opportunities to improve visibility and reputation at higher levels in the organisation	79	3.0	3	4	8	10	6	1
18	Association with and learning from successful individuals outside the organisation	79	2.0	1	8	7	4	5	5
19	Networking and relationship building with stakeholders like suppliers and customers	74	2.0	2	6	10	6	5	2
20	Attending conferences	74	3.0	1	8	6	8	5	2
21	Networking and relationship building external to the company	63	2.0	1	13	5	6	3	2
22	Changing jobs within current company	61	2.0	1	14	2	9	4	0
23	Changing jobs within current industry	55	1.0	1	17	3	4	5	0
24	Changing jobs across industries	54	1.0	1	16	5	4	4	0
25	Luck has played a role in your career	54	2.0	1	12	11	4	2	0
26	Presenting at conferences	54	1.0	1	16	6	3	3	1

Colour Key:

	Modal response

For the respondents that were less than 40 years of age "Willingness to learn" was perceived to be the method that was most important. Of the total 26 variables that were tested, the methods that ranked from 11 to 26 are listed in Table 21 which shows that "Presenting at conferences" was not perceived to be very important for those respondents that were less than 40 years of age.

TABLE 22: TOP TEN RANKED METHODS OF BUILDING CAREER CAPITAL FOR THOSE GREATER THAN AND EQUAL TO 40 YEARS OF AGE

		>40yrs							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
1	Willingness to learn	113	5.0	5	0	0	1	10	14
2	Ensuring that you deliver on your promise	113	5.0	5	0	0	1	10	14
3	Innovation in the way you work	102	4.0	4	0	1	3	14	7
4	Further training and development	99	4.0	5	0	2	7	6	10
5	Ensuring multi-disciplinary exposure	95	4.0	4	0	3	5	11	6
6	Association with and learning from successful individuals inside the organisation	93	4.0	4	0	2	7	12	4
7	Networking and relationship building internal to the company	92	4.0	4	0	3	4	16	2
8	Reading to keep updated with current industry events and issues	92	4.0	4	1	2	7	9	6
9	Adding value by challenging the status quo	90	4.0	4	0	1	9	14	1
10	Developing a complete competence in your role before seeking new opportunities	89	4.0	3	1	3	8	7	6

Colour Key:

	Modal response
	Top 10 ranked sums

The second group of interest was those knowledge workers that were equal to and above 40 years of age. The accumulation methods that were perceived to be the most popular by respondents that are equal to and older than 40 years of age are displayed in Table 22. This group of respondents believes that "Willingness to

learn" is the most important accumulation method, a perception that mirrors that of the respondents that are under 40 years of age.

TABLE 23: RANKING OF OTHER METHODS OF BUILDING CAREER CAPITAL FOR THOSE GREATER THAN AND EQUAL TO 40 YEARS OF AGE

		>40yrs							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
11	Eagerness to adopt new ways of working	84	3.0	3	0	4	10	9	2
12	Keeping to the rules of my organisation	84	3.0	3	0	6	8	7	4
13	Having a personal vision and development plan	80	3.0	3	1	3	11	10	0
14	Changing jobs within current company	76	3.0	4	6	2	6	7	4
15	Identification of opportunities to improve visibility and reputation at higher levels in the organisation	73	3.0	4	3	7	4	11	0
16	Improving education qualifications	72	3.0	4	6	2	7	9	1
17	Networking and relationship building with stakeholders like suppliers and customers	71	3.0	4	3	8	4	10	0
18	Association with and learning from successful individuals outside the organisation	71	3.0	3	2	7	9	7	0
19	Depending on my original qualification	66	3.0	3	2	10	10	1	2
20	Networking and relationship building external to the company	63	3.0	3	7	4	8	6	0
21	Attending conferences	61	2.0	2	4	11	5	5	0
22	Being mentored or coached	59	2.0	2	6	11	3	3	2
23	Luck has played a role in your career	52	2.0	1	9	7	7	2	0
24	Changing jobs within current industry	50	1.0	1	15	1	4	4	1
25	Presenting at conferences	48	1.0	1	13	5	3	4	0
26	Changing jobs across industries	41	1.0	1	15	6	2	2	0

Colour Key:

	Modal response

Of the total 26 variables were tested, the methods that ranked from 11 to 26 are listed in Table 23 which shows that "Changing jobs across industries", ranked at 26, was not perceived to be very important for those respondents that were less

than 40 years of age. The younger group of respondents shared a similar sentiment and ranked the method “Changing jobs across industries” at number 24

To completely answer the research questions, the perception of HR practitioners was required. The perceptions of HR practitioners shape the design of organisation wide policies and it is important that perceptions of HR practitioners be aligned to the knowledge workers because of the impact that the policy design has on the working environment. The ten most important career capital components, as perceived by the HR practitioners are shown in Table 24.

TABLE 24: TOP TEN METHODS OF BUILDING CAREER CAPITAL FOR HR PRACTITIONERS

		HR							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
1	Networking and relationship building internal to the company	25	5.0	5	0	0	0	0	5
2	Having a personal vision and development plan	24	5.0	5	0	0	0	1	4
3	Ensuring that you deliver on your promise	24	5.0	5	0	0	0	1	4
4	Willingness to learn	23	5.0	5	0	0	0	2	3
5	Adding value by challenging the status quo	23	5.0	5	0	0	0	2	3
6	Networking and relationship building external to the company	22	5.0	5	0	0	1	1	3
7	Identification of opportunities to improve visibility and reputation at higher levels in the organisation	21	5.0	5	0	0	2	0	3
8	Networking and relationship building with stakeholders like suppliers and customers	21	4.0	5	0	0	1	2	2
9	Innovation in the way you work	21	4.0	5	0	0	1	2	2
10	Further training and development	21	4.0	4	0	0	1	2	2

Colour Key:

	Modal response
	Top 10 ranked sums

A subjective examination of the data suggests that there are differences between perceptions of the HR group:

- "Having a personal vision and development plan" ranked high at number two for the HR respondents but ranked at number 14 for the younger respondents and at number 13 for the older respondents.

- "Identification of opportunities to improve visibility and reputation at higher levels in the organisation" ranked at number six for the HR respondents but at 17 for the younger group and number 15 for the older group.

TABLE 25: RANKING OF PERCEIVED IMPORTANCE OF METHODS TO BUILD CAREER CAPITAL FOR HR PRACTITIONERS

		HR							
Rank		**Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
11	Reading to keep updated with current industry events and issues	21	4.0	4	0	0	1	2	2
12	Improving education qualifications	20	4.0	4	0	0	1	3	1
13	Being mentored or coached	20	4.0	4	0	0	1	3	1
14	Eagerness to adopt new ways of working	20	4.0	4	0	0	1	3	1
15	Developing a complete competence in your role before seeking new opportunities	20	4.0	3	0	0	2	1	2
16	Association with and learning from successful individuals inside the organisation	19	4.0	5	0	1	1	1	2
17	Association with and learning from successful individuals outside the organisation	19	4.0	4	0	1	0	3	1
18	Ensuring multi-disciplinary exposure	18	3.0	3	0	0	3	1	1
19	Attending conferences	15	3.0	3	1	0	3	0	1
20	Changing jobs within current industry	15	3.0	1	1	1	1	1	1
21	Keeping to the rules of my organisation	14	3.0	3	0	2	2	1	0
22	Presenting at conferences	13	2.0	2	1	2	1	0	1
23	Changing jobs within current company	13	2.0	1	2	1	0	1	1
24	Depending on my original qualification	11	2.0	2	1	2	2	0	0
25	Changing jobs across industries	10	2.0	2	1	3	1	0	0
26	Luck has played a role in your career	10	2.0	1	2	2	0	1	0

Colour Key:

	Modal response

Of the total 26 variables that were tested, the methods that ranked from 11 to 26 are listed in Table 25 which shows that luck, ranked at number 26, is the method that is least likely to build career capital in the high-tech R&D environment.

TABLE 26: THE FIVE MOST POPULAR WAYS TO BUILD CAREER CAPITAL

The 5 most popular ways to build career capital				
Rank	**Entire population**	**<40 years**	**>40 yrs**	**Hr**
1	Willingness to learn	Willingness to learn	Willingness to learn	Networking and relationship building internal to the company
2	Ensuring that you deliver on your promise	Ensuring that you deliver on your promise	Ensuring that you deliver on your promise	Having a personal vision and development plan
3	Innovation in the way you work	Association with and learning from successful individuals inside the organisation	Innovation in the way you work	Ensuring that you deliver on your promise
4	Association with and learning from successful individuals inside the organisation	Networking and relationship building internal to the company	Further training and development	Willingness to learn
5	Further training and development	Innovation in the way you work	Ensuring multi-disciplinary exposure	Adding value by challenging the status quo

The results obtained from the three different groups do not afford the same levels of importance to each of the accumulation methods. In order to compare the methods that were perceived to have the highest significance and those that were perceived to have the least impact, a summary table of the most popular and least popular methods was created and is shown in Table 26 and Table 27 respectively.

TABLE 27: THE FIVE LEAST POPULAR WAYS TO BUILD CAREER CAPITAL

The 5 least popular ways to build career capital				
Rank	**Entire population**	**<40 years**	**>40 yrs**	**HR**
22	Networking and relationship building external to the company	Changing jobs within current company	Being mentored or coached	Presenting at conferences
23	Luck has played a role in your career	Changing jobs within current industry	Luck has played a role in your career	Changing jobs within current company
24	Changing jobs within current industry	Changing jobs across industries	Changing jobs within current industry	Depending on my original qualification
25	Presenting at conferences	Luck has played a role in your career	Presenting at conferences	Changing jobs across industries
26	Changing jobs across industries	Presenting at conferences	Changing jobs across industries	Luck has played a role in your career

The existence of differences in perceptions amongst the groups is less visible in the perceptions of accumulation methods as it is for the components of career capital. To further investigate the existence of differences a more comprehensive analysis was completed and the results are shown in the following sections. The following sections present the results of statistical tests that were performed to measure differences in central tendency of the responses for the different groups.

5.2.3 Differences between perceptions in different age groups

The various tables in the preceding sections gave an indication that differences do exist between the various groups defined in the research questions. This was highlighted through the differences in the most popular and least popular

summaries for career capital components, in Table 16 and Table 17, and summaries for accumulation methods, in Table 18 and Table 20.

TABLE 28: DIFFERENCES IN PERCEPTIONS OF THE IMPORTANCE OF CAREER CAPITAL COMPONENTS

Constructs	α=0.05		α=0.10	
	Difference	Group attributing higher levels of importance	Difference	Group attributing higher levels of importance
Being known for delivery and execution	no		yes	young
Educational qualifications	yes	young	yes	young
Business acumen; understanding of the business bigger picture	yes	old	yes	old
Knowledge and understanding of entire product life cycle or a system view	yes	old	yes	old
Ability to identify new opportunities for the organisation	yes	old	yes	old

The collected data was interrogated by a more rigorous statistical approach, detailed in 4.3.7.4, with the purpose of examining the differences between the defined groups. Research Question 3 required searching for differences between two groups, the respondents that were below 40 years of age and the respondents equal to and above 40 years of age. Each group's responses to every construct, i.e. career capital components and accumulation methods, were tested using the Mann Whitney U test (Hintze, 2007), a non parametric statistical test (Zikmund, 2003). The purpose of the test was to investigate if the most popular responses differed significantly between the two groups. The differences in perceived

importance of career capital components are shown in Table 28 whilst the difference in perceptions of accumulation methods is shown in Table 29.

TABLE 29: DIFFERENCES IN PERCEPTIONS OF THE IMPORTANCE OF CAREER CAPITAL ACCUMULATION METHODS

Constructs	α=0.05		α=0.10	
	Difference	**Group attributing higher levels of importance**	**Difference**	**Group attributing higher levels of importance**
Changing jobs within current company	yes	old	yes	old
Depending on my original qualification	yes	young	yes	young
Being mentored or coached	yes	young	yes	young

Table 28 lists the career capital components where perceptions between the young and old differed. The results are shown for two different levels of significance; α=0.05 and α=0.1. The investigation compared the median responses for 27 components of career capital and of the 27 components only three components were perceived to be significantly different at α=0.05 and at α=0.10 only four components differed. The younger group perceives that their educational qualification and reputation for delivery to be more important and the older group perceives business acumen, knowledge of the entire product cycle and opportunity identification to be more important. In general however it seems that the perceptions of both old and young are similar with the groups only disagreeing on less than 15% of the 27 components.

Table 29 lists the career capital accumulation methods where perceptions between the young and old differed. The results are shown for two different levels of significance; α=0.05 and α=0.10. The investigation compared the median responses for 26 career capital accumulation methods and of the 26 methods only three components were perceived to be significantly different at both α=0.05 and α=0.10. The younger group feels more strongly about depending on their original qualification and being mentored whereas the older group feels that changing jobs within the current company is an important means of building career capital. In general however it seems that the perceptions of both old and young are similar with the groups only disagreeing on less than 12% of the 26 components.

The Mann Whitney U test allows for the comparison of two populations or groups. The research questions include investigating differences between three groups, the young, the old and the HR practitioners. The one-way analysis of variance compares the means of two or more groups to determine if at least one group's measure of central tendency is different from the others (Hintze, 2007). The following section presents the results of the Kruskal-Wallis Z test performed on the three different populations.

5.2.4 Differences between perceptions of HR practitioners and the different age groups

The investigation necessary for Research Question 4 required an analysis of the perceptions of three groups of respondents; the old, the young and the HR practitioners. The Kruskal-Wallis Z test is a non parametric method for multiple

comparisons (Hintze, 2007) and was used to compare popular perceptions amongst the groups.

TABLE 30: DIFFERENCES IN PERCEPTIONS OF THE IMPORTANCE OF CAREER CAPITAL COMPONENTS BETWEEN THE OLD, YOUNG AND HR

Construct	Groups that held similar views		Group that did not hold similar views	Direction
Business acumen; understanding of the business bigger picture	old	HR	young	-
Educational qualifications	old	HR	young	+
Ability to identify new opportunities for the organisation	old	HR	young	-
Knowledge and understanding of entire product life cycle or a system view	young	HR	old	+
Note on Direction: A '+' indicates that the group who did not hold similar views placed a higher level of importance on the construct, where as a '-' indicates that the group that did not hold similar views placed a lower level of importance on the construct.				

Table 30 and Table 31 show the results of a statistical data analysis that searched for differences between the responses for the three different groups:

- Young : knowledge workers under 40 years of age
- Old : knowledge workers equal to and older than 40 years of age
- HR : the HR practitioners in the sample

TABLE 31: DIFFERENCES IN PERCEPTIONS OF THE IMPORTANCE OF METHODS TO BUILD CAREER CAPITAL BETWEEN THE OLD, YOUNG AND HR

Construct	Groups that held similar views		Groups that did not hold similar views	Direction
Depending on my original qualification	old	HR	young	+
Changing jobs within current company	young	HR	old	+
Being mentored or coached	young	HR	old	-
Identification of opportunities to improve visibility and reputation at higher levels in the organisation	young	old	HR	+
Networking and relationship building internal to the company	young	old	HR	+
Networking and relationship building with stakeholders like suppliers and customers	young	old	HR	+
Networking and relationship building external to the company	young	old	HR	+
Adding value by challenging the status quo	young	old	HR	+
Having a personal vision and development plan	young	old	HR	+
Note on Direction: A '+' indicates that the group who disagreed placed a higher level of importance on the construct, where as a '-' indicates that the group that did not hold similar views placed a lower level of importance on the construct.				

Table 30 shows the four career capital components where the popular perceptions differ between the groups. The younger group disagrees with HR and the older group on:

- Business acumen
- Educational qualifications
- Ability to identify new opportunities for the organisation

The younger group feels that educational qualifications are more important and HR and the older group believe that business acumen and opportunity identification are more important than the younger group. The results presented here provide a mechanism to verify the testing as the Mann Whitney U test also finds the same differences between young and old for $\alpha=0.05$. Minor differences in perceptions do exist between the groups but the differences occur for only a small number of the total constructs that were tested.

The preceding sections have presented the results of the descriptive statistic analysis performed on the data collected from the three different groups. The following chapter discusses the results within the context of the research questions.

CHAPTER 6: DISCUSSION OF RESULTS

This chapter discusses the results of the study within the context of the research questions defined in chapter three. The following sections each discuss a single research question by examining the results as documented in chapter five and reflecting on the literature review that is presented in chapter two.

6.1 Research Question 1: What are the components of career capital in a high-tech R&D industry and how are the components ranked in terms of importance?

Research Question 1 investigated the relevance of existing career capital literature, including Lamb's (2007) model, to the high-tech R&D environment. The existing literature, summarised in Table 1, has defined concepts related to career capital components but has not explicitly defined components. This research question identified the explicit components used by R&D knowledge workers in the high-tech R&D environment and ranked the components and methods in order of perceived importance.

The results in Table 8 and Table 9 show that all career capital components have a Likert scale modal response of greater than or equal to three, indicating that R&D knowledge workers attribute a high level of importance to all of the career capital components that were investigated. This is an expected scenario as the questionnaire was carefully designed to ensure applicability to the high-tech R&D environment. The research results represent an important contribution to the body of knowledge on career capital as it is the first time that the specific career capital

components have been identified and ranked by measuring the perceptions of R&D knowledge workers within the high-tech R&D environment.

The ten most important high-tech R&D career capital components are shown in Table 32 where the components are grouped according to categories. Table 32 shows how the categories identified in the literature can be linked to the career capital components but the literature groups do not provide an elegant way of grouping the data obtained during the research. For this reason new groups or categories have been defined that are more relevant to the high-tech R&D environment. The ten most important R&D career capital components have four distinct groups:

- Personal attributes: personal attributes represents those components that are inherent to the individual and influence thinking and behaviour.

- Personal reputation: personal reputation refers to those components that contribute to how the R&D knowledge worker is perceived by others; it is the view of others of the individual.

- Social intelligence: social intelligence has a connotation closely related to notions such as social skills and competence (Björkqvist, Österman, and Kaukiainen, 2000) and

includes components that define how an individual interacts with others in the work environment.

- Technical proficiency: technical proficiency refers to the technical competence and capability that are directly related to the disciplines of science and engineering in the R&D environment.

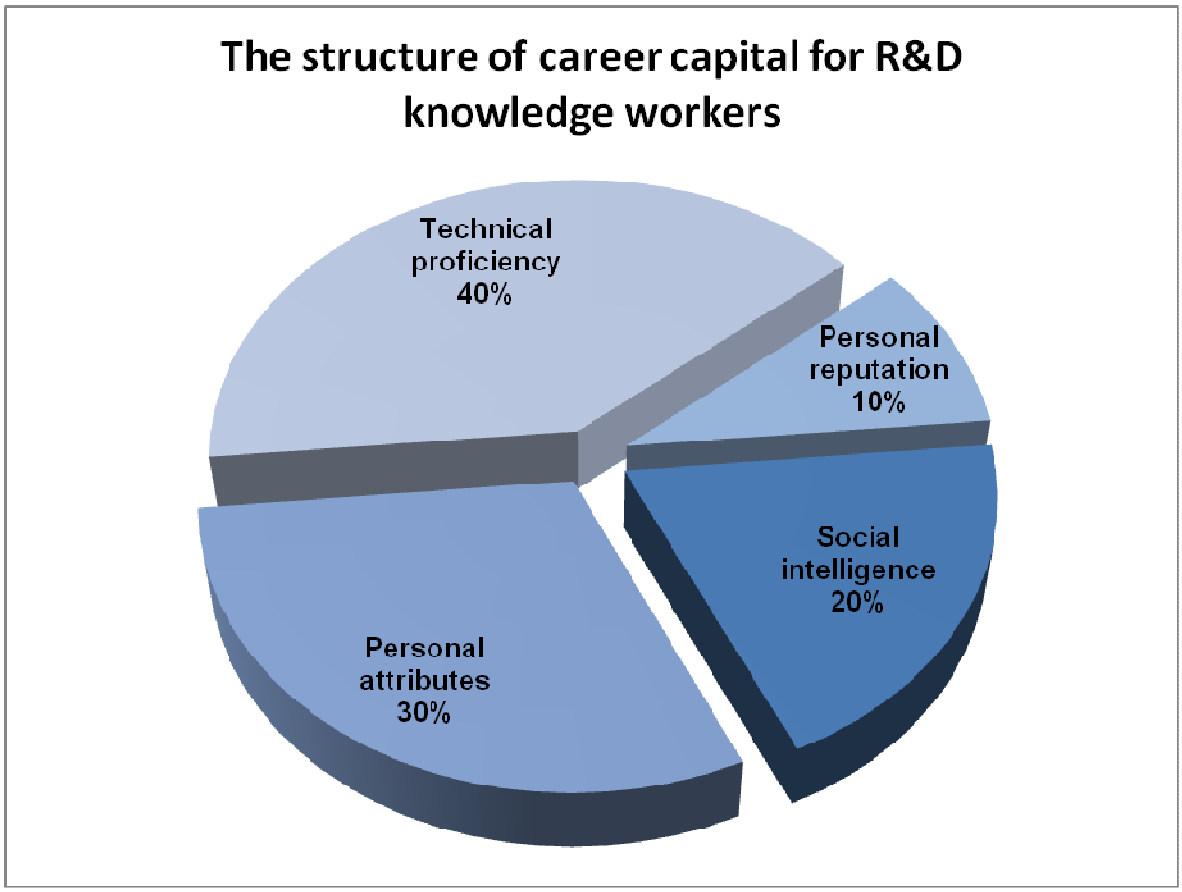
TABLE 32: THE TEN MOST IMPORTANT HIGH-TECH R&D CAREER CAPITAL COMPONENTS GROUPED AND MAPPED TO EXISTING THEORY

R&D Career Capital Groups	Overall rank of career capital component	Career capital component	Literature summary reference to Table 1
Personal attributes	1	Self motivation and drive	Action orientation
	3	Determination and perseverance	Passion
	10	Passion for the industry environment	Passion
Personal reputation	8	Being known for delivery and execution	Knowing whom
Social intelligence	6	Ability to participate in a team (team player)	Knowing whom
	7	People skills; having good working relationships	Knowing whom
Technical proficiency	2	Technical ability (To know how)	Knowing how
	4	A comprehensive technical understanding. (To know why)	Knowing why
	5	A practical or pragmatic understanding of the technical and working environment	Knowing why
	9	Educational qualifications	Knowing how

Personal attributes, personal reputation, social interaction and technical proficiency are four key groups that are evident in the ten most important R&D career capital components. Each group includes at least one of top ten components that have

been ranked at various levels of importance and collectively the four groups represent the basic structure of career capital for the R&D knowledge worker. Figure 6 illustrates the structure of career capital for the R&D knowledge worker by showing the key component groups and the proportion that the groups represent in a R&D knowledge worker's career capital.

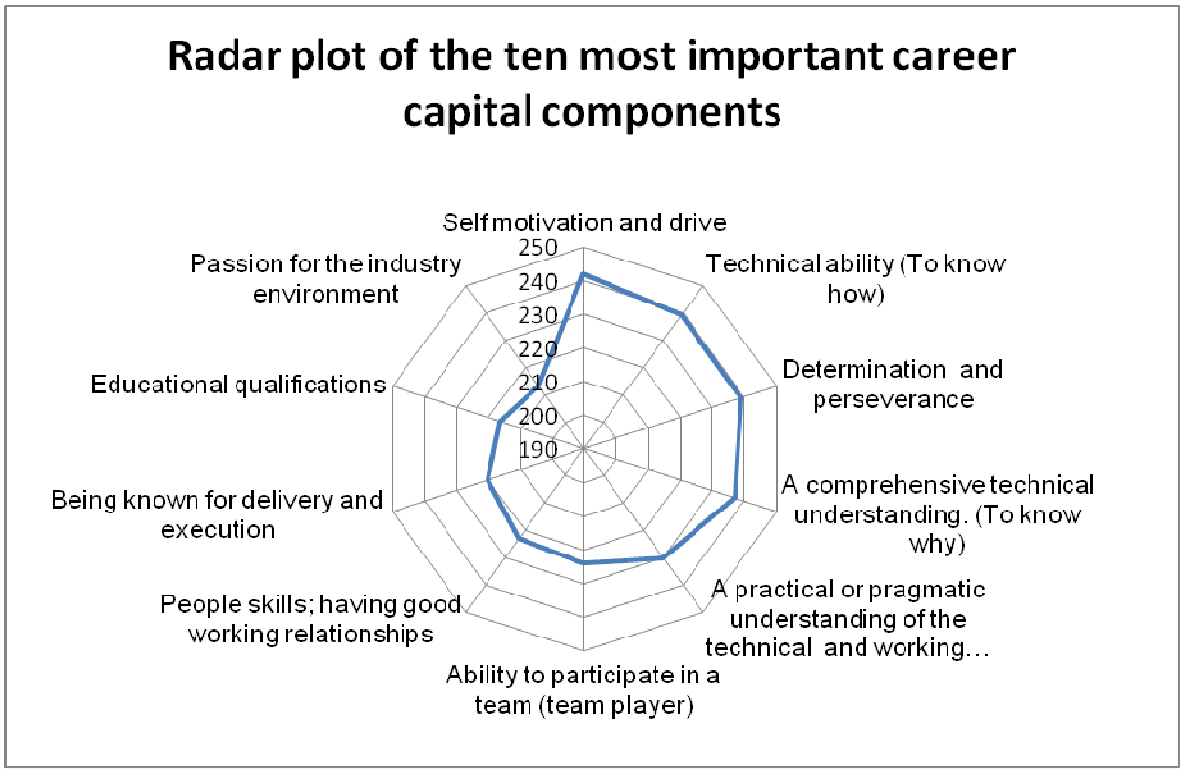
FIGURE 6: THE CONTRIBUTION OF THE IMPORTANT CAREER CAPITAL COMPONENTS TO A R&D KNOWLEDGE WORKER'S CAREER CAPITAL



The proportions of the career capital groups were calculated by summing the weightings of the constituent components for a group. For example, the social interaction group consists of the ability to participate in a team and the people skills

components; these components then have associated weightings, shown in Table 8, that were summed to create a weighting for the group. The structure reveals that the R&D knowledge worker's largest career capital group is technical proficiency that represents 40% of the total capital. This is an expected outcome as high-tech R&D industry demands highly skilled professionals to deal with high complexity that is characterised by high technological risk and extreme design constraints (Farr and Beude, 2003).

FIGURE 7: RADAR PLOT SHOWING WEIGHTINGS OF TEN MOST POPULAR CAREER CAPITAL COMPONENTS FOR R&D KNOWLEDGE WORKERS



Note: Full text of constructs is visible in Table 32.

The technical proficiency group represents the largest R&D career capital group, but this outcome must not be viewed in isolation. Although the technical proficiency

group represents the largest group, the most important component comes from the personal characteristics group. The ten most important capitals are plotted with the associated weightings (Table 8) on a radar plot to give a visual indication of the closeness of the different components. The top five components (Table 16) are in close proximity to each other and represent a combination of two groups, the personal characteristics and technical proficiency groups. R&D career capital therefore consists of an intersection of the four groups and work together to create a synergy for the R&D worker in the high-tech R&D environment; all support and reinforce each other; a finding consistent with Lamb's (2007) work.

The career capital components that are relevant for R&D knowledge workers in the high-tech industry are shown and ranked in Table 8 and Table 9. The ten most important components are shown in Table 32 with their associated rank of importance. Table 32 also groups the career capital components into four newly defined groups that are relevant to the R&D knowledge worker. The R&D knowledge worker's career capital consists of four distinct groups of components and the individual components support and reinforce each other across groups.

6.2 Research Question 2: How do you build career capital in a high-tech R&D environment and how are the methods ranked in terms of importance?

Research question 2 focused on the processes that are used by R&D knowledge workers to build career capital in the high-tech R&D environment. An improved understanding of how R&D knowledge workers perceive the importance of the

different career capital accumulation methods will facilitate the design of career development strategies. With an improved understanding, HR practitioners will be better informed to tailor solutions that fit the requirements of the R&D knowledge worker.

An analysis of the results in Table 18 and Table 19 reveals that only 18 of the 26 accumulation methods that were tested have modal Likert responses greater than or equal to three. This illustrates that only the top 18 accumulation methods that were identified through the literature are relevant to the R&D knowledge worker in the high-tech R&D environment. The ten most important R&D career capital accumulation methods are shown in Table 33 where the components are grouped into categories.

Table 33 shows how the categories identified in the literature can be linked to the career capital accumulation methods and also shows new categories for accumulation methods that represent a better fit for the R&D career capital accumulation methods. The ten most important R&D career capital accumulation methods have four distinct groups that include:

- building a personal brand
- challenging convention
- continuous growth and development
- learning from and through others

TABLE 33: THE TEN MOST IMPORTANT HIGH-TECH R&D CAREER CAPITAL ACCUMULATION METHODS GROUPED AND MAPPED TO EXISTING THEORY

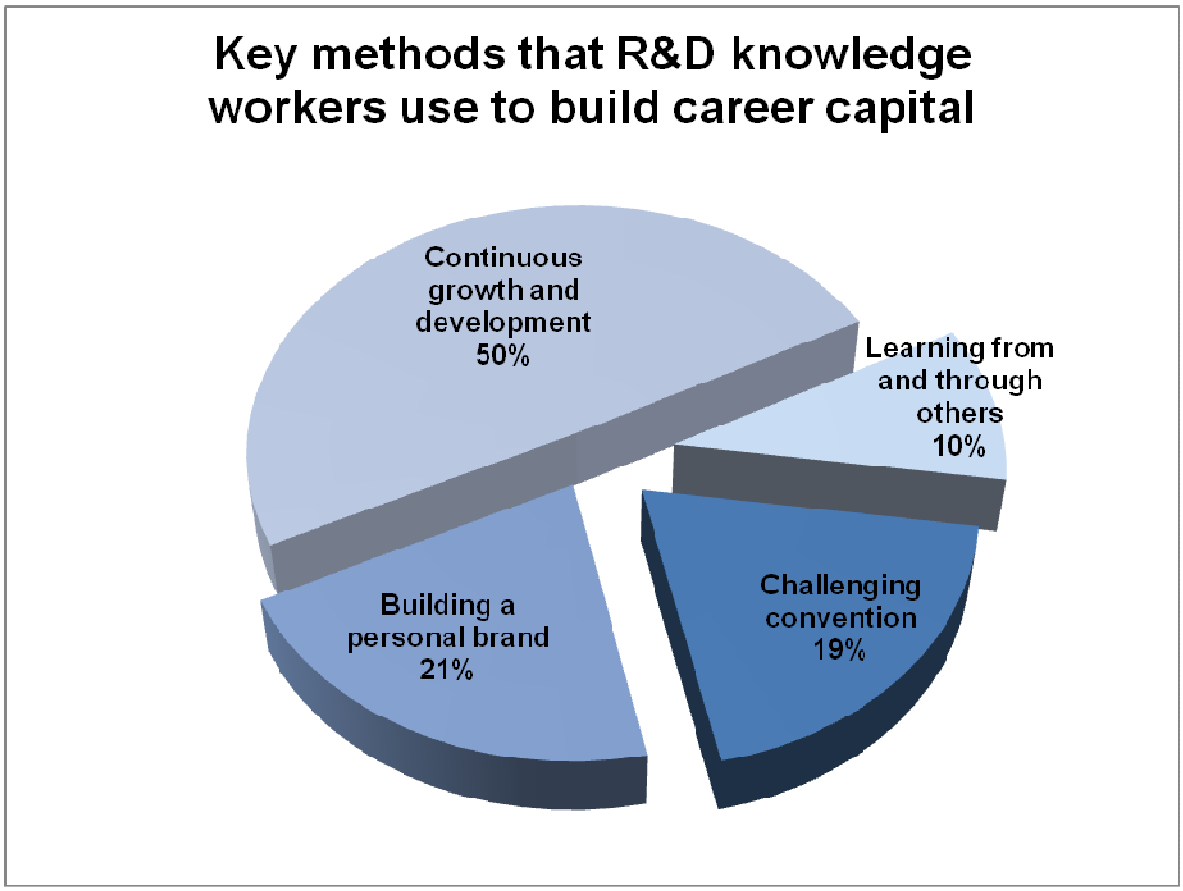
R&D career capital accumulation activity groups	Rank	Career capital	Accumulation activity groups (Lamb, 2007)
Building a personal brand	2	Ensuring that you deliver on your promise	Building social networks for increase visibility
	6	Networking and relationship building internal to the company	Building social networks for increase visibility
Challenging convention	3	Innovation in the way you work	Application of learning to new contexts
	8	Adding value by challenging the status quo	Challenging complacency
Continuous growth and development	1	Willingness to learn	Continual learning
	5	Further training and development	Continual learning
	7	Ensuring multi-disciplinary exposure	Continual learning
	9	Reading to keep updated with current industry events and issues	Continual learning
	10	Developing a complete competence in your role before seeking new opportunities	Learning from experience
Learning from and through others	4	Association with and learning from successful individuals inside the organisation	Learning from experience

Each group includes at least one of the top ten components that have been ranked at various levels of importance and collectively the four groups represent the key themes of accumulation methods that build a R&D knowledge worker's career capital. Figure 8 illustrates the representation of the different career capital accumulation groups that are evident in the ten most important accumulation methods.

Figure 8 shows that engaging in continuous growth and development activities are most important for building career capital in the high-tech R&D environment as it represents 50% of all career capital accumulation activities. The proportions of the

groups were calculated by summing the weightings of the constituent methods for a group. For example, the challenging convention group consists of innovation in the way you work and adding value by challenging the status quo; these two methods then have associated weightings, shown in Table 18, that were summed to create a weighting for the group.

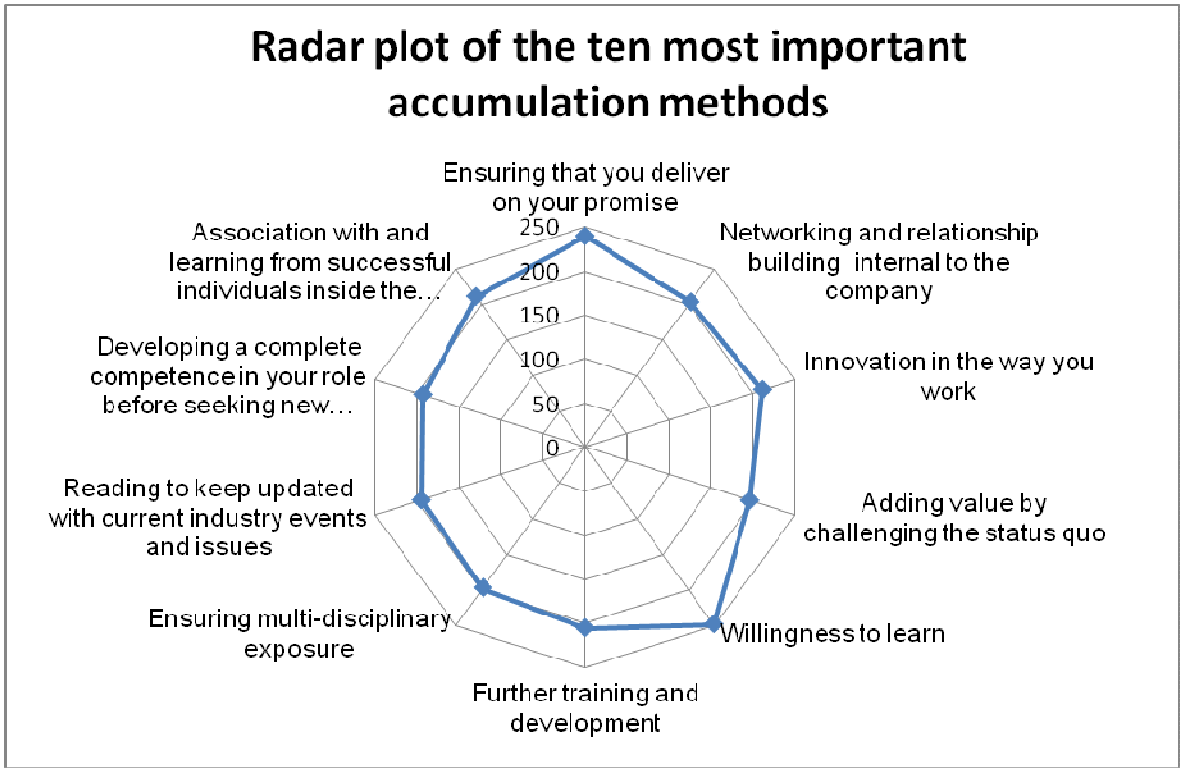
FIGURE 8: THE KEY METHOD GROUPS THAT R&D KNOWLEDGE WORKERS USE TO BUILD CAREER CAPITAL



The high-tech R&D industry is characterised by a rapidly changing technological environment (Farr and Buede, 2003) and it is expected that R&D knowledge workers who participate in the high-tech R&D environment must continuously

engage in development activities to keep abreast of latest technology, theories and practices. The process of obtaining new knowledge takes on the characteristics of an investment activity, an investment activity that increases the capacity to generate additional capital (Harris, 2001). Failure to do this will render the R&D knowledge worker's intangible knowledge assets (Edvinsson, 2002) obsolete thus effectively eroding the value of their career capital. The value of career capital is critical as it is this capital which R&D knowledge workers trade with the high-tech R&D organisation for remuneration and employment.

FIGURE 9: RADAR PLOT SHOWING THE TEN MOST IMPORTANT WAYS R&D WORKERS BUILD CAREER CAPITAL



Note: Full text of constructs is visible in Table 33.

The top ten career capital accumulation methods for R&D knowledge workers can be grouped into four key categories of activities. The activity group that is most prevalent in the top ten activities is continuous growth and development. The prevalence of this group of activities does not mean that it is the most important group since an inspection of the Figure 9 radar plot shows that all the top ten methods have weight values that are in close proximity to each other. This means that a distinction cannot be made as to the most important group for R&D knowledge workers. The top ten accumulation methods therefore all have a high degree of importance which makes the four groups of activities interdependent with each group supporting and reinforcing the other; a finding that supports Lamb's (2007) argument of the integrated nature of career capital formation methods.

Further inspection of Figure 9 reveals that a R&D knowledge workers willingness to learn and ensuring that they deliver on their promise has marginally higher values than the other activities. It is possible that these two accumulation methods allow the R&D knowledge worker to reap greater returns in their accumulation of their career capital. A willingness to learn will afford the R&D knowledge worker more opportunities to participate in diverse activities for accumulation of diverse knowledge that build valuable career capital (Lazarova and Taylor, 2009). The diversity in learning allows the R&D knowledge worker to reinforce previous learning by repeating activities, to learn from new experiences and then to integrate learning and discover innovative solutions. Then by ensuring that they deliver on their promise the R&D knowledge worker builds a reputation for delivery

making them the person that people in the organisation first think of when allocating challenging work. This then affords the reputable knowledge worker greater access to opportunities for learning.

There are 18 career capital accumulation methods that are relevant to the R&D knowledge worker in the high-tech R&D environment. The top ten methods are listed in Table 18 and methods ranked from 11 to 18 are listed in Table 19. The ten most important components can be grouped into four distinct groups as shown in Table 33 that also reveals links to the existing literature. The groups cannot exist independently but integrate to create a synergy where methods from the different groups support and reinforce each other in the process of accumulating career capital in the high-tech R&D environment.

6.3 Research Question 3: What are the perceived differences in importance of career capital components and accumulation methods between R&D knowledge workers younger than 40 and R&D knowledge workers that are equal to and older than 40?

Chen, Chang, and Yeh's (2003) review of career stage literature and age suggests that age can be effectively used to measure career stage. Career literature reveals a distinct turning point at the age of 40 (Super and Hall, 1978). The age of 40 is in the range of Cron's (1984) second career stage known as the career establishment stage and it is understandable that a turning point should surface before entrance into a new stage. Yeh (2008) suggests that this turning point may be more relevant to engineers than other professionals and this turning point may represent a shift in

the R&D knowledge workers career development needs and requirements. This research therefore sought to explicitly identify differences in perceptions between R&D knowledge workers under 40 years of age and R&D knowledge workers equal to and above 40 years of age.

The research results revealed that the perceived importance of career capital components and accumulation methods did not differ significantly between the young and old groups of R&D knowledge workers. For the career capital components, Table 28 shows that of the 27 measured career capital components, only five components were shown to have different levels of importance between the two groups. For the career capital accumulation methods, Table 29 shows that of the 26 measured career capital accumulation methods, only three methods were shown to have different levels of importance between the two groups. These results reveal that there is no dramatic difference between perceptions of young and old R&D knowledge workers on the importance of career capital components and career capital accumulation methods.

One of the five career capital components that were measured to be different was the component that represented being known for delivery and execution and this component was perceived to be more important to the younger group. Examining this difference from the perspective of Super's career development model (Ornstein, Cron, and Slocum, 1989) revealed that the younger group is in the trial career stage and for this stage professional self image is an important factor. Being known for delivery and execution builds a positive image amongst peers and is

therefore likely to be more important to the younger group that has just entered the workforce and who are in the process of building a reputation. So career stages are capable of explaining minor differences in career needs but the career development needs between stages are not significantly different.

The younger group also places more importance on their educational qualification as a career capital component. The R&D knowledge worker progresses through their careers accumulating career capital and the younger group has just begun their journey. A significant milestone would have been the successful completion of a tertiary qualification which would have made a significant and recent impact on the perceived value of the career capital component. The recency effect explains how the most recent experiences would have the greatest effects on perceptions (Aronson, 1972, in Kirchmeyer, 2002) and is a likely explanation as to why the younger group attributes a higher level of importance to their educational qualification. The modal Likert response of the younger R&D knowledge worker was five (Table 10) while the modal response for the older R&D knowledge worker group was four (Table 13), showing that educational qualification is also perceived to be important by the older R&D knowledge workers. Using the recency argument as an explanation, the difference in perceived importance for the educational qualification component does not represent a significant difference in perceptions between the two groups of R&D knowledge workers.

The three other career capital components that held a higher level of importance for the older group of R&D knowledge workers were:

- business acumen; understanding of the bigger business picture
- knowledge and understanding of the entire product life cycle or a system view
- ability to identify new opportunities for the organisation

Yeh (2008) describes how the career of a professional employee can be characterised by four stages and that in the third stage the employee begins to assume a greater responsibility and begins to deal with the external environment. In the fourth stage the employee has a great deal of power and influences the direction of the organisation (Yeh, 2008). The three career capital components that the older R&D knowledge worker places a greater importance on are focused on a macro environment of the business. The older R&D knowledge worker group consists of individuals that are in the third and fourth career stage. The third and fourth career stages are more focused on the external and macro environment of the high-tech R&D business which results in the older R&D knowledge worker placing a greater level of importance on three components defined above.

The older R&D knowledge worker places a higher level of importance on business acumen, understanding the entire product life cycle and the ability to identify new opportunities for the organisation; these components have low overall rankings for the entire population. Business acumen is ranked at number 24 of 27 (Table 9), the ability to identify new opportunities for the organisation is ranked at number 26 of 27 (Table 9) and knowledge and understanding of the entire product life cycle is ranked a bit higher at number 17 of 27 (Table 9). The low ranking of these

components shows that even though there are perceived differences in importance of certain career capital components, their ranking with respect to the other components are low. For this reason, the measured differences in perceptions may be regarded as being insignificant differences in perceived importance between young and old R&D knowledge workers.

The research results in Table 29 revealed only three differences in perceptions of the importance of a total of 26 career capital accumulation methods that were measured. The dependence on one's original qualification was perceived as being more important by the young group of R&D knowledge workers. This difference can be justified with the use of the recency effect (Aronson, 1972, in Kirchmeyer, 2002) as argued above for the difference found in the "educational qualification" career capital component. In addition, the modal Likert response of the younger R&D knowledge worker was four (Table 20) while the modal response for the older R&D knowledge worker group was three (Table 23), showing that the difference in perceptions is not extreme.

The younger R&D knowledge worker attributed a higher level of importance to being mentored and coached. The younger R&D knowledge workers have just entered the work environment and have the greatest need for career development. Younger engineers and scientists have been found more willing to engage in forms of self-development and training (Finegold, Mohrman and Spreitzer, 2002) making mentorship and coaching more valuable to the younger R&D knowledge worker.

The mentorship accumulation method was ranked at number 22 of 26 (Table 21) for the older R&D knowledge worker and at 13 of 26 (Table 23) for the younger knowledge worker. This accumulation method does not rank in the ten most popular accumulation methods and is therefore assumed not to represent a significant difference between perceptions of young and old R&D knowledge workers. Similarly accumulating career capital through changing jobs within the company was ranked at 22 of 26 for the younger R&D knowledge workers and at 14 of 26 for the older R&D knowledge worker. The difference in perceived importance of changing jobs within the company was assumed not to represent a significant difference in perceptions between the two groups.

While statistically significant, the perceived differences in levels of importance of the various career capital components and accumulation methods are small. Of the 27 career capital components there were only five differences in perceptions between the young and old R&D knowledge worker groups, all of which did not rank in the top ten career capital components. Of the 26 career capital accumulation methods, only three showed different levels of importance for the two R&D knowledge worker groups. The non existence of major differences is further emphasised by the young and old R&D knowledge workers holding similar views on at least four of the five most important career capital components (Table 16) as well the least important career capital components (Table 17).

The results reveal that there are few differences in the perceptions of R&D knowledge workers that can be predicted by age. In an attempt to use age as a

predictor of knowledge workers commitment to the organisation, Finegold, Mohrman and Spreitzer (2002), in a study of engineers and scientists, found that the age effect was small and that it is important not to exaggerate the difference among age groups. There are therefore no significant differences in the perceived importance of career capital components and accumulation methods between R&D knowledge workers younger than 40 and R&D knowledge workers that are equal to and older than 40.

6.4 Research Question 4: In the high-tech R&D environment, are the perceptions of human resource practitioners different to the R&D knowledge workers?

Collins and Smith (2006) investigated 136 technology companies and found that the leaders of high-tech firms should carefully choose the human resource practices that are used to manage their knowledge workers because the practices are likely to shape the firm's social contexts, which in turn affect the firm's ability to create the new knowledge that is essential for high performance and growth. The creation of new knowledge drives an organisation's R&D capability and ultimately determines the high-tech R&D organisation's competitive advantage (Chang, Choi, and Kim, 2008). The perceptions of HR practitioners shape the design of organisation wide policies that impact of the working environment; it is therefore important that the perceptions of HR practitioners be aligned to that of the R&D knowledge workers. Research Question 4 investigated the alignment of perceptions between HR practitioners and R&D knowledge workers.

The research results show that HR practitioner's perceptions of the level of importance of the different career capital components do not differ from the perceptions of the R&D knowledge workers where the young and old knowledge workers have similar perceptions on the importance of a career capital components. The results in Table 30 suggest that the perceptions of the HR practitioners do align with the perceptions of at least one of R&D knowledge worker age groups. Where the young and old disagree on business acumen, educational qualification and the ability to identify new opportunities, the HR practitioners hold similar views to the older group of R&D knowledge workers. The young R&D knowledge worker and HR practitioner hold similar views on only one career capital component where the older R&D knowledge worker does not hold a similar view. This career capital component is the knowledge and understanding of the entire product life cycle. The HR practitioners perceived level of importance of career capital requirements therefore do not differ significantly from the perceptions of both the old and young R&D knowledge workers.

The difference in perceived importance of career capital components shows that HR and the older knowledge workers place more importance on:

- business acumen; understanding of the business bigger picture
- ability to identify new opportunities for the organisation

Since the older group of knowledge worker is likely to have more authority and be more senior in the organisation their focus may be biased to organisational

business related issues. It is also possible that this bias influences perceptions of the HR practitioners and what they perceive to be important for the high-tech R&D environment.

The differences in perceptions of career capital accumulation methods were measured and the results are shown in Table 31. For the accumulation methods, the HR practitioners did not hold similar views to the R&D knowledge workers on only 6 of the 26 accumulation methods that were investigated. The HR practitioners perceived the following accumulation methods to hold a higher level of importance:

- identification of opportunities to improve visibility and reputation at higher levels in the organisation
- networking and relationship building internal to the company
- networking and relationship building with stakeholders like suppliers and customers
- networking and relationship building external to the company
- adding value by challenging the status quo
- having a personal vision and development plan

Three of the six accumulation methods are related to networking with various stakeholders and HR practitioners perceived a higher level of importance for the career capital components that were related to networking.

In a study of 58 professionals in one high-tech aerospace organisation, Bush and Schkade (1985, in Capretz, 2003) found that the professionals in the high-tech environment exhibited high levels of introversion. Assuming that the R&D knowledge workers exhibit high levels of introversion, it is expected that the R&D knowledge worker will not attribute a high level of importance to networking related activities. The HR practitioner's emphasis on networking and interaction is likely to be associated to the organisational role of employee champion that has a focus on people and human relations (Francis and Keegan, 2006).

Adding value through challenging the status quo was perceived to be more important to the HR practitioners than the R&D knowledge workers. Challenging the status quo is extremely important as it encourages innovation. Innovation then allows the high-tech R&D organisation to create a competitive advantage to remain ahead of the pack (Cho, 2009). Innovation in the way you work was ranked at three of 26 (Table 26) for the R&D knowledge workers so R&D knowledge workers do believe that challenging the status quo is important. Then, the modal response for challenging the status quo was four for the R&D knowledge workers and five for the HR practitioners. This does not represent a significant difference in perceived importance between the HR practitioners and the R&D knowledge workers.

HR practitioners perceived a higher level of importance for:

- identifying opportunities that improve one's visibility and reputation at higher levels in the organisation
- having and maintaining a personal vision and development

The identification of opportunities to improve one's visibility is associated with the previously identified key R&D career capital accumulation group of building a personal brand identified in section 6.2 and shown in Figure 8. This apparent difference can be considered to have a low level of significance as the accumulation method can be allocated into one of the four key accumulation method groups. Similarly, maintaining a personal vision and development may be allocated to the continuous growth and development group, identified in section 6.2 and shown in Figure 8, therefore diminishing the significance of the difference.

One of the key roles that are required from an organisation's HR function is the role of employee champion (Francis and Keegan, 2006). The employee champion role can be further split into two more distinct roles, the employee advocate and human resource developer roles (Lemmergaard, 2009). Lemmergaard (2009) states that of the two roles the role as human resource developer will have more focus in the future. Focusing on employee development needs ensures that employee's capabilities are matched to their responsibilities; HR practitioners must therefore ensure that HR perceptions are aligned with the needs of the R&D knowledge worker when human resource development strategies are designed.

The research shows that there are no significant differences in perceived importance of career capital components between the HR practitioners and the R&D knowledge workers. There are only five differences in perceived importance evident in the total of 26 career capital accumulation methods. In the high-tech R&D environment, the perceptions of human resource practitioners are not significantly different to the perceptions of the R&D knowledge worker.

CHAPTER 7: CONCLUSION

The “war for talent” (Tulgan, 2000, in Jordan and Sutherland, 2004), the skills shortage and the knowledge workers’ desire to accumulate career capital contribute to the increasing mobility of knowledge workers. The skills shortage is exacerbated in the current global economic crisis and all economies, both old and new, have to define a “brain based” competitive advantage and be hubs of innovation to remain ahead of the pack (Cho, 2009). The knowledge based competitive advantage is especially important to high-tech R&D organisations and it is imperative that these organisations focus on their ability to attract and retain the best engineers and scientists.

The findings of this research are applicable to both the high-tech R&D organisation and the R&D knowledge worker and this study builds on existing work in the field of career capital. The findings provide insight into behaviours, intentions and requirements of the knowledge worker as they seek to accumulate career capital. The new knowledge uncovered in this study has been used to develop recommendations for both the organisation and the R&D knowledge worker. For the organisation, the recommendations will assist in the design of strategies that retain valuable R&D knowledge workers; for the R&D knowledge worker the recommendations will reveal development activities that add the best value to their career capital. The following sections present a summary of the findings, recommendations for the high-tech R&D organisation and recommendations for the R&D knowledge worker.

7.1 The R&D knowledge worker's career capital components and the ways in which it is accumulated

The R&D knowledge worker's career capital consists of four distinct groups of components and the different groups that support and reinforce each other are:

- personal attributes
- personal reputation
- social intelligence
- technical proficiency

The R&D workers career capital is accumulated through four categories of activities that integrate to create a synergy where methods from the different groups support and reinforce each other. R&D knowledge workers build career capital using activities that fall into the following four groups:

- building a personal brand
- challenging convention
- continuous growth and development
- learning from and through others

In the high-tech R&D environment, there are no significant differences in the perceived importance of career capital components and accumulation methods

between R&D employees younger than 40 years of age, R&D employees that are equal to and older than 40 years of age and human resource practitioners. The fact that there are similar views shows that there is a congruent and cohesive point of view on the understanding of career capital components and accumulation methods in the high-tech R&D environment.

7.2 Recommendations for organisations

The research has uncovered the key career capital components and the methods used to accumulate career capital within the high-tech R&D environment. This improved understanding of the desires of the knowledge worker affords the organisation an opportunity to design innovative career management solutions that will brand them as an attractive employer and position them as the employer of choice in the “war for talent”. Figure 10 shows how the R&D knowledge worker’s career development activities and needs impact on the organisation’s business performance. The following sections give a description of the model revealing how the model was developed and how the model can be used.

7.2.1 Developing the macro career capital model

The macro R&D career capital model unfolded as this research project progressed. The model began with reference to the business problems identified in chapter one. The chapter two literature review allowed the business challenges to be linked to relevant theoretical constructs to form an unfolding macro model of the research. The results from chapter five and discussions in chapter six were consolidated and incorporated into the unfolding model to arrive at Figure 10.

FIGURE 10: THE MACRO R&D CAREER CAPITAL MODEL, ITS ACCUMULATION METHODS AND THE BUSINESS IMPACT ON THE ORGANISATION

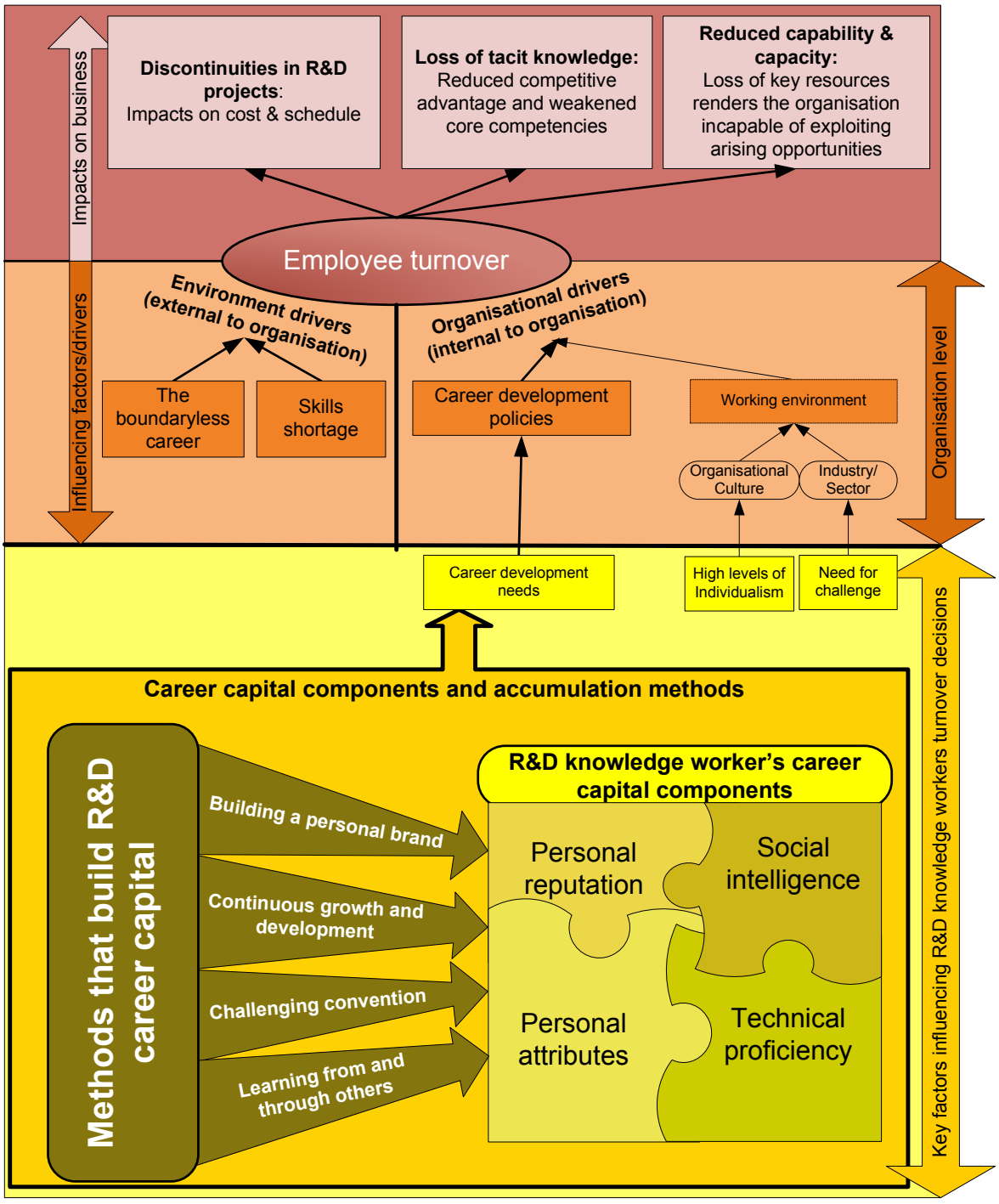


Figure 10 shows how the R&D knowledge workers career capital requirements can impact the organisation from a business perspective. A R&D organisation's employee turnover negatively impacts the business by:

- creating discontinuities in projects when R&D knowledge workers leave which has a negative impact on schedule and cost
- reducing the R&D organisation's knowledge base which effectively reduces the organisation's competitive advantage and weakens the core competency as tacit organisational knowledge is lost
- reducing the organisation's capacity and capability thereby limiting the organisation's ability to exploit new opportunities

These impacts on business are a result of increase employee turnover which has two key drivers:

- environment drivers that are external to the organisation like the boundaryless career and the current skills shortage,
- drivers that are internal to the organisation like the working environment and organisational career development policies

An organisation's career development policies must be aligned to the needs of the R&D knowledge worker. Figure 10 shows how the career development needs of the R&D knowledge worker is linked to the career development policies that impact employee turnover and ultimately impact the business. The four categories of

career capital components do not exist independently but exist as a system of components that support and reinforce each other to a achieve synergy. R&D career capital is built using four key categories of activities that also work together to accumulate R&D career capital.

7.2.2 Using the macro career capital model

The model illustrates the impacts that employee turnover has on the high-tech R&D organisations business and can be used to illustrate external and internal drivers and how the drivers link to the key factors relevant to the R&D knowledge worker. The model illustrates the importance of collectively understanding the career capital components due to the integrated nature of the key career capital groups. The accumulation methods are built into the model to highlight the key groups of activities that grow the R&D knowledge worker's career capital and the complete career capital model is used for support in justifying the recommendations that follow.

Organisations must create an enabling environment to afford knowledge workers the opportunity to grow their career capital. This can be accomplished by designing and facilitating activities that are aligned with the four key accumulation activity categories. As the knowledge workers grow their career capital, their inclination to exit the organisation will reduce as their career development needs would have been addressed, therefore potentially reducing voluntary turnover of key R&D employees. Then, by focusing on the real needs of the R&D knowledge worker, the high-tech R&D organisation will improve their value proposition to potential hires.

The improved value proposition improves the organisation's reputation therefore strengthening the organisation's positioning as the employer of choice which is likely to result in the organisation achieving a "super power" status in the "war for talent". Reducing the voluntary turnover of key R&D knowledge workers and attracting the best R&D knowledge workers will benefit the high-tech R&D organisation by effectively increasing their collective human capital and building a stronger competitive advantage.

High-tech R&D organisations must provide an enabling environment for all the accumulation methods as each method reinforces and supports the other. Factors that limit any group of activities will result in a less effective environment to build career capital and has the potential to erode career capital. For example, if more emphasis is placed on building a personal brand and less on continuous growth and development, the R&D knowledge worker will create an excellent temporary reputation. On non performance due to the lack of training and development, the R&D knowledge worker's personal reputation could be destroyed below previous levels. This also has impact on the organisation as an inadequately trained individual with a good reputation may be given levels of responsibility that expose that organisation to higher levels of risk.

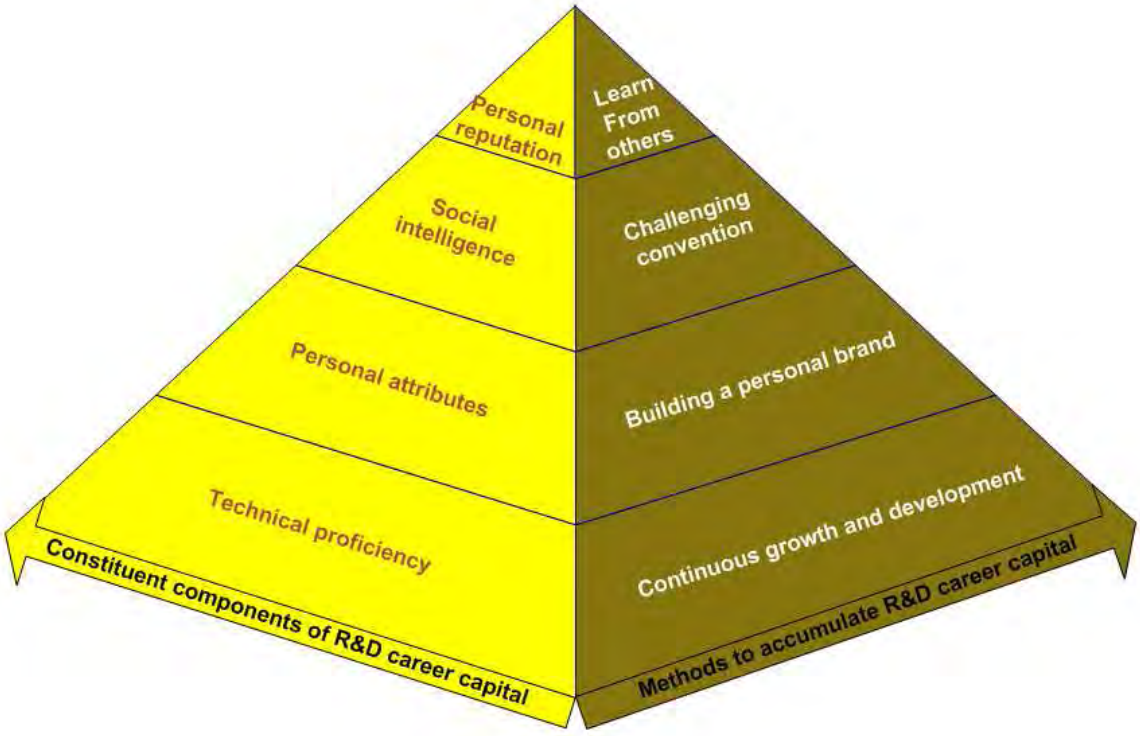
High-tech R&D organisations can leverage off creating an enabling environment for R&D knowledge workers to grow their career capital. By supporting R&D knowledge workers in their career growth activities, R&D organisations can

potentially reduce employee turnover and grow the organisation's competitive advantage by retaining and growing the human capital.

7.3 Recommendations for R&D knowledge workers

The R&D knowledge worker can now design their career development activities so that the design focuses on those career capital components and accumulation methods that are most applicable to the high-tech R&D environment. This design will then benefit the R&D knowledge worker by ensuring that maximum benefit is derived from career development activities. Figure 11 shows the R&D career capital development model created for R&D knowledge workers that has been designed from the research findings.

FIGURE 11: THE R&D CAREER CAPITAL DEVELOPMENT MODEL



The model shows the four key career capital component groups that are most beneficial to the R&D knowledge worker and the four key accumulation activities that that grow a R&D knowledge worker's career capital. It is necessary for all the components and accumulation methods to exist; any absence will represent an incomplete pyramid structure and symbolise a deficient R&D career position for the R&D knowledge worker. It is therefore essential that the R&D knowledge worker's career development encompass and address all the elements defined in the pyramid structure. The following recommendations are designed to assist the R&D knowledge worker to ensure a complete pyramid:

- develop a future learning mindset with a clear focused strategy
- be associated with relevant industry bodies and councils that are in touch with the latest developments
- build professional relationships internally and external to the organisation and promote their capabilities and skills
- be prepared to learn from any event, person or experience
- continually question the traditional approaches and try to improve ways of working; challenge the status quo
- build capacity to learn from others by understanding differences in personalities and the techniques to extract learning from different personality types

The R&D career capital model represents the minimum requirements for a R&D knowledge worker. R&D knowledge workers can differentiate themselves by engaging in additional accumulation activities defined in Table 18 and Table 19; the more activities that are used the more they are differentiated.

7.4 Recommendations for future research

This research has explored the career capital requirements of R&D knowledge workers in the high-tech R&D environment and has contributed to the career capital knowledge base by, for the first time, identifying and ranking explicit career capital components and accumulation methods. Further research in the area of R&D knowledge workers will contribute to creating a more comprehensive understanding of the behaviour and requirements of R&D knowledge workers.

The next step in growing the understanding of the R&D knowledge worker is to understand the R&D knowledge workers preferred performance management techniques and whether specific performance management techniques influence the R&D knowledge worker's innovative and creative capacity. This will allow organisations to design enabling working environments where R&D knowledge workers thrive and in the process effectively increase the competitive capacity of the high-tech R&D organisation.

In order to further build on the understanding, the findings from this research can be compared to industries other than the high-tech R&D industry; for example the banking industry that is involved in software development and fast moving

consumer goods industry that has short R&D projects. This will reveal any differences in the structure of career capital or in the ways that the other knowledge workers build their career capital. Organisations in the different sectors will then be in a position to tailor career development policies and working environments to suit the appropriate type of knowledge worker.

The interrelationship between career capital accumulation activities, performance at work and remuneration can also be investigated. This will show organisations the value of investing in career capital development activities by highlighting a causal link to employee performance. For the R&D knowledge worker, the recommended research will reveal how investment in career development activities impacts on remuneration.

7.5 Conclusion

R&D plays a critical role in the knowledge based competitiveness of countries and organisations. R&D activities generate innovative products, services and processes that positively influence the performance of economies and organisations by generating new revenue streams and improving efficiencies. A key role player is the R&D knowledge worker who is an essential resource to organisations that wish to compete in the knowledge based economy. With the findings from this research, it is hoped that organisations can be better equipped to attract, develop and retain the rare and valuable R&D knowledge workers.

Reference List

Ahmed, S., Wallace, K.M. and Blessing, L.S., (2003) Understanding the differences between how novice and experienced designers approach design tasks. *Research in Engineering Design*, 14, 1–11.

Albright, S.C., Winston, W.L. and Zappe, C. (2006) *Data analysis and decision making with Microsoft excel.* 3rd ed. United States of America: Thompson South-Western.

Appelton, J.V. (1995) Analysing qualitative interview data: addressing issues of validity and reliability. *Journal of Advanced Nursing*, 22, 993-997.

Arthur M.B, DeFillippi R.J., Jones, C. (2001) Project-based learning as the interplay of career and company non-financial capital, *Management Learning*, 32(1), 99-117

Arthur, M.B. and Rousseau, D.M. (1996) The boundaryless career as a new employment principle. In M.G. Arthur, & D.M. Rousseau (Eds.), The boundaryless career (pp.3-20) New York: Oxford University Press.

Baruch, Y. and Hall, D.T. (2004) The academic career: A model for future careers in other sectors?, *Journal of Vocational Behavior*, 64(2), 241-262

Björkqvist, K., Österman, K. and Kaukiainen, A. (2000) Social intelligence - empathy = aggression? *Aggression and Violent Behavior*, 5(2), 191–200

Bourdieu, P. (1986) 'The forms of capital'. In Richardson, J.G. (ed). Handbook of theory and research for sociology of education. New York: Greenwood Press.

Brelade, S. and Harman, C. (2007) Understanding the modern knowledge worker. *Knowledge Management Review*, 10(3), 24-29

Brooking, A. (1996) *Intellectual capital core asset for the third millennium enterprise*. London, International Thomson Business Press

Burke, R.J. and Ng, E. (2006) The changing nature of work and organizations: Implications for human resource management. *Human Resource Management Review*, 16, 86–94

Capretz, L.Z. (2003) Personality types in software engineering. *International Journal of Human Computer Studies,* 58, 207-214

Chang, J. Y., Choi, J. N., & Kim, M. U. (2008) Turnover of highly educated R&D professionals: The role of pre-entry cognitive style, work values, and career orientation. *Journal of Occupational and Organizational Psychology*, 81, 299-317

Chen, T., Chang, P. and Yeh, C. (2003) The study of career needs, career development programmes and job satisfaction levels of R&D personnel: the case of Taiwan. *The International Journal of Human Resource Management*, 14(6), pp. 1001 – 1026

Chien, C. and Chen, L. (2008) Data mining to improve personnel selection and enhance human capital: A case study in high-technology industry, *Expert Systems with Applications*, 34(1), 280-290

Cho, K. (2009) *Re-skilling Europe for the new global knowledge economy*. [Internet], France, INSEAD. Available from: <http://knowledge.insead.edu/EBSreporto090422.cfm?vid=221>

Collins, C.J. and Smith, K.G. (2006) Knowledge exchange and combination: the role of human resources practices in the performance of high technology firms. *Academy of Management Journal*, 49(3), 544-560

Cron, W.L. (1984) Industrial salesperson development: A career stages perspective. *The Journal of Marketing*, 48(4), 41-52

Currie, W. Galliers, B. and Galliers, R. (1999) *Rethinking management information systems: an interdisciplinary perspective.* Oxford University Press, 1999

Davenport, T.H., Thomas, R.J. and Cantrell, S. (2002) The Mysterious Art and Science of Knowledge Worker Performance. *MIT Sloan Management Review*, Fall (2002), 23-30

De Castro, M.G. and Sáez, P.L. (2008) Intellectual capital in high-tech firms: The case of Spain. *Journal of Intellectual Capital*, 9(1), p25-36

DeFillippi, R. and Arthur, M. (1994) The boundaryless career: A competency-based perspective. *Journal of Organisational Behaviour*, 15 (2) 307 – 324.

Dickmann, M. and Harris, H. (2005) Developing career capital for global careers: The role of international assignments, *Journal of World Business*, 40(4), 399-408

Droege, S.B. and Hoobler, J.M. (2003) Employee turnover and tacit knowledge diffudion: a network perspective

Drucker, P. (1994) The age of social transformation. *The Atlantic Monthly*, November 1994.

Dunn, O.J. (1964) Multiple Comparisons Using Rank Sums. *Technometrics*, 6(3), 241-252

Edvinsson, L. (2002) The new knowledge economics. *Business Strategy Review,* 13 (3), 72-76.

Edvinsson, L. and Malone, M. (1997) Intellectual Capital. Realizing your Company's True Value by Finding its Hidden Brainpower, HarperCollins, New York, NY

Engelbrecht, L. (2008) Defence, aerospace decry skills shortage. Defenceweb [Internet]. Available from: http://www.defencethink.co.za/ [Accessed 02 June 2008]

Farley, C., Malkani, D. and Smith, D. (2008) *What employers need to know about recent university graduates: Shaping recruitment and retention strategies to achieve high performance.* White Paper. Accenture.

Farr, J.V. and Beude, D.M. (2003) System engineering and engineering management: keys to efficient development of products and services. *Engineering Management Journal*, 15(3), 3-9

Finegold, D., Mohrman, S. and Spreitzer, G.M. (2002) Age effects on the predictors of technical workers' commitment and willingness to turnover. *Journal of Organizational Behavior*, 23, 655–674

Francis, H. and Keegan, A. (2006) The changing face of HRM: in search of balance. *Human Resource Management Journal*, 16(3), 231-249

Gaertner, S. (1999) Structural determinants of job satisfaction and organisational commitment in turnover models. *Human Resource Management Review*, 4(4), 479-493

Gardner, T.M. (2005) Human Resource Alliances: defining the construct and exploring the antecedents. *The International Journal of Human Resource Management*, 16(6), 1049-1066.

Gob, R., McCollin, C. and Ramalhoto, M.F. (2007) Ordinal methodology in the analysis of likert scales. *Quality & Quantity*, 41, 601–626

Harris, R.G. (2001) The knowledge-based economy: intellectual origins and new economic perspectives. *International Journal of Management Reviews*, 3(1), 21-40.

Hintze, J.L. (2007) *NCSS Help System*. Utah, NCSS

Hsu, I. (2008) Knowledge sharing practices as a facilitating factor for improving organizational performance through human capital: A preliminary test. *Expert Systems with Applications*, (35), 1316–1326

Huang, E.Y and Lin, S. (2006) How R&D management practice affects innovation performance: An investigation of the high-tech industry in Taiwan*. Industrial Management & Data Systems*, 106(7), 966-996

Inkson, K. and Arthur, M.B. (2001) How to be a successful career capitalist. *Organisational Dynamics*, 30(1), 48-61

Jones, C. and DeFillippi, R.J. (1996) Back to the Future in Film: Combining Industry and Self-Knowledge to Meet the Career Challenges of the 21st Century, *The Academy of Management Executive,* 10(4), 89-103

Kaplan, R. and Norton, D. (1992) The balanced scorecard – measures that drive performance, *Harvard Business Review*, 70, 71-9.

Kassarjian, H.H. and Nakanishi, M. (1967) A study of selected opinion measurement techniques, *Journal of Marketing Research*, 4(2), 148-153

Kazanjian, R.K., Drazin, R., Glynn, M.A., (2000) Creativity and technological learning: the roles of organization architecture and crisis in large-scale projects. *Journal of Engineering and Technology Management*, 17(3–4), 273–298.

Kinnear, L., and Sutherland, M. (2000) Determinants of organisational commitment amongst knowledge workers, *South African Journal of Business Management*, 31(3), 106–112.

Kumar, R. (2005) *Research methodology: a step-by-step guide for beginners*. London, Sage Publications Ltd.

Kupperschmidt, B.R. (2000) Multigeneration employees: strategies for effective management, *Health Care Manager*, 19 (1), 65-76.

Lamb, M. (2007) *The components of career capital for knowledge workers in the global economy*, Master in Business Administration Research Report, Gordon Institute of Business Science, University of Pretoria

Lazarova, M. and Taylor, S.(2009) Boundaryless careers, social capital, and knowledge management: Implications for organizational performance. *Journal of Organizational Behavior*, 30, 119–139

Lemmergaard, J. (2009) From administrative expert to strategic partner. *Employee Relations*, 31(2),182-196

Macky, K., Gardner, D. and Forsyth, S. (2008) Generational differences at work: Introduction and overview. *Journal of Managerial Psychology*, 23(8), 857-861

Mallon, M. and Walton, S. (2005) Career and learning: the ins and the outs of it, *Personnel Review*, 34(4), 468-487

Mayrhofer, W., Meyer, M., Iellatchitch, A. and Schiffinger, M. (2004) Careers and human resource management—a European perspective. Human Resource Management Review 14, 473–498

McCall, C.H. (2001) An empirical examination of the likert scale: some assumptions, development, and cautions. *Proceedings of the 80th Annual CERA Conference*, November 15-16, 2001 South Lake Tahoe, CA.

McFadyen, M.A. and Cannella, A.A. JR. (2004) Social capital and knowledge creation: Diminishing returns of the number and strength of exchange relationships. *Academy of Management Journal*, 47(5), 735–746.

Meisinger, S. (2006) Talent management in a knowledge-based economy*. HR Magazine*, 5 (1), 10

Miles, M.B. and Huberman, A.M. (1984) *Qualitative Data Analysis A Sourcebook of New Methods*. London, Sage Publications, Inc.

Miles, M.B. and Huberman, A.M. (1994) *Qualitative Data Analysis*, 2nd Edition, California, SAGE Publications, Inc.

Mrinalini, N. and Nath, P. (2008) Knowledge management in research and technology organizations in a globalized era. *Perspectives on Global Development & Technology,* 7(1), 37-54

Niederman, F. and Sumner, M. (2003) Decision paths affecting turnover among information technology professionals. In: *Proceedings of the 2003 SIGMIS Conference on Freedom in Philadelphia: Leveraging Differences and Diversity in the IT Workforce, April 10–12, 2003, Philadelphia, Pennsylvania*, pp. 133–142

Niederman, F., Sumner, M. and Maertz, C.P. (2006) An analysis and synthesis of research related to turnover among IT personnel. *Proceedings of ACM SIGMIS-CPR*, Claremont, CA,130–136.

Oh,W., Choi, J. N., & Kim, K. (2006) Coauthorship dynamics and knowledge capital: The patterns of cross-disciplinary collaboration in information systems research. *Journal of Management Information Systems*, 22, 265–292.

Ongori, H. (2007) A review of the literature on employee turnover. *African Journal of Business Management*, 1(3), 49-54.

Oppenheim, A. (1992) *Questionnaire Design, Interviewing and Attitude Measurement.* London, Pinter Publications Ltd

Ornstein, S., Cron, W.L. and Slocum, J.W. (1989) Life stage versus career stage: A comparative test of the theories of Levinson and Super, *Journal of Organizational Behavior*, 10 ,117-133

Raspe, O. and Van Oort, F. (2006) The knowledge economy and urban economic growth. *European Planning Studies*, 14(9)

Smola, K.W. and Sutton, C.D. (2002) Generational differences: revisiting generational work values for the new millennium, *Journal of Organizational Behavior*, 23(SP1),363-82

Stewart, T.A. (1998) Intellectual capital: The new wealth of organizations. New York, Broadway Business

Subramaniam, M. and Youndt, M.A. (2005) The influence of intellectual capital on the types of innovative capabilities*, Academy of Management Journal*, 48 (3), 450–463.

Sutherland, M. and Jordaan, W. (2004) Factors affecting the retention of knowledge workers. *South African Journal of Human Resource Management,* 2(2), 63-72

Super, D. E. and Hall, D. T., (1978) Career development: Exploration and planning. *Annual Review of Psychology*, 29, 300–351

Suutari, V. and Mäkelä, K. (2007) The career capital of managers with global careers. *Journal of Managerial Psychology,* 22(7), 628-648

Tai, W. and Chen C. (2009) A new evaluation model for intellectual capital based on computing with linguistic variable. *Expert Systems with Applications*, 36(2), 3483-3488

Yeh, Q (2008) Exploring career stages of midcareer and older engineers—When Managerial Transition Matters. *IEEE Transaction on Engineering Management*, 55 (1), 82-93

Zikmund, W.G. (2003) *Business research methods*. United States of America, South-Western a division of Thomson Learning.

APPENDIX A: CONSISTENCY MATRIX

Question Number	Research Question	Literature Review	Data Collection	Analysis	Results
Research Question 1	What are the components of career capital in a high-tech R&D industry and how are the components ranked in terms of importance?	DeFillippi and Arthur (1996); Lamb (2007); Inkson and Arthur (2001);	Phase one expert interviews guided by interviewer schedule as defined in C.1	Content analysis recording frequency of communicated concepts to determine constructs to be used in phase two questionnaire design.	Table 5; Table 8; Table 10; Table 12Table 14; Table 16; Figure 4Figure 3;Figure 4
Research Question 2	How do you build career capital in a high-tech R&D environment and how are the methods ranked in terms of importance?	Chang, and Yeh (2003); Chang, Choi, and Kim, (2008);	Questionnaire developed from literature review and constructs identified from research phase 1.	Descriptive Statistics	Table 5; Figure 5; Table 18; Table 20;Table 26;Table 27
Research Question 3	What are the perceived differences in importance of career capital components and accumulation methods between R&D knowledge workers younger than 40 and R&D knowledge workers that are equal to and older than 40?	Yeh (2008); Macky, Gardner and Forsyth (2008); Cron (1984)	Questionnaire developed from literature review and constructs identified from research phase 1.	Descriptive Statistics	Table 28
Research Question 4	In the high-tech R&D environment, are the perceptions of human resource practitioners different to the R&D knowledge workers?	Collins and Smith (2006)	Questionnaire developed from literature review and constructs identified from research phase 1.	Descriptive Statistics	Table 30; Table 31

APPENDIX B: QUALITATIVE INTERVIEWS

TABLE 34: SUMMARY OF QUALITATIVE INTERVIEWS

Respondent	1	2	3	4	5	6	7	8	9	10
Position	Group Manger: Mechanical Engineering	System Engineer	Software Engineer	Line Manager	Engineer (High Speed Hardware Design)	HR Consultant (Engineering)	Group Manger: Electrical Engineering	Executive: HR	HR Manager: Career and organisational development	Software Engineer
Age	48	47	46	49	27	35	54	51	51	28
Experience	25	21	20	21	3	2	30	24yrs (6mths in high-tech R&D)	23	6
Component	Academic Qualification	Academic Qualification (relevant for Role)	Academics Qualification	Academics Qualification – dept of study; Applicable to role	Base Academics. Higher level, not important. Qualification applicable to role.	Academics Qualification – dept of study; Applicable to role	Academics	Academics Qualification Gives indication of intellectual capability	Academics Qualification Level of Qualification – pre requisite	Academics Qualification Level of Qualification – pre requisite
	Applicable hands on Experience	Experience in applying the knowledge	Experience in applying the knowledge		Experience in applying the knowledge – hands on	Skills relevant to the job – hands on knowledge	Experience in applying the knowledge – hands on	Experience in applying the knowledge – hands on	Experience in applying the knowledge – competencies and know how, not years	Experience in applying the knowledge – competencies and know how,

Respondent	1	2	3	4	5	6	7	8	9	10
Position	Group Manger: Mechanical Engineering	System Engineer	Software Engineer	Line Manager	Engineer (High Speed Hardware Design)	HR Consultant (Engineering)	Group Manger: Electrical Engineering	Executive: HR	HR Manager: Career and organisational development	Software Engineer
Age	48	47	46	49	27	35	54	51	51	28
Experience	25	21	20	21	3	2	30	24yrs (6mths in high-tech R&D)	23	6
			Experience in the Industry – Understanding of the environment	Experience in the Industry – Understanding of the environment	Experience applicable to the industry/environment	Experience applicable to the industry/environment	Experience applicable to: Industry (Fit to the environment) & Role	Experience applicable to the environment	Track record – reputation in the field	
	Experience in Project Life Cycle- working experience	Experience in Project Life Cycle – working experience			Understanding of your product operation in the real world – this experience in the entire life cycle				Experience in Project Life Cycle – working experience	
	Diverse experiences in the different disciplines	Experience in diverse disciplines			Experience in diverse disciplines; variety of experiences	Experience in diverse disciplines; variety of experiences		Experience in diverse disciplines; variety of experiences; Diversity within the same industry		Experience in diverse disciplines; variety of experiences;

Respondent	1	2	3	4	5	6	7	8	9	10
Position	Group Manger: Mechanical Engineering	System Engineer	Software Engineer	Line Manager	Engineer (High Speed Hardware Design)	HR Consultant (Engineering)	Group Manger: Electrical Engineering	Executive: HR	HR Manager: Career and organisational development	Software Engineer
Age	48	47	46	49	27	35	54	51	51	28
Experience	25	21	20	21	3	2	30	24yrs (6mths in high-tech R&D)	23	6
		Big Picture view	Big Picture view	Systems view, broader view	NOT Required				Big Picture view - Company's perspective Clients Perspective	Big Picture view - Understanding of where you fit in
		Ability to collect and integrate knowledge	Pragmatic – Understanding why.		Understanding of cost vs. performance – not only technical specification			Business acumen	Business acumen – Company's perspective Clients Perspective	
	Managing in technical environment – understanding of the challenges typical of the environment			Managing in technical environment – understanding of the challenges typical of the environment						

Respondent	1	2	3	4	5	6	7	8	9	10
Position	Group Manger: Mechanical Engineering	System Engineer	Software Engineer	Line Manager	Engineer (High Speed Hardware Design)	HR Consultant (Engineering)	Group Manger: Electrical Engineering	Executive: HR	HR Manager: Career and organisational development	Software Engineer
Age	48	47	46	49	27	35	54	51	51	28
Experience	25	21	20	21	3	2	30	24yrs (6mths in high-tech R&D)	23	6
	Passion for the environment – assists in overcoming difficulties/challenges inherent in R&D	Passion for the environment				Passion for the environment	Passion – related to work. Inherent interest	Passion for the Industry		
	The ability to access networks of people to solve challenges		The ability to access networks of people to solve challenges	The ability to access networks of people: contractors; resources internal and external					Ability for to network socially, to market your true value.	Ability for to network socially,
			Teamwork Working in a team	Teamwork Working in a team	Teamwork Working in a team	Teamwork Working in a team – in R&D Ability to deal with conflict	Teamwork, Constructive Interpersonal and communication Collaborative	Teamwork, Players and Leaders - Collaborative	Teamwork, Players and Leaders - Collaborative	Teamwork, Players and Leaders - Collaborative – ability to work with and communicate with a diverse group of people.

Respondent	1	2	3	4	5	6	7	8	9	10
Position	Group Manger: Mechanical Engineering	System Engineer	Software Engineer	Line Manager	Engineer (High Speed Hardware Design)	HR Consultant (Engineering)	Group Manger: Electrical Engineering	Executive: HR	HR Manager: Career and organisational development	Software Engineer
Age	48	47	46	49	27	35	54	51	51	28
Experience	25	21	20	21	3	2	30	24yrs (6mths in high-tech R&D)	23	6
				Ability to influence		Interpersonal and communication	Convincing,		Ability to lead and influence	
				Ability to lead and direct	Ability to lead		Ability to lead technical direction Leadership is extremely important – can get nothing done without – BEST CAREER CAPITAL is combination of technical and team/individual leader	Ability to motivate and inspire	Ability to lead and influence	
				Drive and Positive energy						Determination; Perseverance
					Taking initiative	Taking initiative	Willingness to experiment and try new things. Taking initiative – not afraid to take risks	Action oriented		

Respondent	1	2	3	4	5	6	7	8	9	10
Position	Group Manger: Mechanical Engineering	System Engineer	Software Engineer	Line Manager	Engineer (High Speed Hardware Design)	HR Consultant (Engineering)	Group Manger: Electrical Engineering	Executive: HR	HR Manager: Career and organisational development	Software Engineer
Age	48	47	46	49	27	35	54	51	51	28
Experience	25	21	20	21	3	2	30	24yrs (6mths in high-tech R&D)	23	6
					Ability to look for and seize relevant opportunities		Optimistic,		Ability to look for and seize opportunities: Early in career – any opportunity to prove. Established career – selected.	Ability to look for and seize opportunities: Early in career – any opportunity to prove. Established career – selected.
				Understanding company culture – how things are					Emotional Intelligence (EQ)	
				Differentiator: The ability to work in unfamiliar situations; solving unfamiliar problems	Ability to adapt to changing environment. Comfortable with many tools and using new tools	Unique thinking Problem Solving				Ability to adapt to changing environment.
					Managing oneself, multitasking					

APPENDIX C: INTERVIEWER SCHEDULES AND QUESTIONNAIRES

C.1 PHASE ONE INTERVIEWER SCHEDULE

Informed Consent

I am conducting research on how career capital is built (or accumulated) by individuals in the high-tech R&D environment. I need to determine what career capital consists of in the high-tech R&D environment. Our interview is expected to last for approximately half an hour, and will help me understand what the constituent components of career capital are. Your participation is voluntary and you may withdraw at any time without penalty. Of course, all data will be kept confidential. If you have any concerns, please contact me or my supervisor. Our details are provided below:

	Researcher	Supervisor
Name:	Mr. Garsen Naidu	Prof. Margie Sutherland
Email:	garsen.naidu@mtnloaded.co.za	sutherlandm@gibs.co.za
Phone:	+27 83 234 7225	+27 11 771 4362

Signature of Participant _____ Date: _____

Signature of Researcher _____ Date: _____

Discussion Schedule

“Imagine if you had to buy a house. You first look at the amount of capital you have and based on that, decide on the type of house you can afford. If you have large amounts of capital you are not restricted and can purchase a house that meets your every need.

When organisations employee individuals they typically look at what the employees can invest in their organisation. Employees invest their career capital in the organisation, a sum of value that they have collected through their career and the potential it has for the future.

When you look at becoming a part of an organisation, you need to show the career capital that you have to invest in an organisation that you want become a part of; also, if you are part of a company, career capital is the resources (i.e. what you have at your disposal) that allows you to excel in your job. Career capital then consists of many components that is accumulated in ones career.

What do you think are the components that make up career capital in the high-tech R&D environment?”

Qualitative Interview Response

Participant Details

Position	Experience in R&D industry (years)	Age (years)

Participant Response

DATE		NO:	

C.2 PHASE TWO QUESTIONNAIRE

SURVEY INTRODUCTION

I am conducting research on how career capital is built (or accumulated) by individuals in the high-tech R&D environment. I need to determine what career capital consists of and how it is accumulated in the high-tech R&D environment such as in Denel so that we understand how people like yourselves build your careers.

You are requested to please complete the attached survey that should take no more than 20 minutes of your time. The survey consists of two sections:

1. An introduction to career capital.
2. A questionnaire that seeks to elicit your experience.

Your participation is voluntary and you may withdraw at any time without penalty. Of course, all data will be kept confidential. If you have any concerns, please contact me or my supervisor. Our details are provided below:

	Researcher	Supervisor
Name:	Mr. Garsen Naidu	Prof. Margie Sutherland
Email:	garsen.naidu@mtnloaded.co.za	sutherlandm@gibs.co.za
Phone:	+27 83 234 7225	+27 11 771 4362

Thank you for your participation

What is career capital?

Imagine if you had to buy a house. You first look at the amount of capital you have and based on that, decide on the type of house you can afford. If you have large amounts of capital you are not restricted and can purchase a house that meets your every need.

When organisations employ individuals they typically look at what prospective employees can invest in their organisation. Employees invest a range of different career capitals in the organisation. Career capital is the sum of the value that they have collected through their career as well as the potential future value of the career capital. For example a medical doctor's career capital might consist of an original qualification, experience in a specialisation, building up a reputation amongst patients and through teaching at a medical school which might enhance his reputation with soon to be qualified doctors who would then refer patients to him.

When you look at becoming a part of an organisation, you need to show the career capital that you have to invest in an organisation. If you are part of a company, career capital is the resources you have at your disposal that allows you to excel in your job. Career capital then consists of many components that is accumulated through one's career.

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Survey questions

Please indicate answers by ticking the appropriate boxes on the following page:

Age	20 - 29	30 - 39	40 – 50	50
Code	1	2	3	4

Gender	Male	Female
Code	1	2

Role/Current Area:	Design Engineer/ Scientist (Non managerial)	HR	Management Line/Executive	Other: (Please Specify)
Code	1	2	3	

Years of experience in high-tech R&D environment:	

Question 1: How important have the following career capital components been in building your career capital?

Please rank your response on the 5 point scale by marking the appropriate block in the table below.

Please vary your responses your responses along the scale as far as possible.

Group One: Career Capital Components

Code	1	2	3	4	5
	Not important at all		Some-what important		Critically Important
Flexibility and adaptability; Ability to adapt to various environments					
Educational qualifications					
Business acumen; understanding of the business bigger picture					
A comprehensive technical understanding. (To know why)					
A practical or pragmatic understanding of the technical and working environment					
Technical ability (To know how)					
Relevant hands on knowledge					
Experience in industry					
Knowledge and understanding of entire product life cycle or a system view					
Ability to identify new					

Code	1	2	3	4	5
	Not important at all		Some-what important		Critically Important
opportunities for the organisation					
Personal reputation					
Multi disciplinary experience i.e. experience in diverse disciplines e.g. different roles in the organisation					
Networking within the organisations					
Networking with stakeholders like customers and suppliers.					
Networking external the company					

Group Two: Career Capital Components

Code	1	2	3	4	5
	Not important at all		Some-what important		Critically Important
Action orientation					
Determination and perseverance					
Passion for the industry environment					
Being known for delivery and execution					
Self motivation and drive					
Ability to participate in a team (team player)					
Ability to lead a team (team leader)					
Ability to influence/motivate					
Knowing yourself or emotional Intelligence.					
People skills; having good working relationships					
Understanding your reactions and feelings to different situations					
Understanding challenges of managing in your industry and working environment					

Group Three: Additional Career Capital Components

Other components that you have encountered: Please say what they are and then rate them:					
Code	1	2	3	4	5
	Not important at all		Some-what important		Critically Important

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Question 2: Which of the following methods have you used to build your career capital?

Please rank your response on the 5 point scale by marking the appropriate block in the table below.

Please vary your responses your responses along the scale as far as possible.

Group One: Building Career Capital

Code	1	2	3	4	5
	Not used at all		Some-what used		Used extensively
Changing jobs across industries					
Changing jobs within current industry					
Changing jobs within current company					
Depending on my original qualification					
Further training and development					
Improving education qualifications					
Identification of opportunities to improve visibility and reputation at higher levels in the organisation					
Ensuring multi-disciplinary exposure					
Being mentored or coached					
Eagerness to adopt new ways of working					
Willingness to learn					
Networking and relationship building internal to the company					
Networking and relationship					

Code	1	2	3	4	5
	Not used at all		Some-what used		Used extensively
building with stakeholders like suppliers and customers					
Networking and relationship building external to the company					
Luck has played a role in your career					
Developing a complete competence in your role before seeking new opportunities					

Group Two: Building Career Capital

Code	1	2	3	4	5
	Not used at all		Some-what used		Used extensively
Reading to keep updated with current industry events and issues					
Adding value by challenging the status quo					
Innovation in the way you work					
Keeping to the rules of my organisation					
Association with and learning from successful individuals inside the organisation					
Association with and learning from successful individuals outside the organisation					
Having a personal vision and development plan					
Ensuring that you deliver on your promise					
Attending conferences					

Code	1	2	3	4	5
	Not used at all		Some-what used		Used extensively
Presenting at conferences					

Group Three: Additional Ways to Build Career Capital

Other ways you have developed your career: Please say what they are and then rate them:					
Code	1	2	3	4	5
	Not used at all		Some-what used		Used extensively

Question Three: Open Ended Questions

Are there any barriers that prevent you from building your career capital?	Yes	No
Please Explain		

APPENDIX D: SURVEY DATA

D.1 RESPONSES OF KNOWLEDGE WORKERS IN THE HIGH-TECH R&D ENVIRONMENT

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

Responses of knowledge workers in the high-tech R&D environment				Likert Scale Responses				
Construct	**Weighted Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
Flexibility and adaptability; Ability to adapt to various environments	212	4.0	4	1	1	9	33	10
Educational qualifications	216	4.0	4	0	2	12	24	16
Business acumen; understanding of the business bigger picture	172	3.0	3	2	12	21	12	7
A comprehensive technical understanding. (To know why)	237	4.0	4	0	0	4	25	25
A practical or pragmatic understanding of the technical and working environment	230	4.0	4	0	1	2	33	18
Technical ability (To know how)	239	5.0	5	0	0	6	19	29
Relevant hands on knowledge	208	4.0	4	0	1	16	27	10
Experience in industry	186	3.5	3	3	4	20	20	7
Knowledge and understanding of entire product life cycle or a system view	196	4.0	4	0	9	15	17	13
Ability to identify new opportunities for the organisation	155	3.0	3	7	13	18	12	4

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

Responses of knowledge workers in the high-tech R&D environment				Likert Scale Responses				
Construct	**Weighted Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
Personal reputation	199	4.0	4	0	6	13	27	8
Multi disciplinary experience i.e. experience in diverse disciplines e.g. different roles in the organisation	183	3.0	3	1	8	21	17	7
Networking within the organisations	185	4.0	4	4	6	16	19	9
Networking with stakeholders like customers and suppliers.	156	3.0	3	9	13	13	13	6
Networking external the company	146	3.0	3	10	14	17	8	5
Action orientation	205	4.0	4	0	3	14	28	9
Determination and perseverance	239	4.5	5	0	0	4	23	27
Passion for the industry environment	213	4.0	4	1	3	11	22	17
Being known for delivery and execution	220	4.0	4	1	1	6	31	15
Self motivation and drive	242	5.0	5	0	0	3	22	29
Ability to participate in a team (team player)	224	4.0	4	0	1	9	25	19
Ability to lead a team (team leader)	186	3.5	4	0	10	17	20	7
Ability to influence/motivate	201	4.0	4	1	7	10	24	12
Knowing yourself or emotional Intelligence.	202	4.0	4	1	4	15	22	12
People skills; having good working relationships	223	4.0	4	1	1	7	26	19

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

Responses of knowledge workers in the high-tech R&D environment				Likert Scale Responses				
Construct	**Weighted Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
Understanding your reactions and feelings to different situations	186	3.0	3	2	4	24	16	8
Understanding challenges of managing in your industry and working environment	179	3.0	3	1	8	22	19	4
Changing jobs across industries	95	1.0	1	31	11	6	6	0
Changing jobs within current industry	105	1.0	1	32	4	8	9	1
Changing jobs within current company	137	3.0	1	20	4	15	11	4
Depending on my original qualification	171	3.0	3	2	13	20	12	7
Further training and development	205	4.0	4	1	7	11	18	17
Improving education qualifications	158	3.0	4	11	10	11	16	6
Identification of opportunities to improve visibility and reputation at higher levels in the organisation	152	3.0	4	7	15	14	17	1
Ensuring multi-disciplinary exposure	197	4.0	4	2	8	11	19	14
Being mentored or coached	161	3.0	2	8	15	10	12	9
Eagerness to adopt new ways of working	192	4.0	4	0	7	19	19	9
Willingness to learn	248	5.0	5	0	0	3	16	35
Networking and relationship building internal to the company	203	4.0	4	1	6	9	27	11

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

Responses of knowledge workers in the high-tech R&D environment				Likert Scale Responses				
Construct	**Weighted Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
Networking and relationship building with stakeholders like suppliers and customers	145	2.5	2	9	18	10	15	2
Networking and relationship building external to the company	126	2.0	1	20	9	14	9	2
Luck has played a role in your career	106	2.0	1	21	18	11	4	0
Developing a complete competence in your role before seeking new opportunities	193	4.0	4	2	6	16	19	11
Reading to keep updated with current industry events and issues	195	4.0	4	3	6	15	15	15
Adding value by challenging the status quo	196	4.0	4	0	4	19	24	7
Innovation in the way you work	211	4.0	5	0	5	13	18	18
Keeping to the rules of my organisation	175	3.0	3	1	13	19	14	7
Association with and learning from successful individuals inside the organisation	211	4.0	4	0	3	12	26	13
Association with and learning from successful individuals outside the organisation	150	3.0	2	10	14	13	12	5
Having a personal vision and development plan	180	3.0	4	3	10	15	18	8

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

Responses of knowledge workers in the high-tech R&D environment				Likert Scale Responses				
Construct	**Weighted Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
Ensuring that you deliver on your promise	239	5.0	5	0	3	2	18	31
Attending conferences	135	2.0	2	12	17	13	10	2
Presenting at conferences	102	1.0	1	29	11	6	7	1

D.2 RESPONSES OF HR EMPLOYEES IN THE HIGH-TECH R&D ENVIRONMENT

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

HR Responses				Likert Scale Responses				
Construct	**Weighted Sum**	**Median**	**Mode**	**1**	**2**	**3**	**4**	**5**
Flexibility and adaptability; Ability to adapt to various environments	19	4.0	4	0	0	2	2	1
Educational qualifications	17	4.0	4	0	1	1	3	0
Business acumen; understanding of the business bigger picture	21	4.0	5	0	0	1	2	2
A comprehensive technical understanding. (To know why)	19	4.0	3	0	0	2	2	1
A practical or pragmatic understanding of the technical and working environment	19	4.0	4	0	1	0	3	1
Technical ability (To know how)	23	5.0	5	0	0	1	0	4
Relevant hands on knowledge	22	4.0	4	0	0	0	3	2
Experience in industry	16	3.0	2	0	2	1	1	1
Knowledge and understanding of entire product life cycle or a system view	17	3.0	3	0	0	3	2	0
Ability to identify new opportunities for the organisation	18	4.0	4	0	1	1	2	1
Personal reputation	20	4.0	4	0	0	1	3	1
Multi disciplinary experience i.e. experience in diverse	15	2.0	2	0	3	0	1	1

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

HR Responses				Likert Scale Responses				
disciplines e.g. different roles in the organisation								
Networking within the organisations	21	4.0	5	0	0	1	2	2
Networking with stakeholders like customers and suppliers.	21	4.0	5	0	0	1	2	2
Networking external the company	19	3.0	3	0	0	3	0	2
Action orientation	20	4.0	4	0	0	1	3	1
Determination and perseverance	21	4.0	4	0	0	0	4	1
Passion for the industry environment	21	4.0	4	0	0	0	4	1
Being known for delivery and execution	23	5.0	5	0	0	0	2	3
Self motivation and drive	22	5.0	5	0	0	1	1	3
Ability to participate in a team (team player)	19	4.0	4	0	0	2	2	1
Ability to lead a team (team leader)	17	3.0	3	0	0	4	0	1
Ability to influence/motivate	20	4.0	5	0	0	2	1	2
Knowing yourself or emotional Intelligence.	21	4.0	5	0	0	1	2	2
People skills; having good working relationships	22	4.0	4	0	0	0	3	2
Understanding your reactions and feelings to different situations	19	4.0	4	0	0	2	2	1
Understanding challenges of managing in your industry and working environment	20	4.0	5	0	0	2	1	2

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

HR Responses				Likert Scale Responses				
Changing jobs across industries	10	2.0	2	1	3	1	0	0
Changing jobs within current industry	15	3.0	#N/A	1	1	1	1	1
Changing jobs within current company	13	2.0	1	2	1	0	1	1
Depending on my original qualification	11	2.0	2	1	2	2	0	0
Further training and development	21	4.0	4	0	0	1	2	2
Improving education qualifications	20	4.0	4	0	0	1	3	1
Identification of opportunities to improve visibility and reputation at higher levels in the organisation	21	5.0	5	0	0	2	0	3
Ensuring multi-disciplinary exposure	18	3.0	3	0	0	3	1	1
Being mentored or coached	20	4.0	4	0	0	1	3	1
Eagerness to adopt new ways of working	20	4.0	4	0	0	1	3	1
Willingness to learn	23	5.0	5	0	0	0	2	3
Networking and relationship building internal to the company	25	5.0	5	0	0	0	0	5
Networking and relationship building with stakeholders like suppliers and customers	21	4.0	5	0	0	1	2	2
Networking and relationship building external to the company	22	5.0	5	0	0	1	1	3
Luck has played a role in your career	10	2.0	1	2	2	0	1	0

Key to Colour Codes	Top 10 construct defined by summative scores	Modal Response		

HR Responses				Likert Scale Responses				
Developing a complete competence in your role before seeking new opportunities	20	4.0	3	0	0	2	1	2
Reading to keep updated with current industry events and issues	21	4.0	4	0	0	1	2	2
Adding value by challenging the status quo	23	5.0	5	0	0	0	2	3
Innovation in the way you work	21	4.0	5	0	0	1	2	2
Keeping to the rules of my organisation	14	3.0	3	0	2	2	1	0
Association with and learning from successful individuals inside the organisation	19	4.0	5	0	1	1	1	2
Association with and learning from successful individuals outside the organisation	19	4.0	4	0	1	0	3	1
Having a personal vision and development plan	24	5.0	5	0	0	0	1	4
Ensuring that you deliver on your promise	24	5.0	5	0	0	0	1	4
Attending conferences	15	3.0	3	1	0	3	0	1
Presenting at conferences	13	2.0	2	1	2	1	0	1