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Declaration

I, Rosie Hermina Massyn Romo, hereby declare that this thesis is my own original work. This work has not been handed in by anyone else for academic purposes. I have published parts of this study as the sole author, as set out in Annexure A to this study.

All work of other authors supporting my thesis is duly and clearly referenced in text where such work is referenced. I did not plagiarise any work of other authors. All research participants were aware of the fieldwork being conducted and great care was taken to conduct this research in an ethical manner.

____________________________________  __________________________
Signature                        Date
Rosie Hermina Massyn Romo
ABSTRACT

There is attentive focus on skills shortage and skills gap management to address the increasing industry reporting on the difficulty to find suitable candidates for employment. This study examined the organisation’s decisions and behaviour towards skills management in the Engineering and Technology disciplines and found evidence of inadequate skills management. A Skills Gap Management Model is offered and introduces the concept of a job fitness ratio as the guiding principle that organisations can and should adopt to take control of improved job definitions to clearly articulate its skills demand to enable an improvement in the skills matching processes. This approach places the onus on the organisation to own and manage skills gaps by being thorough and consistent in how it manages, compensates or substitutes for the lack of skills. If skills gaps are properly articulated and measured, then interventions can be targeted more effectively. This study assumes skills shortage as a constant and only provides a model describing the mechanism for defining and determining the skills gap as a fitness ratio between the individual and the job he is assigned to. It does not address ways to reduce the skills shortage or potential interventions to alleviate the skills gaps that organisations experience.
ACKNOWLEDGEMENT

I had the privilege of working as a contracting resource for several Organisations in the Telecommunication and Banking sectors where I could first hand witness, and experience, good and poor human resource decisions. I was also fortunate to have established relationships with many people, ranging from fellow project resources to the Executive echelon, who understood this study and its value. These are people who were eager to engage in discussions and be willing listeners and reviewers of my attempt to make sense of what is happening out there in terms of skills management of Engineering and Technology human resources.

A special thank you goes to all my Engineering friends and by name, my husband Juan, without whom the quality of this study may have suffered. Something we don’t learn as Social Sciences majors is the logical and sometimes clinical separation of fact from emotion. What is the cold fact about the Developer’s competence that contributed to a fraudster finding a wide open backdoor into the core banking solution? He was then such a nice person with so much potential! The Social Scientist sees opportunities for further development and the effect of cultural and situational factors on the ability to perform on the job. Engineering allows us to see levers, trajectories and the application of engineering laws to understand how employees function in complex and disruptive environments.

A Scarce Skills Scholarship awarded to me by the National Research Foundation supported this study.
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<tr>
<td>AA</td>
<td>AFFIRMATIVE ACTION</td>
</tr>
<tr>
<td>ABET</td>
<td>ACCREDITATION BOARD FOR ENGINEERING AND TECHNOLOGY</td>
</tr>
<tr>
<td>CMMI</td>
<td>CAPABILITY MATURITY MODEL INTEGRATION</td>
</tr>
<tr>
<td>EE</td>
<td>EMPLOYMENT EQUITY</td>
</tr>
<tr>
<td>EMEA</td>
<td>EUROPE, MIDDLE EAST AND AFRICA (REGION)</td>
</tr>
<tr>
<td>ESB</td>
<td>ENTERPRISE SERVICES BUS</td>
</tr>
<tr>
<td>GSM</td>
<td>GLOBAL SYSTEM FOR MOBILE COMMUNICATION</td>
</tr>
<tr>
<td>HR</td>
<td>HUMAN RESOURCES</td>
</tr>
<tr>
<td>HRM</td>
<td>HUMAN RESOURCE MANAGEMENT</td>
</tr>
<tr>
<td>ICT</td>
<td>INFORMATION AND COMMUNICATION TECHNOLOGY</td>
</tr>
<tr>
<td>IOP</td>
<td>INDUSTRIAL AND ORGANISATIONAL PSYCHOLOGY</td>
</tr>
<tr>
<td>IT</td>
<td>INFORMATION TECHNOLOGY</td>
</tr>
<tr>
<td>KPI</td>
<td>KEY PERFORMANCE INDICATOR</td>
</tr>
<tr>
<td>MDM</td>
<td>MASTER DATA MANAGEMENT</td>
</tr>
<tr>
<td>MIS</td>
<td>MANAGEMENT INFORMATION SYSTEM</td>
</tr>
<tr>
<td>SDLC</td>
<td>SYSTEMS DEVELOPMENT LIFE CYCLE</td>
</tr>
<tr>
<td>SOA</td>
<td>SERVICE ORIENTED ARCHITECTURE</td>
</tr>
<tr>
<td>STEM</td>
<td>SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (SKILLS)</td>
</tr>
<tr>
<td>OE</td>
<td>OPERATING ENVIRONMENT</td>
</tr>
<tr>
<td>TE</td>
<td>TECHNICAL ENVIRONMENT</td>
</tr>
<tr>
<td>ES</td>
<td>EDUCATION SYSTEM</td>
</tr>
<tr>
<td>DOE</td>
<td>DOMAIN OF EXPERTISE</td>
</tr>
<tr>
<td>LM</td>
<td>LABOUR MARKET</td>
</tr>
<tr>
<td>SMA</td>
<td>SKILLS MIX AND ALLOTMENT</td>
</tr>
<tr>
<td>PPT</td>
<td>PRODUCTION TOOLS AND TECHNIQUES</td>
</tr>
<tr>
<td>SS</td>
<td>SKILLS SHORTAGE</td>
</tr>
<tr>
<td>SG</td>
<td>SKILLS GAP</td>
</tr>
<tr>
<td>OS</td>
<td>ORGANISATIONAL STRUCTURE</td>
</tr>
<tr>
<td>OM</td>
<td>OPERATING MODEL</td>
</tr>
<tr>
<td>MP</td>
<td>MANAGEMENT PRACTICES</td>
</tr>
<tr>
<td>JD</td>
<td>JOB DESCRIPTION</td>
</tr>
<tr>
<td>SM</td>
<td>SKILLS MIX</td>
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<tr>
<td>NLO</td>
<td>NATURAL LEVEL OF COMPETENCE</td>
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Preface

On 27 June 2013 the television network CNN was doing an update on Europe’s “lost generation”. Seven and half million young people between the ages of 16 and 25 years of age are out of work [1]. The European Union’s Summit is being held in Brussels in June 2013 and the world is waiting to hear what coordinated efforts will come from this summit to help address the plight of so many young unemployed people.

Contrasted to this, the media informs us that employable candidates are just not available [2-5]. The skills crisis is a burning topic being discussed around the globe. While it is generally accepted in industry that real skills shortages do exist, annual surveys on employers’ difficulty of finding suitable employees are reporting statistics of up to 85% [3:4] of survey respondents not finding employable resources. Numbers this high, in conjunction with the numerous reports of the unemployment of graduate people suggest that there is more to the skills crisis than simply a lack of training and adequate development of resources.

Is it possible that the supply and demand of labour processes broke down somehow or has the job market changed so drastically that the scale has tipped? What else could account for 85% of a sample group of employers being unhappy with the current resource pools?
Chapter 1

1 Contextualisation of the study

1.1 Introduction to skills gaps management

Organisations struggle to balance a low number of adequately skilled human resources with an ever-increasing resource demand for the complex jobs to be performed. This shortfall in skilled staff contributes to an industry wide concern of “skills gap management”. The full term “skills gap management” is not as commonly used in the literature as several related, but encompassing concepts such as “mind the talent gap” [6]; improve the “measures of skills gaps” [7]; and “fixing the middle-skills gap” [8] all aimed at offering advice and interventions to manage the consequences of having a skills gap. It is accepted that skills gaps exist and this requires active management of the contributing factors, and resulting issues.

Related to skills gaps is “skills shortage”. Annual talent “shortage” surveys and institutional research into the current state of skills shortages are sizeable [2-3], [6-7], [9]. In general, organisations complain about the lack of available candidates with the right skills, with Science, Technology, Engineering and Mathematical skills (STEM) being inadequate to satisfy industry needs [3]. On closer scrutiny there are a number of underlying factors leading up to the unavailability of suitable candidates. Some factors are the legitimate unavailability of trained resources [4-5], [8], [10], while other factors support employment candidate views of a broken recruitment process and unrealistic demands by employers [11-17].

Skills gap management is a specific topic of concern in Engineering. Engineering Management is the emerging sub-discipline in Engineering responsible for the sound integration of engineering principles and the economic organisation, which includes, but is not limited to the management of technology [18-19]. The management of technology coupled with engineering education contribute to the
clarification of the skills gaps definition and management to improve the engineering employee-employer fit for productive contribution. Specific to engineering skills gap management, the focus is on the skills that are lacking in the Engineer to enable him to contribute positively to the organisation [20-24].

1.2 Skills Shortages vs. Skills Gaps

During the literature review it became clear that the foundation theory for the skills gap management dilemma was not sufficient to provide the framework and lexicon required for this study. It is necessary to understand what is meant with the term “skills gap” and how the reported statistics on “skills shortages” should be interpreted. This differentiation forms an important foundation of this study. The frequent reference to “skills gaps” and the interchangeable use of “skills gaps” and “skills shortage” obscure conditions for their use. In some instances it may refer to a real shortage of skills available in the recruitment pool [4-5], [25] while in other instances it refers to actual limitations in the individual’s skill set to complete defined tasks [6-7], [20], [26]. The literature relevant to this study does not refer to a common working definition for “skills gaps” and “skills shortages”, but use these concepts to describe a general industry concern of not finding employable candidates.

A shortage of skilled resources is technically a “skills shortage”. The term “skills gaps” as used in industry refers to both the shortage of certain skills as well as the absence of skills in the individual that is assumed to possess these skills. In the academic literature, a “skills shortage” is defined as “deficiencies within the labour pool, which create problems in recruiting new staff caused specifically by the shortage of individuals with the required skills in the accessible labour market” [27:18]. These skill shortages can also be contextualised in terms of new or modern jobs to be done for which there may not be enough skills available, an example being waste management of chemical and electronic materials, which require engineering skills [28]. Skill shortage is one of the components of the skills gaps management concern, especially in the Engineering discipline where too few formally qualified Engineers enter the market [3-5].
There is however a perception that available human resources with the required education and training may lack certain skills to complete the job. “Skills gaps” refer to deficiencies in the skills that employees need to carry out tasks. A skills gap is defined as “a disparity between the quality and adequacy of skills possessed by an individual and that required by industry” [29:1403]. The emphasis on skills gaps is on the action of doing the job, not the theoretical knowledge the Engineer may have. The gap is thus stated as a shortfall in performance delivery. There is consensus that employees are generally not equipped to deal with the demands of modern jobs [20], [22], [29-31].

1.3 Current literature on skills gap management

A background is given to our current understanding of skills gap management, which also serves as the literature overview applicable to this study.

1.3.1 Academic literature related to Engineering education

A few clusters of academic literature are relevant to this study. Most prominent is the cluster of literature related to the improvement in Engineering Education and the adequacy of the variety of curricula to prepare students for entry into the market [22-24], [32-34]. Engineering Education literature provides a rich source of engineering skills development context and challenges. This work helps to define what skills are being developed. Current academic efforts emphasise the need to develop or improve non-technical skills to bridge the shortfall in performance delivery [22], [31], [34]. Employer dissatisfaction with graduate employee skills for instance can be attributed to the under development of personal transferable skills and the recognition of graduates of their weaknesses in these skills [32]. It appears that organisations rely substantially on well-developed professional skills such as communication, problem solving and interpersonal skills. It is perceived in industry that this reliance compensates for the lack of *I know how to do this* in favour of *I can figure this out and make it happen*.

To this end, education curricula have been extended over the last ten years to include professional skills development in an attempt to make new graduates more adaptable to industry demand. There are several research studies in developing
Engineering profiles, attributes and performance expectations, which have resulted in the addition of professional skills criteria to guide educational outcomes [21], [34-37]. The Accreditation Board for Engineering and Technology (ABET) accredited these additional criteria. The rationale for adding the professional skills to the learning curricula is to address the shortfall in performance delivery, which is associated with a lack of the Engineer’s personal development.

1.3.2 Engineering skills assessment literature

Academic work is also done in the area of assessing current skills in the newly graduated group. This literature provides rich descriptions of the skills required as perceived by industry. The majority of academic work in the skills gaps management literature uses mostly informal interview techniques to establish industry skills expectation, which is very superficial. The required skills description is often derived through qualitative questionnaires completed by industry participants, be they Human Resource or Operations Management representatives. Examples of the industry skills expectation assessment that informs skills development effort for educational purposes include:

1. Employer perceptions of skills gaps in the Retail industry [30];
2. Engineering graduate’s perception of how well they are prepared for work in industry [31]; and
3. The skills gaps observed between IS graduates and the System Development industry [29].

This literature is an important aspect of this study as it very often points to coping, adapting, change tolerance and problem solving skills rather than scientific and technical skills [20], [22], [32], [35], [38]. An important message from this work is that students in general feel reasonably confident about their technical knowledge and skills, and through limited industry interaction, that their non-technical skills may be challenged [29], [31], [39].

The confirmation of these skills shortcoming focuses on employability skills as defined by industry in annual skills audits or regular publications aimed at stimulating the development of required skills [20], [22], [24], [31-32], [34-36].
The crux of these publications is that the non-technical or soft skills (professional skills) seem to be in short supply and thus should be better integrated into the Engineering curricula.

### 1.3.3 The role of Human Resource Management theory in this study

Human Resource Management (HRM) is a strategic process in organisations that is responsible for managing the workforce. HRM is concerned with the recruitment and selection of personnel; providing human relations and personnel administration support; management of culture, leadership and change initiatives; as well as remuneration, reward and disciplinary procedures [40-43].

HRM processes are included in this study as it vital for the organisation to acquire and maintain the skilled resources it needs. The HRM theory applicable to this study is reviewed in more detail in Chapter 4 to give context to the field observation and the Engineering Skills Management model development.

### 1.3.4 Advances in work analysis approaches

The literature review for this study will also show that current HRM theory, specifically job analysis, relies on out-dated frameworks and lacks the lexicon to describe modern job attributes and characteristics such as inter-job activities and customer service orientation [20], [30]. In the absence of these, it is possible that the meaning of skills gaps could be distorted due to incomplete naming conventions for existing skills or the inability to capture job characteristics due to the unavailability of a generally accepted term. Inter-job activity is an example of an unavailable term. It refers to the actions of two or more people, who are doing work outside the boundary of their defined job description, and which renders a usable output. This description comes from a few sources discussing the concept of the boundaryless job and the need to pick up additional work, [3], [17], [44]. No source provides a formal definition for this boundaryless situation other than what is covered in teamwork theory [41], [45]. Teamwork theory assumes the team composition and sub tasks are definable within the bigger delivery objective. Teamwork theory looks holistically at the team delivery and is not concerned with the ad hoc changes in tasks between two or more team members. The term “inter-
job activity” is not currently used in the Information and Communication Technology (ICT) industry and the concept of two or more people working towards a reusable output is not contextualised in this industry.

Job behaviour is changing as a result of more complex business and systems processes [2-3], [6], [9], [28]. Organisations need to adapt to this complexity and is experiencing challenges in meeting investor and executive expectations with increasingly fewer resources. Organisational practices are changing as a result of this adaptation process, which result in changes in job definitions and job boundaries. The traditional job descriptions appear to be less relevant to certain categories of jobs such as technology and business management. These changes in job behaviour lead to changes in the demand for certain skills.

Individuals further adapt to job demand changes and are developing the skills they offer to remain employable. Individuals may offer skills not developed by traditional means and may offer skills and competencies not directly related to their primary skill set [9-10], [12], [46]. Current recruitment and personnel management practices may not be geared towards identifying and recognising these skills. There is very little research available from the individual’s perspective and covers mostly graduate Engineers’ perception of career readiness [29], [31]. Little is known about the skill development motivation of working Engineers with longer tenures. There is however evidence of seasoned workers who exercise an influence over the employer in that they can be selective of the jobs they do want to accept [9], [44], [46-47].

Work analysis is incorporated in this study from the discipline of Industrial Psychology. This review covers seminal work in the last decade on the traditional job analysis theory of the previous century. The current HRM practices in industry are based on theory developed between 1970 and 2000 [48-51]. These theories make assumptions about the job and job behaviour that are no longer valid. Some of these out-dated assumptions include defined and stable job boundaries, stability of the relationship between the job and the job holder, hierarchical jobs and the employment of people within predefined positions aligned to a fixed and stable organisational hierarchy. Jobs have become dynamic,
boundaryless, with extension of ones responsibilities and boundaries being encouraged as opposed to the twentieth century practice that discouraged such behaviour [49].

1.3.5 Industry literature related to skills gaps management

The Manpower Group’s 2013 skill shortage survey results suggest that one in three organisations experience difficulty in filling jobs [3], [9]. At 35% skills shortage on average (from a 38,000 interviewee sample as demonstrated in Figure 1 below), this number has grown from 34% in the 2011 survey, with 85% of employers surveyed in Japan reporting the lack of adequate applicants as an issue [9:4]. The 2013 survey results list the same jobs as previous years as being difficult to fill [3].

**Figure 1: Global difficulty in finding suitable candidates**

![Figure 1: Global difficulty in finding suitable candidates](image)


The percentages of interviewees depicted by country below in Figure 2, which are having difficulty to fill certain positions, vary greatly between countries. The picture provides the context for the quoted 85% for Japan.
Figure 2: Percentage by country experiencing difficulty in finding suitable candidates

Source: Manpower Group 2013 Talent Shortage Survey [3:5]

Engineers are particularly difficult to find as indicated in Figure 3 [3-5].

Figure 3: Global view of jobs that are hard to fill

The flipside of these results is that for every story of an employer not finding the right candidates, there is a story of an available candidate not finding a job [3], [13], [16-17]. On-line job boards such as LinkedIn are advertising hundreds of positions every week\(^1\). On-line blogs provide an interesting picture of candidate views on what they refer to as a broken recruitment process [16]. Keyword matching, resume formatting rules, and the use of automated resume search functionality are lambasted for contributing to a mismatch between candidate capability and organisational requirement [11], [14-15], [17]. It is not uncommon to read of unemployment periods of up to two years for older workers. The assumptions of a smooth and relatively short recruitment process, given the number of positions that are advertised, are somewhat wrong.

There is concern raised about the use of, and reliance on, perception-based surveys to inform skills gap management interventions [7], [52-53]. The authors touch on the critical nature of reporting high skills shortage statistics when the underlying details supporting such claims are not available. An argument is made for more quantitative studies with measureable skills gap data to better inform the interventions aimed at alleviating the skills crises and improve the talent pipeline.

\section*{1.3.6 Deficiencies in the literature}

The deficiencies in the literature can be summarised as follows:

1. There is a lack of working definitions for skills gaps and skills shortages as used in industry today. These terms have become buzzwords that could mean many things to different people and may therefore distort or even aggravate the skills gap debate.

2. The perception based skills requirement and skills availability assessments lack quantifiable measures and descriptors of skills. We do not know what the exact skill set is that is required nor to what extent potential candidates fall short of this requirement.

\footnote{\textit{LinkedIN job boards} \url{http://www.linkedin.com/job/home?trk=nav_responsive_sub_nav_jobs}}
3. The available academic and industry literature cover mostly the employer perspective of the skills crises. The employee perspective is not well documented.

4. Very little is known about the influence that seasoned workers have on employer selection decisions. There appears to be a group of highly experienced and well-networked individuals that play by a different set of rules. There are only a few industry articles presently available on this trend.

1.4 Market job behaviour and assumptions

1.4.1 Expected job market behaviour and assumptions

For purposes of this study, it is assumed that the definitions for skills gaps and skills shortages quotes in Section 1.2 above refer to a natural state. This means that a natural skills shortage exists when fewer Engineering students enrol for, and complete, an Engineering course than what industry requires. This would support the claim that too few qualified candidate resumes are available in the recruitment pool when a prospective employer advertises a position [4-5], [25], [28]. Similarly, a natural skills gap exists when an employee with the correct education and training is found wanting in terms of his professional skills and experience [20], [23], [26], [36]. A definable and measurable gap would exist between the skills and experience he offers and that required by the job. Current HRM practices would provide a means to address and manage the shortfall likely to occur in this employee’s performance.

The expected job market behaviour and assumptions can be summarised as follows:

1. It is expected to see job vacancies where suitably skilled resources are not available in the recruitment pool due to the lack of a technical or scientific knowledge foundation.

2. It is expected to see poor performance where a skills placement was done without the resource having adequate experience and professional or soft skills. The assumption underlying this expectation is that the job-person
match was done only on the technical or scientific skill set (a Software Engineer was appointed in a Software Engineering position).

3. It is expected to see a larger portion of the human resource complement requiring additional training and development to fully grow into the position. The assumption underlying this expectation is that the job boundaries are larger and more fluid than generally understood.

4. Improved HRM practices are required to cater for the larger group of resources who need fit assistance due to the change in job boundaries.

5. Longer recruitment cycles will occur due to more variety in the resource pool due to additional skill offerings and longer assessment cycles to determine the best of a poorer person-job fit process.

### 1.4.2 Observed job market behaviour and assumptions

There is industry evidence of the difficulty for both the employer and potential employee to establish a mutually beneficial relationship. There is an abundance of documented examples of the employer inability to match available candidates to a job opportunity as well as graduated and experienced candidates who believe they can make a positive contribution to the organisation but are not given an interview [13], [16], [54].

Organisations are often caught in a perpetual cycle of recruitment for long standing vacancies, redeployment and ad hoc re-assignment of personnel in an attempt to address the skills gaps they experience. It is evident that organisations often require a person to assume a role that he was not originally employed for. The reason for this assignment is often not consciously made. It appears to result from crisis management but is often also initiated by the resource himself where an opportunity exists for learning new skills, or when displaying a positive team attitude. The job needs to be done and the individual is motivated to figure it out, and the employee thus assumes responsibility for the job by performance rather than by contract. Once assumed, there is very little formal intervention to re-assess the sound assignment of this work.
An age-old adage in business is that one cannot manage what one cannot measure. The working definitions as set out earlier for skills gaps and skills shortages are theoretically sound but of little practical use in business today. Organisations do not clearly differentiate between the two scenarios and are reporting on a general state of dissatisfaction with the quality and speed with which work is completed.

The observed job market behaviour and assumptions can be summarised as follows:

1. Very high incidences of employer dissatisfaction with available skills are reported.
2. High numbers of unemployment are reported around the globe. Media and public discussions refer to unemployment numbers; however the study detail may not be readily available to confirm these numbers. Statistics South Africa conducts a Quarterly Labour Force Survey. The unemployment figure was 24.7% in Q3 of 2013 with many of the country’s provinces sharing the national average. Eastern Cape and the Freeestate have unemployment rates of over 30% and Limpopo slightly lower at 17% [55]. The Quarterly Labour Force Survey unfortunately does not distinguish unemployment rates by occupation to provide detail for Engineers. It does however show that job losses occurred over the last two years in the manufacturing, utilities and construction industries.
3. Prolonged unemployment of educated candidates is reported in the media. These reports again appear to be public opinion with few solid studies verifying the reported numbers or providing a working definition for “educated”. A meta-analysis done on South African data between 1995 and 2004 [56] suggests that the definition for “educated” may include people with a post matric certificate and may not normalise the data for real workforce growth. Never the less, there may be real instances of graduated candidates being unable to find employment, which in conjunction with poor research papers, may create the perception of a growing unemployment of graduates.
4. Negative candidate views regarding their job search experiences are posted on several websites.
5. Field evidence exists of incorrect employee-job matches being done (Technology Solution Architect in possession of an optometry qualification).

6. Advice is given to job searchers on resume formatting rules and the use of keywords to outwit the automated search engines to avoid search results that prevent consideration for an interview.

7. Less formal appointments are made for specific work while keeping the job boundaries open to self-interpretation.

1.5 Problem statement

The observed job market behaviour does not align with the expected job market behaviour. Statistics of skills shortages of up to 85% become questionable given the on-going effort of educational institutions to align curricula to industry expectation; the availability of HRM practices to manage and develop resources; the on-going effort of individuals to do self-study and career changes; the number of educated and qualified candidates being out of work for months; and the challenge of candidates with years of experience not being offered an interview. There is an unnatural force at play in the supply and demand of skills in the market.

It may be possible that our understanding of the operational reality of resources in organisations is incomplete. Skills gaps is generally accepted as the unavailability of employability skills (professional skills) and is given in context of complex working conditions, exponential growth in technology functionality and the creation of jobs that did not exist before [4], [6], [28], [57]. While some of these factors could be new and novel to modern jobs, current organisational practices and policies may equally contribute to a widening gap between skills on offer and skills demanded. The perspective is that skills offered may be overlooked due to policies and practices that delimit the profile of the recruitment pool and selection eligibility criteria. Under- or over-utilisation of available skill in the organisation as well as unrealistic expectations of employers can also contribute to the general perception of a skills gap.
Due to the lack of working definition for modern job behaviour, which is most likely attributable to the lack of frameworks, methodology and a lexicon, there may be a distortion in the true shape and size of the skills gap statistics being reported due to process and practice constraints within organisations. The organisational processes responsible for recruiting, selecting, managing and developing resources are crucially important vehicles in a skills gap management drive. Organisations may not be aware that certain HRM practices have the effect of enlarging the skills gap. Organisations may further not be aware that they are not making the most of the limited skills sets they do have access to, or may not be in a position to change some of the factors leading to the poor utilisation of available skills. The pressure and speed with which work needs to be churned out may inhibit organisations from doing proper skills matrices and making a concerted effort to redeploy a resource to a role where that person’s skills can be better utilised.

1.6 The purpose of this study

This study attempts to describe what human resource decisions organisations make in an effort to keep positions filled and getting the work done. As a second objective the study describes how individual resources in the Engineering and Information Technology industries experience and cope with job search and job placement events. The objective is to understand the organisational factors influencing skills management practices to enable the identification and isolation of process and practice issues that might cloud real skills shortages (natural lack of technical and scientific skills) and real skills gaps (natural lack of professional skills contributing to a shortfall in performance delivery).

Several more detailed research questions are stated below to guide the study and the fieldwork:

1. What challenges do organisations have when looking for, and retaining resources?
2. What do organisations do to development resources and keep their knowledge current and relevant?
3. What do organisations do if they cannot find resources?
4. What can organisations do to improve the recruitment, selection and management of personnel processes?
5. What can Engineering and Information Technology resources do to improve their fit within the organisation?

This study addresses the skills gap management issue from four perspectives.

Figure 4: Study scope

1. Current skills gaps and associated interventions from a literature perspective highlight the skills that are being developed in response to industry demand. This perspective is discussed in Chapter 2, which considers academic literature on Engineering skills enhancement. The result of this discussion also guides the fieldwork with regard expected skills as discussed in Chapter 4;

2. The recruitment and selection practices are investigated for clarity on changes in these practices from pre 1990 business models. Industry
literature in Chapter 2 and field observations in Chapter 4 contribute to this perspective;

3. The individual’s approach to ensuring employability is factored into the skills gap management debate. This perspective is taken from industry literature discussed in Chapter 2; field observations in Chapter 4 and the skills profile match to a current job as discussed in Chapter 6.

4. Finally, the changes in job behaviour are explored for its impact on job definition and skills profile expectations. This aspect is covered by academic and industry literature in Chapter 2 as well as field observations in Chapter 4. Chapter 6 positions the need for proper job definition as a requirement for skills matching.

For purposes of this study a few working definitions are stated.

Table 1: Working definitions for this study

<table>
<thead>
<tr>
<th>TERM</th>
<th>DEFINITION</th>
</tr>
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<tbody>
<tr>
<td>Skills gap</td>
<td>“A disparity between the quality and adequacy of skills possessed by an individual and that required by industry” [29:1403]</td>
</tr>
<tr>
<td>Skills shortage</td>
<td>“Deficiencies within the labour pool, which creates problems in recruiting new staff caused specifically by the shortage of individuals with the required skills in the accessible labour market” [27:18].</td>
</tr>
<tr>
<td>Technical skills</td>
<td>Technical skills refer to the domain specific skills in technology and engineering fields, covering the technologies used in those fields such as development languages and telecommunication network elements and network management systems.</td>
</tr>
<tr>
<td>Functional skills</td>
<td>Functional skills refer to subject manager expertise required for a specific industry such as commercial banking or internet-hosted services.</td>
</tr>
<tr>
<td>Hard skills</td>
<td>Technical and Functional skills are often referred to as hard skills.</td>
</tr>
<tr>
<td>Professional skills</td>
<td>Professional skills are the preferred term to refer to soft skills or personal skills such as communication, time management, positive work ethics, interpersonal skills and punctuality.</td>
</tr>
<tr>
<td>Job description</td>
<td>A detail description of the work (tasks and processes) normally done by a person carrying out the job, including all relevant duties and responsibilities.</td>
</tr>
<tr>
<td>Job specification</td>
<td>A specification of a set of job requirements including skills, competencies, qualifications and other personal factors important in the ability to carry out the job.</td>
</tr>
</tbody>
</table>

II Oxford Dictionary of Psychology

III ibid
1.7 Methodological Considerations

1.7.1 Paradigmatic perspective
The researcher subscribes to an interpretive paradigm, specifically constructivism. The aim of a constructivist study is to reconstruct a reality in order to understand it [58]. The reality is collectively reconstructed and the reconstruction is based on consensus. The principle belief is that people construct their own understanding of reality, which in turn gives meaning based on the interactions and transactions with their surroundings.

1.7.2 Methodological perspective
The study is qualitative and concerned with the experiences of organisations and its employees with regard skills gap management practices. It seeks to describe a substantive area to build an understanding of factors leading to organisations experiencing skills gaps. The research design is open and flexible to allow the researcher to make a series of observations and then analyse these observations [59-61].

Cresswell provides a practical summary of what qualitative research is 62:58]:

*Qualitative research is an inquiry approach useful for exploring and understanding a central phenomenon. To learn about this phenomenon, the inquirer asks participants broad, general questions, collects the detailed views of participants in the form of words or images, and analyzes the information for description and themes. From this data, the researcher interprets the meaning of the information drawing on personal reflections and past research. The structure of the final report is flexible, and it displays the researcher’s biases and thoughts.*

A research methodology suitable for understanding the reality of skills issues in the organisations and individual Engineering and Technology resources in scope of this study is Ethnography. Ethnography is interested in examining the shared patterns of values and behaviours of a larger group of people who interact over time and thus develop shared practices, language, values and behaviours [61]. The research participants are seen as a culture-sharing group and can provide insight
into this reality through allowing the researcher to observe and tell their story. The research fieldwork is done in the form of participant observations, unstructured interviews and the analysis of documented artefacts describing a reconstructed reality of the recruitment, selection, management and development of resources in the Engineering and Technology industries. Chapter 3 is devoted to the research design and the research process.

1.7.3 Researcher’s theoretical assumptions

The researcher’s demographics and worldviews influence the research. An ideology is a set of ideas regarding how things are, or should be, that support an individual’s goals and actions. Prevailing paradigms or personal motivation may discourage the challenging of such existing beliefs.

In view of the above, a brief reference to the researcher’s professional background is made. The researcher has 18 years’ experience in the project and program management of technology adoption and business innovation in Telecommunication as well as the Financial Services industry, both in the South African market, as well as in the United States of America. Other work experience and professional career interests include business performance management, organisational design, and organisational change management. This experience, coupled with a qualification in Industrial and Organisational Psychology inform the interest in human performance and competency matters that lie at the heart of this study.

1.8 Overview of Chapters

1. Chapter 1 provides an overview of the study and states relevant assumptions and research questions;
2. Chapter 2 is dedicated to a review of literature pertinent to this study;
3. Chapter 3 discusses the qualitative research design supporting this study;
4. Chapter 4 is devoted to an Ethnographic description of skills management in industry;
5. Chapter 5 considers alternative Management Theories emanating from the fieldwork findings;
6. Chapter 6 offers a Skills Gap Dynamics model
7. Chapter 7 concludes the study by summarising the study contributions.

1.9 Conclusion
Chapter 1 introduced the main concepts and keywords for skills gap management for this study. It also provided a brief overview of the literature relevant to this study as well as some challenges the study experienced due to loosely defined or overused terms. Chapter 1 further introduced the research methodology adopted for this study.

Chapter 2 will do a more thorough review of the literature to support the fields thematically.
Chapter 2

2 Literature Review

2.1 Introduction
This chapter considers literature relevant to the study of skills gap management. The chapter commences with an overview of skills gap management research from an academic perspective. These are studies assessing skills gaps in specific industries or skills gaps experienced between what industry expects and what an academic qualification provides to new graduates [22-24] [29-32], [63].

Skills gap management contained in popular industry literature is included in this literature review. Since 2010 several articles have been published in periodicals such as the Harvard Business Review and Engineering News related to organisations finding it increasingly difficult to fill certain roles. The literature review includes several annual talent shortage surveys and consulting company recommendations to overcome these constraints [2-6], [9-10] [64-66].

The chapter concludes with a review of work analysis as a practice in organisations supported by Industrial and Organisation Psychology (IOP) theory. The discipline of IOP is concerned with the development of skills and is contributing to this study in the form of skills requirement definition methodology [57], [67-70].

2.2 An academic view of industry required skills
It became apparent during the initial review of engineering skills gap literature that there is an emphasis on the need to develop professional skills. Since this research thesis does not focus on engineering education as such, the content of curricula or interventions to address engineering skills shortages and reference to technical skill development were excluded from the literature review. The term professional skills is used to include soft skills, personal skills or non-technical skills and is done to align to the ABET criteria for the engineering profile [21], [34].
A few of the often-occurring professional skills are discussed below. This is not an exhaustive list but it serves as a background to contextualise the field observations. The importance of the integration of the academic work in skills gap management and the field observations is to understand why industry is expecting certain well-developed professional skills. The required skills that stood out are “Communication”, “Lifelong learning”, “Multi-disciplinary team” (work as a member of), “Problem solving skills”, and “Attitude”.

These professional skills in general are very seldom well defined in the literature. The reader can determine the meaning from the context in which these skills are referred to, however, there are also a number of occurrences where professional skills are merely listed, assuming the reader knows that communication skills for example refer to the ability to transfer technical knowledge to a listener that has the technical foundation to decode the message.

A shortcoming in the contextualisation of the professional skills development requirement is the practice of identifying the expected skills from graduate student’s self-reports or through industry surveys [3], [9], [29], [31]. These are mostly qualitative studies reporting on the perception of the student’s readiness to function in industry from which inferences are made regarding the adequacy of their skill sets. In Scott’s study [29], the students rated themselves as adequately skilled in professional skills while being more qualified in system design, system analysis and business process re-engineering skills as what the study perceived the industry needed. While it is not disputed that Engineers are well trained and prepared technically as well as mentally to apply themselves in industry, this confidence of skills adequacy may stem from technical mastery in a protected environment and not necessarily from the understanding and appreciation of a real world challenge. Stephens refers to a “snapshot of perception” as these annual skills surveys can at best capture what industry experiences as lacking at that moment and there is evidence of substantial skills need variances with no apparent bases for the differences reported year on year [3], [9], [20].

The main professional skills as they appear in the literature are discussed below.
2.2.1 Communication skills

Communication skill is one of the most commonly occurring references to professional skills [22-23], [30-31], [35]. In general, it calls for the ability to communicate effectively. Factors affecting the ability to communicate effectively include practice and confidence, but more importantly, the ability to convey technical knowledge. The emphasis on the ability to communicate technical information suggests that the communication skills requirement has a deeper meaning than initially assumed in the many articles that merely list the communication skill as one of the important skills to develop. Communication consists of a coding and decoding of a message and the assumption that the listener can decode the intended message. No further research could be found where communication skills requirements were unpacked specifically for the Engineer to support or refute the need to have a solid technical and scientific foundation to enable proper communication. Literature on communication skills as a general skills requirement is limited to the context described here which is a professional skill.

Communication skills are required to build relationships. During the review of the work analysis literature the importance of individual relationships was highlighted as necessary to get the job done. The development of relationship currencies relies on the ability to communicate effectively and with confidence [31]. Here again, the need to develop communication skills does not focus on the ability to articulate oneself properly and being able to put together an MS Powerpoint slide deck for example, but rather to know what to communicate to whom, and when to do so.

Information sharing was found related to communication skills. Listening skills were mentioned but not defined to include the ability to decode the message or the decision related to the correct content and nature of the communication that should be done [20], [31]. Interpersonal skills appear to encompass communication skills, sharing of information as well as the cooperation with others, [23], [26], [31].

2.2.2 Lifelong learning

A sample of articles considering the need to have a positive attitude or commitment toward lifelong learning, surveyed university graduates on their perception of their
preparedness to work in industry [22-23], [31], [35]. For this study sample of students the reported achievement in learning and willingness to continue learning is expected to be high. If the same assessment was done amongst seasoned workers, the attitude towards lifelong learning could look much different. The research in lifelong learning points to the ability to recognise the need for learning, and the ability to engage in such learning. It also requires the commitment to continue with this learning beyond the achievement of formal educational outcomes. In the skills gaps and skill shortage literature, lifelong learning is not explored for the type of learning or the frequency but is always positioned in context of staying current with regard to technology knowledge and awareness of changes in one’s environment.

Lifelong learning is positioned as the ability and motivation to adapt presumably to new technology and ways of doing things. This is not always pertinently stated. Lifelong learning also includes the ability to apply oneself that again suggests that the need to learn and stay current is required to be able to solve current problems. Problem solving is discussed further down. This study did not find much research considering the motivation and success of lifelong learning in older employees. It is clear in the industry observation why it is important to stay current with regard to technology changes as the absence of current technology knowledge prevents an employee from delivering.

2.2.3 Multi-disciplinary teams

Multi-disciplinary teams are positioned as a skills need that organisations have. This skills need refers to the ability to function as a member of a multi-disciplinary team and not multi-disciplinary skills within one individual although Meier alludes to this definition for multi-skilled people [22]. Multi-disciplinary can either mean a team that is made up of people representing different disciplines such as Chemical, Electrical and Mechanical Engineers or people from different levels in the organisation such as Operators, Technical Officers, Engineers and Managers [22-23], [31], [35].

When the ability to work effectively as a team is further analysed, the skills discussed above such as communication skills, information sharing, cooperation, and the
willingness to learn and stay current with technology change are the core skills necessary to function in either category of a team defined here.

Meier [22] refers to multi-skilled people as those that are not narrow focused Engineers or semi-skilled Operators. Industry observation suggests that the definition of a skilled worker is context specific; hence, it may be possible that narrow focused could mean that the person is allowed to exercise the opportunity to engage in preferred work only or in the case of a semi-skilled worker, the person is simply not skilled to do the job. It has little to do with the fact that the worker is expected to have more than one set of skills, for example a technology project resource that has both business and data analytical skills while also being capable of doing solution regression testing. Multi-skilled is not defined in the context of modern jobs.

2.2.4 Problem solving skills

Problem solving skills refer to the ability to solve problems as presented in practice. Problem solving is described as a required skill in the literature. It is believed that problem-solving skills can be taught and should be included in education curricula [26], [38]. The need to teach these skills comes from a perception that students became collectors of sample solutions who attempt to solve a new problem by patching together parts of previous solutions. Wood defines problem solving as the process of obtaining the best answer to, or the best decision subject to some constraints [26:75] as students should be taught how to scope and sectionalise a problem so that they can arrive at novel solutions to address the problem. While many authors of problem solving skills either just listed them as a requirement or added some context to suggest that they may include, or rely on, good communication and interpersonal skills, Wood properly summarised the attributes of problem solving [26:76]:

1. Being aware of the processes used to scope and sectionalise a problem;
2. Using pattern matching to quickly decide whether a situation is a problem or an exercise;
3. Applying a variety of tactics and heuristics;
4. Placing an emphasis on accuracy (as opposed to speed);
5. Being active by writing down ideas, creating charts and figures;
6. Monitoring and reflecting on the process used to resolve sections of the problem;
7. Being organised and systematic yet being flexible (keeping options open, seeing the situation from many different perspectives and points-of-view);
8. Drawing on the pertinent subject knowledge and objectively and critically assessing the quality, accuracy and pertinence of that knowledge and data;
9. Being willing to risk and cope with ambiguity, welcoming change and managing distress;
10. Being willing to spend time reading, gathering information and defining the problem (as opposed to equating problem solving with “doing something” despite its pertinence); and
11. Having an overall approach that uses fundamentals rather than trying to combine various memorised sample solutions.

It is unlikely that problem-solving skills represent a singular set of skills that could or should be taught. The degree to which these skills may comprise personality attributes, motivation and technical foundation competence has not been addressed in current problem solving literature. In the IOP literature, one finds views on general and cognitive ability and the correlation between cognitive abilities and work performance, which includes the ability to learn fast, master complex subject matter and perform complex reasoning [22], [43]. This literature is not specifically focusing on the Engineer but is relevant to the challenge of understanding what the task of problem solving entails and how organisations should go about recruiting for those skills. Literature on individual differences and psychological assessment [40], [43], [71] fall outside the scope of this study.

2.2.5 Attitude

Attitude appears regularly as a high-level skills requirement but more often it is embedded in something more specific. Concepts such as approachability, commitment, conscientiousness, flexibility, integrity, reliability, tolerance, and willingness all point toward having a positive work attitude [20], [22], [29-31], [33].
Hart [30] refers to young workers in the Retail industry as having an attitude gap. This reference attempts to capture the younger generation’s lack of motivation and passion for a seemingly menial job such as working in a clothing store. Should the lack of a positive attitude be considered a skills gap, and if so, how is a positive attitude to be trained? The personality attributes contributing to a positive work attitude may rather be personality traits that should be recruited for and enabled through organisational practices and polices geared toward harmony and constructive contribution, rather than attempting to intervene in professional skills development aimed at changing or instilling a professional skill.

2.3 Industry view on required skills

2.3.1 Contextualisation of the industry literature

A few organisations do annual surveys on the state of human capital and the trends in addressing persistent skills gap management issues. This section provides an overview of these surveys and adds more industry periodical views to the main themes explored in these surveys.

The Manpower Group conducts a global annual talent shortage survey, interviewing over 38,000 employers. The 2012 and 2013 survey results are included in this review [3], [9]. The Manpower Group surveys focus on the inability of organisations to fill required positions and are contextualised as a shortage of required candidates to employ. Deloitte Consulting also conducts annual surveys [2], [6]. The Human Capital Trends survey [2] provides the survey results of 1,300 businesses in 59 countries, citing reasons for the inability to find suitable candidates and what organisations are doing to overcome this constraint. Other Deloitte Consulting research is more focused on specific industry issues such as IT Talent [6]. South Africa is included in the EMEA sections of all these survey reports however the reports provide little detail of our immediate situation. Specific observations are included below, where relevant.

Institutional bodies such as ACT [7] and the Royal Academy of Engineering [4] regularly publish reports on skills gap management. Examples of these reports are
incorporated into this literature review to support the current themes in the industry literature. A number of South African examples of organisations addressing the pressing skills gap management issues are also included [25], [72-73].

Industry experts venture their opinions on a range of related issues. These are normally in the form of printed periodicals but may include web blogs or on-line short articles of these periodicals such as FinweekIV, Physics TodayV, Business InsiderVI, Engineering NewsVII and The Wall Street JournalVIII.

The review is organised by major themes as these appear in the literature.

### 2.3.2 A lack of available candidates

The surveys confirm that there is a lack of available candidates with the right technical expertise and employability skills [2-3], [6], [9]. The global results for the Manpower Group surveys suggest that more than a third of interviewed employers find it difficult to fill specific jobs (34% in 2011, 34% in 2012 and 35% in 2013) [3], [9]. Skilled trades and engineering jobs top these surveys year on year, suggesting that there is a lack of focus on developing STEM skills.

The reasons cited in the surveys for the difficulty to find suitable candidates range from a lack of technical, industry and generic skills, to a lack of experience, undesirable geographic locations, and candidates expecting higher remuneration [9]. This list grew in 2013 to also include the unwillingness of candidates to relocate for the short-term nature of work offered, overqualified applicants, poor image of the company, and the unwillingness of the candidate to take on part-time or contingent roles [3], [6]. Interestingly, all surveys found that many candidates also lacked motivation, professionalism and enthusiasm [3], [6], [9].

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IV Financial Week online articles [http://finweek.com](http://finweek.com)
V Physical Today online articles [http://www.physicstoday.org](http://www.physicstoday.org)
VI Business Insider online articles [http://www.businessinsider.com](http://www.businessinsider.com)
VII Engineering News online articles [http://www.engineeringnews.co.za](http://www.engineeringnews.co.za)
VIII The Wall Street Journal online articles [http://online.wsj.com](http://online.wsj.com)
The lack of applicants appears to be more relevant to America and the Asia Pacific regions where few responses are received for positions offered. People simply don’t apply. The EMEA sections of these surveys indicate that the unavailability of applications is not one of the major issues for this region, presumably because of lower economic activity. However, technical or hard skills are in shorter supply than professional skills in this region, which contributes to the inability to find suitable candidates. In South Africa, with its 25% unemployment [55], the lack of technical competencies is a big concern [5].

These surveys predominantly use aggregate labour demand and supply data coupled with perception based assessment from business leaders and potential employees to inform the general state of the skills gaps crises and supposed skills available rather than a true verified measure of actual skills available. These indirect measures do not provide quantitative data to help focus interventions. The Deloitte Consulting IT survey [6] for example, refers to high-performing individuals or employees who can operate across technical and functional business silos. Skills gaps reporting in these surveys normally group skills in categories such as low, middle and high skills, which leave the exact jobs included and excluded open to interpretation [7]. These perception-based surveys do add value for educational feedback or identifying hot areas for policy debate such as the brain drain phenomena and the inconsistency of engineering registration and practice requirement across Africa [4].

Concerns are raised regarding the use of level of education attained to signify skill level. There is no distinction made between skills required and skills acquired either. The one appears to be a proxy for the other, which is not necessarily true give the focus on lifelong learning practices. These concerns lead to more focused attempts to do quantitative work to clearly identify which skills need to be developed and why [7], [52]. An important point underlying these focused attempts is that many studies assume a one to one mapping between tasks and skills that is not true. A task is a unit of work that produces certain outputs while skills are a personal endowment of capabilities that are used to do the task. This distinction is very relevant when a worker with a given skill level can perform a variety of tasks, and further, can change tasks they perform in response to environmental or technology changes [52].
The counter advocates to annual perception-based surveys do not deny that there are skills gaps. They only suggest that the skills gap be defined better and measured and that caution be taken when interpreting indirect statistics of the availability of skills. ACT [7], a workforce development and career readiness organisation did an assessment in American companies of competencies deemed necessary for foundational workplace and lifelong career success. The competencies assessed included applied mathematics, reading for information and location of information. Although they critiqued the use of skill level categorisation of low, middle and high, these are the categories the study used as these are currently linked to job descriptions in O*Net [43]. In summary the study found that less than half the workers with a middle or high education level had the required mathematics skills. This insight may point to higher foundational skills being required by industry than before, while it also suggests that a high level of education may not prepare workers for current workplace demands, or that the higher level of education is free from skills gaps [7]. This insight would not become available from the annual perception-based surveys or those survey reports that impute supply and demand numbers.

2.3.3 Skills gaps or mismatch between supply and demand of skills?

Several sources point to the origin of the current skills gaps problem as a mismatch or misalignment in the supply and demand of skills with some stating that there simply isn’t a skills gap [2], [5], [10-11], [14-17]. From the literature it is also clear that unfilled jobs co-exist with high unemployment numbers in all regions.

“Depending on who you speak to, the South African ICT industry faces a critical shortfall of skills, or it doesn’t have enough jobs for all of its experienced professional” [10:1]. There is evidence of structural job changes where jobs are lost in one sector and many new jobs created in another sector [8], [55]. The labour market does not have time to catch up and are not producing enough graduates with current skills. Educational institutions such as College Campus [72] in Johannesburg are responding with new technology degrees to overcome the pressing skills needs. The South African Home Affairs Minister also promised in 2013 to increase the effectiveness of the scarce skills permits issuance process to speed up the recruitment of international skills [74].
Industry is addressing the gap between education or vocational training and what industry needs. ABB, a power and automation solution provider is taking part in an internship scheme to teach new graduates the required industry skills [73]. The Plastics Federation of South Africa (PFSA) and Merseta are mapping out career paths in the plastics industry while promoting this industry as a career choice rather than having people land in this industry by chance and entering unprepared [75]. IT skills service provider Rigatech is offering an internship for black female ICT talent [25].

But are these the right type of interventions? Organisations that specialise in psychometric assessment and matching of candidates to roles based on personal attributes suggest in their experience that organisation’s value experience more than ability. Organisations are not employing people for who they are but for what they have done hence use traditional hiring criteria and are unable to do a proper match [13]. Organisations are increasingly fearful of taking on somebody with potential but who does not have a proven delivery track record and who would require investment to become productive [13], [17], [64]. There is an industry contradiction between “have done” and “can do”. The hiring practice is inconsistent. In some cases the exact experience and a long list of academic qualifications are required including the exact title on a candidate’s resume. In other cases the correct “can do” attitude is required, which suggest that the employer is looking for somebody who can figure it out and make it happen [17].

A challenge with traditional search criteria is the hybrid nature of jobs today. Partly due to retrenchments and roles going unfilled, current staff doubles up to perform the work. When this staff member needs to be replaced, the search criteria do not resemble the traditional job but the attributes that the previous person brought to the job. In other words, the organisation is looking for somebody who has done exactly that combination of work before [13], [17], [54]. This job combing is referred to as a hybrid job (containing elements of two or more traditional jobs such a Payroll and Accounts Payable). Hybrid jobs reflect infinite combinations of skills and attribute and cannot be matched through screening software or even manually given the volumes of potential candidates applying for a specific job. Since the organisation
does not want to train but expects the exact match, the majority of candidates will be unsuitable.

Qualifying criteria are modified by legislation. In America the criteria need to be vague so as not to discriminate. In South Africa the opposite happens when job advertisements clearly state when the position is reserved for affirmative action or employment equity (AA/EE) applicant only as demonstrated in Figure 5. This is a conscious delimitation of the selection pool from which a match can be made. An employer may also pile on all the possible requirements to ensure that they only get the perfect fit [17]. Broadening of skill requirement is common due the jobs being combined to reduce head count and the combined job inherits the features of each individual job.

Figure 5: Job advertisement delimiting the applicant pool

Another factor making candidate matching difficult is adding search criteria unrelated to the job. The HR partner may not realise the criteria is invalid or may be disempowered to alter the criteria where there is an inclusion of invalid criteria. Cappelli [17] uses the example of an Engineer that must be able to type 65 words per minute. This inclusion of criteria may happen when a job is modeled on somebody

IX PNET  
http://www.linkedin.com/jobs/viewJob=&jobId=4842786&trk=vsrc_jobs_res_name&trkInfo=VSRPsearchId%3A241265411372324541526%2CVSRPtargetId%3A4842786%2CVSRPempty%3Aprimary
doing that job at present and who may be able to type 65 words per minute.

A major contributor to job mismatching is filtering software. Due to the enormous volumes of applications being received, computer technology is employed to sift through these volumes and identify potential candidates worth further scrutiny. The success of a resume making the semi-final cut depends largely on the use of specific keywords and document formatting rules [14-15], [17]. Below in Figure 6 is an example of an entry-level job on LinkedIn, which attracted over 400 interested potential applicants in three days.

**Figure 6: A Hot Job**

To demonstrate the industry views towards poor search criteria, one case study is included here of an employer looking for a work-from-home independent contractor with a 4-year college degree and some writing and editing experience to assist with marketing intelligence work. No marketing experience is needed. For a year she found only “worthless” resumes. This employer’s experience supports the claim that there are no qualified skills available for employment. Her audience in Figure 7 seems to differ [16].

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X LinkedIn Job Board

http://www.linkedin.com/jobs?viewJob=&jobId=4842786&trk=vsrp_jobs_res_name&trkInfo=VSRPsearchId%3A241265411372324541526%2CVSRPtargetId%3A4842786%2CVSRPempt%3Aprimary
Figure 7: Views towards poor recruitment practices

Kurt Uehlein
Ms. Yasa says she'll hire someone with NO EXPERIENCE, and that she'll "Make them an expert", the. Goes on to say that the resumes she received were WORTHLESS.

How about considering the possibility that your hiring skills are worthless. Perhaps the reason why you feel the resumes were worthless was that YOU TOLD PEOPLE YOU HIRE THEM WITH NO EXPERIENCE!

You can't offer a job with subsstandard pay and no benefits to people without experience and expect to get resumes from Ivy League graduates! You're a perfect example of an entrepreneur that wants something (or someone) for nothing... or close to nothing. Stop belly-aching, get off your butt and HIRE SOMEONE already, or do as many others LIKE YOU have done when they want indentured servitude from their employees: HIRE SOMEONE FROM INDIA!

William Kitchen
She might get better results if she would focus more on looking for a good junior analyst instead of looking for a good self-promoter. And I can't help thinking that maybe it's the employer who is failing to sell her services. It takes time to create customized cover letters, so that will likely be reserved for jobs that the applicants really want. A job that offers $30K and no benefits with a 4-year degree requirement and that sounds suspiciously like an email scam is unlikely to be at the top of anyone's "I want" list.

August 12 2012 at 6:43 PM

thedragonclaw
I'm sure a lot of potential applicants simply don't believe the listing. Do you have any idea how much "work from home for $30,000 - $35,000 a year spam I get every day?"

August 12 2012 at 1:40 AM

Roger Pedacter
"They just want to throw them out there and see what sticks," she says. ... What the hell do you think ??? Who the hell do you think you are ??? Do you think people apply to ONE GODDAMNED JOB? And miraculously it happens to be YOUR STUPID OFFERING? PLEASE go die.

December 07 2012 at 1:30 PM

Roger Pedacter
This concept is nauseatingly preposterous. Pick any idiot off the street and they can be coerced into manipulating desktop publishing software and playing shallow office politics.

People do not get hired on skills. They get hired on politics, religion, personality or references from another person the HR knows. People hire people they like and fudge the rest. HR people look at resumes like fourth-graders trying to figure out how to add fractions.

December 07 2012 at 1:25 PM

[16] http://jobs.aol.com/articles/2012/08/10/employer-says-shes-been-looking-for-a-year-cant-find-a-soul-t/
Then there is the view that it is not what you know but who you know that lands you the job. Advice is given to job hunters to create a “career campaign” for themselves as applying for the position when you do not know the recruiter will not be of much value today [11-12]. Finding a suitable job requires active self-marketing, networking and lobbying to win votes and support before making a move.

2.3.4 The changing role of HR and Business Leadership

There is an increase over the last three years in organisations looking for alternative solutions to address the lack of available skills. There is also a noted change in survey respondents’ attitude towards the perceived availability of the correct skill at any price. In 2013 it becomes more evident that employers realise they are over the worst of the financial crises; that economic growth should be at the top of the agenda; and that alternative solutions to finding adequate human resource capability should be sought [3], [6].

Resources aren’t out there at any price and job openings cannot be put on hold indefinitely. In fact, 25% of the 2013 respondents are blaming their high staff turnover on their inability to fill roles, suggesting that current employees are picking up the extra work and leave due to undesirable working conditions [3]. Symanowitz [44] comments on the peril of hiring freezes and mass retrenchments believing this tendency to remove roles without removing the work or keeping a role vacant while current employees are assumed to have spare capacity to pick up additional work, is a leadership failure. The rest of the team suffers the loss. Stress, overwork and low morale make the good people go in search of better opportunities, because they can.

It appears that organisations take longer in their search in the hope to find candidates with higher skills willing to do the job at a lower salary [16-17]. When labour is scarce and expensive, job requirements are lowered to get cheaper labour and more variety in the selection pool. When supply of labour goes up, the requirements increase to select the best in the available selection pool however, the salaries do not increase in response because the supply is still deemed high enough to lower the salary offered [17]. This seems to be a function of the multi skilled nature of modern
employees. Job specifications are not standard and candidates come with a variety of skills, knowledge and experience. Because of the differentiation between individual candidates the employer takes longer to assess the absolute required attributes in the salary bracket they are willing to offer. It takes longer to fill a vacancy not because there are not suitable candidates but because there are many suitable candidates but with great variation. During this period of searching, the skills gaps experienced in the organisation are included in the skills gaps reported when in reality there are a number of adequately skilled people unemployed.

A large proportion of organisations claim they know something should be done but do not have adequate human capital development strategies in place [2-3], [6], [9]. Figure 8 positions this view.

**Figure 8: Perception of the current state of Human Capital Development Strategies**

![Pie chart showing perception of current state of human capital development strategies](image)

<table>
<thead>
<tr>
<th>Region</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Americas</td>
<td>315</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>582</td>
</tr>
<tr>
<td>EMEA</td>
<td>412</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1319</td>
</tr>
</tbody>
</table>

Deloitte Consulting’s Human Capital Trends 2013 [2] indicates that the immediate focus is on developing talent and aligning HR practices with the bigger organisational goals. Following this as a rising trend, there is an emphasis on developing a more sustainable pipeline of people and finding better practices to ensure that the talent is being looked after.

The role of the Human Resources department (HR) in proper talent oversight and the accountability for proactive strategies is becoming crucial. There is evidence of HR leadership being drawn into business strategic decision as one of the key drivers for delivery and success of new ventures or mergers and acquisitions. This requires different talent frameworks and people practices that are flexible enough to support different business models and includes a different take on organisational change management. Figures 9 and 10 below list the focus areas of the HR leadership.

**Figure 9: Strategies to address talent shortages**

![Graph showing strategies to address talent shortages](image)

A new leadership type may be required to cope with increasingly complex and fast-paced business world changes. It is argued that disruptive technology is now the rule, not the exception and instant obsolescence is fact [2]. The term leader in the Deloitte Consulting surveys appears to point to independent, self-managed and forward-thinking people at all levels in the organisation, rather than the senior echelon of the organisation. These new leaders must own the business case for talent development. This new leadership style must embrace chaos and have a high tolerance for risk and failure. It is suggested that a deliberate strategy of “fast failure” can increase the learning curve and accelerate success [2:16]. But, a diverse set of leadership skills is required to cater for all the different business models, which has implications for a standard role profile and recruitment criteria.

2.3.5 Previously untapped talent pools
Organisations are employing strategies to access hidden talent. Woman is still not fully participating in the economy and this presents an untapped resource pool being explored that could boost productivity and alleviate critical resource shortages. There may be a potential disparity in gender opportunities and access to technical training and experience needed for advancement to managerial, executive and senior roles [2], [76].
McKinsey, Goldman Sachs and Sara Lee are attempting to get their mothers back to work. The retention of women is an age-old concern and one that the organisation will not win if it is not prepared to bring in new workforce flexibility policies. Flexibility does not only imply shorter work weeks, but could include short paid assignments or newly created roles to harness the contribution of a mature high-calibre person whose parental leave and spousal job relocation needs may be something of the past. “Returnship program” is the new buzzword for bringing back experienced people who left the working world. This program is meant to ease the person back into productive roles while allowing for some adjustment time, and it can be used as a screening tool [64-65].

Another untapped pool is the aging workforce that can benefit from a returnship program too. With the increase in healthcare as well as the financial crises, Baby Boomers are looking into prolonging their careers and can fill a much needed skills requirement if correctly incorporated into the organisation [2], [10], [64]. Workforce flexibility and career customisation are important enablers for this group of talent and will be explored further below.

In a South African context, the inclusion of more black females is also regarded as untapped resource pool. IT skills service providers are establishing integrated learning and internship programs in conjunction with educational institutions and industry to fast track the development of black female ICT skills [25]. Although the black IT graduates number have surpassed white IT graduate numbers in 2002, there are still more men than women graduating [10]. This talent pool will need significant additional training and the opportunity to gain much needed experience through funding and collaboration with government and industry.

2.3.6 Changes in work and career models

Those organisations that find it difficult to fill positions and for whom the impact of unfilled positions is high turn to using contingent workers or non-traditional staff [2-3], [9]. Deloitte Consulting refers to a future state consisting of an open talent economy of which the main feature is the new pattern of employers and talent
seeking each other out on more equal terms, from anywhere in the world [2]. These multidirectional talent networks include more contractors, offshore staff, freelance or independent resources, joint ventures or open source talent, where people don’t work directly for the organisation but are a crucial part of the delivery value chain, such as an insourced or multi-sourced project. New work models are required to incorporate these resource types as the current work models are built around employees being on site every day and having access to local infrastructure [2].

A trend in new work models includes a move toward project-based work rather than on-going operations work. “The best executive and professional jobs may no longer be full-time gigs” [46:1]. Similar to Deloitte Consulting’s open talent economy, there is a free agent nation characterised by the super-temp. These are professionals who pursue project based careers as independent entities and typically pick up work that is of a short term, short notice nature and used to be done by permanent people no longer employed in the organisation [46]. This is the result of the flexibility needs change of professional people in conjunction with the changing needs of modern organisations. Organisations are finding ways to work with the mobile project-based resources. The talent surveys [2-3] suggest that people are reluctant to accept short-term contingent assignments. There is perhaps a need to better define the nature of this job as it may distort the numbers. How many people in these super-temp roles don’t realise this is the new way and are still looking for permanent positions and reporting an inability to “find employment”?

Flexible work models also need to acknowledge this group of talent and how to engage with them. These professionals go solo because they can choose what projects they want to work on and with whom to work. They would find it hard to fit back into a traditional permanent job. They are not between jobs; they consciously decide to go independent. This route is best suited to people whose skills are already at a high level as it presents them with an alternative career path [46].

There is a growing tendency to promote from within and up skill current employees who show the potential to grow and develop. The Manpower Group specifically mentions South Africa, where a third of interviewed employers indicate that they will help grow potential candidates [5], [9]. However, the survey suggests that globally,
less than 25% of the interviewed employers are offering additional training and development. Career customisation, including continued development for existing and new employees; new challenges in the workplace; new career paths and new roles are important enablers for making more of the existing talent pool.

Job redesign can help to make sure that skilled resources are not being wasted on jobs that can be done by others. The redesign process involves identifying where the skills gap is and then creating narrower, more focused job descriptions in the areas where the skills are scarce to allow the job incumbent to focus solely on those tasks that require these scarce skills [77].

Current trends in defining more flexible work arrangements to accommodate a larger, more diverse resource pool includes compressed workweek, job sharing, telecommuting, and career re-entry [2]. Flexibility in location is very important to employees, as is their freedom to schedule their work and balance their workload. Workplace disruption is a common feature of the job market, thus work can be done anywhere, with anyone, at anytime, anywhere in the world. Rigid 8 to 5 work hours in a static work location is not always feasible. Specifically for the aging workforce, flexibility includes phased retirement structures, wellness programs, flexible work schedules, mentoring program, and offering fair choices in terms of retirement benefits [44], [64]. The Deloitte Consulting [2] survey refers to workplace flexibility as an employee entitlement, albeit an entitlement that is confused as a technology challenge rather than a management challenge. The success of such flexible work arrangements depend largely on the management ability to properly plan, control and manage the work being done in remote locations and to relinquish control while supporting workers who have different flexibility needs.

Performance management and remuneration practices are geared towards the permanent employee model when in reality this is no longer the primary resource model. As work models move toward project based delivery and encompass more lateral career movements in the organisation, the current practice of doing annual performance goals and progress tracking become less relevant [2]. Performance management systems must support lateral moves and project work. Factors affecting the success of a performance management system include the structure of the
organisation (people don’t have to work in close proximity to be regarded as team members); technology improvement and the adoption of social media as delivery tools; differing expectations of the different generations; managerial capability (to mentor rather than manage with a more hierarchical mind set); and the performance evaluation value of peer networks [2].

2.3.7 Workforce development

An important item on many surveyed organisations’ agenda is the need to develop talent as an alternative to recruiting the talent, especially technical, managerial and leadership talent [2-3], [9]. Employee turnover cost is escalating and institutional and intellectual capital is lost when employees move on. However, the much-needed new career models and adequate workforce development planning practices are not yet in place to capitalise on this agenda item.

Until the 2013 survey results were published, recruitment and compensation strategies were preferred to people development by the survey participants. The workforce development planning processes need to be addressed to look at future oriented assessment of skills, insight and experience needed. This may mean not to add to the existing skills and capabilities but to identify what else may be needed in the future [2]. Skills development must ensure that on the job training, project assignments, the use of talent networks, formal education and training and individual experience are balanced.

Organisations unfortunately still see training expenses as too high and are reluctant to offer further training and development. Many people leave due to their dissatisfaction with employer development programs [66]. While the direct job training appears to be acceptable, the additional development, mentoring and coaching assistance and support from a superior appear to still be lacking.

The middle skills sector (that requires post-secondary technical education and training and often includes a college maths course) is suffering due to college dropouts and fewer people enrolling for STEM courses [8]. The influence of technology on modern jobs coupled with automation in most industries increase the
requirement for this middle skilled group of people who make up the majority of employees. Yet, they are the least likely to receive the additional vocation training they need to remain productive. Organisations fear that if they invest in the training, the competitor will poach the talent. The training budget is often one of the first budget items to be cut.

There is evidence of accelerated development programs that target potential talent and put them on the fast track to cover as much ground as quickly as possible. This includes job rotation; proper career succession plans; coaching discussions; compensation aligned to this fast track development plan; and exposure to discontinuous experiences that accelerates their growth in a multidimensional business environment [6], [78]. These candidates also have experience maps that allow the organisation to see at all times which people have what experience and how best to align them with the next available opportunity.

The industry material is very rich with regard what employers believe they need and cannot find. The consulting company surveys also include strategies on how to overcome skills constraints as suggested, and as sometime implemented at their client organisations. When these potential strategies are compared to the field results for this study, the application of these strategies can be beneficial. Perhaps due to the lack of quantitative data and better working definitions for modern jobs and current skills profile requirements, the practical and successful implementation of some of these strategies in industry is some time away.

2.4 Theoretical advancement in work analysis

An important element informing this study is recent advancement in job analysis theory that critically evaluates the analysis practices that inform job descriptions and job specifications. This work extends to include a description of modern work.

2.4.1 The history of job analysis

The methods used to analyse jobs come from time and motion study work done by Frederick Taylor early in the twentieth century to select and motivate employees in
an attempt to create efficiency. Taylor used job analysis specifically to select, 
motivate and train personnel. Job analysis became a practice used in the initial 
studies into selection and placement as well as supervision and efficiency studies that 
followed [57], [79].

In the 1950-60’s management studies revisited job analysis practices to understand 
job enlargement and rotation needs. During this period division and specialisation of 
labour become important and in this sense job analysis became an important 
management tool in business. Industrial engineering had a significant impact on job 
analysis in a bid to increase productivity and streamline the division of labour and 
subsequent specialisation of labour. Job analysis received renewed focus in the 
1970’s to serve a wider variety of organisational needs such as staffing, change 
management, training, performance appraisals, compensation, employment equity 
and affirmative action [67].

The job analysis resulted in a job description that gave a complete list of tasks and 
outputs with time and performance indicators where applicable. The traditional 
approach to job analysis indicated the jobholder as the provider of job related 
information with the immediate supervisor doing the validation and adding 
perspectives [67]. The objective of traditional job analysis was to have an accurate 
and complete description of the job itself and the tasks to be performed. Unionisation 
and legal battles with employees relied on sound job analysis to assign fair work 
demands and compensation and provide adequate opportunities for training, 
development and promotion. Job specifications followed which described the 
characteristics of the person doing the work and may include characteristics of any 
equipment or environmental factors that must be present to complete the job, such as 
specialised engineering or manufacturing infrastructure. Both the job description and 
the job specification were required for HRM processes such as recruitment and 
performance appraisals.

Theoretical advancement in 1980’s contributed to the development of various job 
analysis and position questionnaires that helped HR practitioners gather data related 
to jobs for purposes of remuneration, promotion and performance management. 
Instruments such as the Position Analysis Questionnaire and the Critical Incidence
Technique were, and still are, being used frequently to get an accurate and complete as possible view of a specific job.

Closer to the end of the century job analysis theory was well established in creating stable job descriptions, which included re-useable components in the form of job families. O*Net is a good example of a dictionary of occupation titles and associated job description using job family structures [43]. O*Net started out in the early 1930’s as an American federal government program to match applications with job openings and was known as the Dictionary of Occupation Titles or D.O.T. The D.O.T. was last published (its fifth publication in paper form) in 1991 and included over 13,000 occupations and full job descriptions. The success of the D.O.T was based on a number of assumptions including:

1. The job and individual match is stable over time;
2. If much effort is spent, the job description can be accurate and complete;
3. Current and past job information is available to define the job;
4. There is a one to one relationship between the job and an individual holding the job;
5. Job boundaries are fixed with clear handovers between jobs;
6. Job descriptions are static and valid for a long period of time;
7. Hierarchies of employment and promotion are followed.

Organisation design theory of the nineteen eighties advocated specialisation of labour and subsets of tasks given to multiple employees to contribute to the final product. Employees seldom cross boundaries and inter-job activities did not exist. There were clear boundaries between jobs with handovers that were easily observable. Organisational design theory further suggested that the organisation consisted of positions that can be defined and designed independent of the people filling them. There was also a clear division between labour and management that defined who did the work and who monitored and who managed the work. This division in roles discouraged people to take on responsibility that was not in their job description.
2.4.2 Changes in job behaviour

In 1995, the federal government of America introduced the concept of electronic databases [43]. The Occupational Information Network was established and consists of six databases, all still the process of development and integration. These changes to the D.O.T. were required to provide guidance to performance and fit requirement in the modern workplace [43] as D.O.T.’s usefulness was questioned due to its heavy dependence on task related information and little context with regard human abilities and attributes, and work environment context given the shifting job boundaries.

The traditional approach to job analysis is still informing some of the practical HRM processes although the approach and methods came under attack for not being relevant to current organisational concerns [57], [70], [78-79]. The criticism raised against the traditional approach ranges from questionable and inaccurate information being provided to the information, once it is available, being obsolete thereby suggesting that the process takes too long to complete or may lack the context within which the job is to be performed. The manner in which jobs in modern organisations change and the underlying assumptions listed above does not hold anymore.

Stable, static jobs are characteristic of long production cycles in mass production and large markets. This assumption does not hold for a modern service organisation [43], [57, [78]. Static jobs, especially in manufacturing also allow for the observation and time taking of related tasks. These jobs can be analysed through surveys. Traditional job analysis is not suitable for service-oriented jobs where employees often go beyond their stated job description.

Employee responsibilities are broadened and boundaries between jobs are becoming less distinct [57], [67], [78]. Work has become more dynamic; fast paced, and with many inter job activities. Self-directed work teams do the work. There is a blurred line between labour and management with increased interaction across functional and national boundaries. Due to flatter organisation hierarchies and global financial economic changes there are limited career advancement opportunities. There is a tendency towards shorter rather than longer-term employment and the creation of jobs that did not exist before [67].
Modern employees change and adapt to work demands and have more freedom to express personal preference for certain work or work situations [57]. These personal changes cannot be captured by the traditional organisation structures. The employees operate on a number of relationships with other employees that cannot be incorporated in a rigid organisation structure and embedded in processes and procedures. Individual performance becomes less important than the ability to develop and maintain relationships throughout the organisation on which the employee relies to help him get the work done.

A more modern take on job analysis recommends a broader scope of job analysis as work analysis to encapsulate changes in work demands, the scope of the work to be done and the changing nature of team processes. Recent research considers work analysis as a set of tools intended to facilitate the inferences regarding important aspects of the work tasks and specifications that should form the basis of the HRM processes. The consequences of work analysis and how the work analytical data is used in the organisation become more important than an accurate and complete description of the job. The output of work analysis is not directly used to make decisions about the employee but rather to inform interventions and practices to facilitate people and process change [67]. The O*Net capability for example is used to do occupational counselling [43] and these six databases’ are scoped to address worker requirements, experience requirements, occupational contexts, occupation-specific requirements, occupation characteristics, and worker characteristics.

Work analysis practice is required for teams. While the job activity analysis is still very important, a wider perspective that integrates inter job activities are becoming vital [57]. Dynamic and self-managed work teams are responsible for work delivery. The work is assigned to the team and they determine among themselves who does what work based on individual skill and preference. Individual tasks are thus not formally assigned. Individuals have a better opportunity to learn and apply difference skills. This situation requires key performance indicators for team-based processes such as task coordination, customer service, participation, communication, conflict resolution and problem solving. A set of generic skills may serve such a team well. Generic or professional skills are skills that are required for longer periods while
specific technical skills are situation and temporally based, for example the adoption of new technology for which specific technical skills and knowledge is required at a defined point in time.

An approach that may be more beneficial to organisations is to look into competency-focused work analysis rather than the traditional job and key performance indicators. In this approach an organisation would staff itself with high calibre individuals that form the basis of future capability rather than a pool of historic core competencies. High calibre people would have competencies such as interpersonal skills, conflict resolution skills, innovative thinking, flexibility, self-motivation and decision making skills [57]. In the engineering education and engineering management literature relevant to this study these same skills are identified as the foundation of the ideal Engineer. This tie back closely to the ABET accredited profile of the Engineer [21], [34], [36].

2.5 Conclusion
This chapter covered an array of views and current research into skills gaps and skills shortage research. It focused on academic work in defining what professional skills are sought by industry as well as advancements in work analysis as included in the discipline of Industrial and Organisational Psychology, to improve our understanding of modern jobs.

Industry writing was covered on the employer challenges of finding suitably skilled resources and the alternatives to alleviate those difficulties. Several sound strategies are offered by industry leaders to overcome acknowledge skills shortages. Skills shortages are however challenged by some authors who believe that the supply and demand process of labour does not work, as it should, and that poor organisation and leadership processes contribute to organisations not finding the right skills while leaving qualified and experienced resources without jobs.

Chapter 3 follows with a review of the research methodology and research process applicable to this study.
Chapter 3

3 Theoretical Framework and Research Design

3.1 Introduction to the framework and research process

The theoretical framework and research design discussed in this chapter include both the theory of qualitative study as well the application of this theory to the current study. The importance of this chapter is to convey the research process and the management of qualitative data to give effect to the rigor requirements of qualitative research.

Qualitative research is interested in the qualities of entities and processes being researched rather than experimentally examining and measuring the quantity, amount, intensity and frequency of entities [58:8]. The chosen framework for a qualitative study must thus provide the means to identify these qualities and not render a numbered output. Qualitative research does not predefine concepts and hypotheses to be tested but may have broad research interests and theoretical assumptions that guide the research depending on the research methodology and techniques adopted [80].

The quality of a qualitative research design is a process issue. Quality involves the decision process that starts at the outset with the research question; the selection of an appropriate methodology; the definition of data collection and analysis strategies and adherence to this design; the completeness of a rich descriptive research finding report; and the attention to ethical considerations throughout the process [59]. Transparency of the research process is thus required to support claims regarding the quality of the research output [81-82].

Qualitative research is not without its criticism. Scholars of qualitative research methodology regularly revisit the current paradigms and methodological considerations. The *Sage Handbook of Qualitative Research*, now in its fourth edition [58], is an example of such an effort to illustrate development and challenges
in qualitative research methodology in the last five years. A critical evaluation and full description of the benefits and constraints of qualitative research are outside the scope of this study, however, where current methodological issues might affect the study, these will be discussed in context of the theory and research process below.

The research process requires the consideration of five main topics. Denzin and Lincoln [58] refer to these as phases however these are not process phases as such but rather important aspects of successful qualitative study that may be neglected if not consciously considered. These five topics are [58:12];

1. The researcher as a multicultural subject;
2. Theoretical paradigms and perspectives;
3. Research strategies;
4. Methods of collection and analysis; and
5. The art, practice, and politics of interpretation and evaluation.

### 3.2 The researcher as a multicultural subject

The objective of considering the researcher as a multicultural subject is to understand whom the researcher is and how his worldviews can affect the research outcome. This has to do with the researcher’s natural fit in the researched environment or his ability to adjust to enable him to do the research [80]. It is also positioned in terms of the heightened focus on cultural sensitivities and taboo subjects that require certain finesse and rapport building to explore in detail. The researcher’s motivation and orientation also speak to ethical considerations and his personal experience and worldviews are included as background in the study required for practices of approval from Independent Review Boards used in some countries [59], [80].

The researcher’s inclinations must further match the research process expectations for the different research designs that could be applicable. This is placed specifically in context of the change from a pure positivistic outlook on qualitative research, as practiced a century ago, to the more participative methods used today [83]. It is important to give as much detail about the researcher, his theoretical worldviews and research interest to position the study. The researcher’s orientation for this study was done in Chapter 1.
3.3 Theoretical paradigms and perspectives – Constructivist-Interpretive

The chosen paradigm for a study informs the research design or methodology as well as the data collection and analysis strategies and must thus be considered and communicated in the study so that the intended audience can evaluate the study contribution given this context.

There are four principles or major paradigms supporting qualitative inquiry. These are positivist and postpositivist; constructivist-interpretive; critical; and feminist-poststructural [58]. These paradigms have several related paradigms when applied in more detail and can be combined with a number of additional perspectives such as Marxist models or Queer theories. The basic believes of these paradigms include its views on the nature of reality (ontology), the relationship between the researcher and the researched (epistemology), and how knowledge is gained (methodology) [84].

This study adopts a constructivist paradigm. Reality is relative and local (to the researched setting or place); it is specifically constructed and is co-constructed between the researcher and the research participants. The interaction between the researcher and the participants is transactional and subjective to enable them to create the findings [84:98]. Knowledge is constructed through dialogue (dialogic methods) between the researcher and the research participants and uses debates, discourse and reasoning (dialectical methods) to arrive at an agreed version of the truth should differing opinions exist.

3.4 The art, practice, and politics of interpretation and evaluation

Qualitative research has elements of both art and politics [58]. The researcher sets out to create field text, which is then interpreted into research text. The research text is re-created as a working interpretive document that is issued to its audience as the final product. This final product has the value of influencing policy and public opinion. It can be targeted at isolated populations, inform interventions, and lead to certain actions taken on other people.
There is no single interpretive truth for all the different interpretive methodologies available however; each of these interpretive communities of practice has their own set of evaluation criteria to judge the value, quality and usefulness of research output [58]. The positivist/postpositivist paradigm with its logical-deductive theory orientation uses internal and external validity as evaluation criteria, while the feminist paradigm that has a critical standpoint theory orientation, uses lived experience, accountability and concrete grounding evaluation criteria.

The constructivist paradigm, with its substantive-formal standpoint theory orientation, uses trustworthiness as its evaluation criteria. The concept of trustworthiness of qualitative research originated from work done by Guba in 1981 [85] to find criteria to judge if a given enquiry was methodologically and analytically sound, thus having the rigor that a quantitative methodology would provide. Credibility, transferability, dependability, and confirmability are identified as four useful criteria [59-60], [80:60], [82], [85]. These criteria for constructivist studies are briefly discussed below to support this study.

### 3.4.1 Confirmability

Confirmability’s core issue is to ensure that the finding represents the situation being researched rather than the researcher’s own beliefs or theories. Strategies to increase confirmability of a qualitative study are aimed at addressing the data analysis stage. Reflexive self-awareness must be acknowledged and implicit influences, biases, and prejudices guarded against [82]. Reflexivity is more than just self-awareness. It is conversations with the self, reflecting on the self as part of the social context affecting the area being studied, as well as the self as someone who applies biases and cognitive filtering. The researcher has bounded rationality. The rationality of individuals is limited by the information they have, the cognitive limitations of their minds, and a finite amount of time to make decisions. The researcher should make assumptions and frameworks explicit, show how these were arrived at [59], [82], [86], and keep a paper trail of all work done [60], [82], [87].
3.4.2 Dependability
Dependability is concerned with ensuring that the study is conducted consistently across time and analysis techniques. Dependability is improved through establishing clear and repeatable procedures for research to reflect a position or decision as it is taken [82]. This does not require highly structured and predefined frameworks but rather consistency in how the research process is executed. The researcher should describe this process upfront and show throughout the research process how it was adhered to and reflect on and record the means by which theoretical constructs are arrived at. Transparency of this reflexive process is important [85].

3.4.3 Credibility
Internal consistency or credibility requires the researcher to show what data were used to arrive at the theoretical constructs and whose perspectives these constructs reflect [82]. The researcher must also show the process of constant comparison (or data triangulation) between theoretical constructs and new data [59], [60], [86].

A strategy to aid internal consistency includes avoiding deep hierarchical coding too early in the coding process as this discourages the reordering of concepts and tends to act as disincentive to think radically about reconceptualisation of the core categories previously identified [59], [82]. The objective of internal consistency is to ensure that all parts of the theory fit with each other and that they appear to explain all the data. This is achieved through prolonged engagement, persistent observation, and using different data and even different researchers and research methods.

3.4.4 Transferability
Transferability refers to how far a researcher can make claims regarding the general application of their theory. When multiple realities exist and they are unique enough to not allow guidance to be drawn from one situation to the other, the theory cannot be generalised. Here the concept of generalisability is replaced by transferability. The thick contextual description of the situation studied allows the reader to assess the transferability to other settings [87]. To achieve this, the researcher must report findings in context, consistently and with sufficient detail to allow the reader to share
the research subjects’ experience [82]. Claims of transferability can be made based on constant comparison with other data sets that yield similar findings or show that differences have enabled the researcher to extend the theory [82], [86].

3.5 Research strategies

3.5.1 Design objectives for constructionist studies

The design and methodology adopted for a study guide the execution of the research project. The methodology must answer design objectives such as the aim of the research; how knowledge accumulation is done; the value or importance of the research output; and practical issues such as ethics, the voice or language of the research output, control and the action of the findings [84].

Since this study adopts a constructivist orientation, the design objectives will be explored in this paradigm. The aim of a constructivist study is to understand by interpreting subjective perceptions [84]. This requires vicarious experiences and a passionate participant attitude in the researcher to reconstruct realities for multiple participants (multivoice) research. Knowledge is constructed through collective reconstruction of events, which contributes to the value of the study forming during the research process. Ethics are intrinsic to the research relationship and are revealed through the research process. The researcher is the primary voice and applies self-awareness through reflective action when finalising the reconstructed insight. The researcher and the research participants both contribute to the production of the research and shaping whom and for what the research output can be used. Both parties are required to produce this research output and are thus in control of the production. The researcher guides the action to be taken from the research output and must explicitly consider this objective when selecting a design.

Qualitative inquiry methodologies include designs such as case studies, action and applied research, grounded theory methods, ethnographic methods, life histories and clinical research. These designs all make provision for addressing the design objectives as discussed above. This study uses an ethnographic research methodology
and uses participant observation, unstructured interviews and document analysis. These will be explored in more detail below.

3.5.2 Study design - Ethnography

Ethnography is a field-based research methodology conducted over a long term and is useful for getting people’s perspective on important issues [80]. The ethnographic methodology can be used where people engage in their natural settings and it has been extended methodologically to include “communities of interest” which may not mean a tribe or cultural group of people as the case was a century ago when the method came into existence [83], [80].

Ethnography is interested in analysing the reality construction and the institutional contexts of meaning making and social order [83]. Social realities are not taken for granted but require the researcher to go into the research setting with the objective of understanding how the community achieves social order. Communities of interest could be smaller and very context specific groups of people. These groups of people must be described early in the study to allow pattern emergence to happen in subcultural concepts that describes how they function or work together [61].

Ethnography focuses on an entire culture-sharing group, which may not be in one location. Culture sharing means they have the same practices, beliefs, and behaviours. The objective of an ethnographic study is to identify shared patterns in this culture-sharing group and requires engagement over a long period of time, typically as a participant observer to allow the researcher to be immersed in the day to day lives of the research participants [61]. Cresswell provides a few characteristics of good ethnographies [61:91-92]:

1. Ethnographies focus on developing a complex and complete description of the culture of a group.
2. The researcher looks for patterns, rituals or regularities in how this group behaves or express their beliefs and ideas through language or action.
3. The culture groups being researched would be well established and interacting long enough to have discernible work patterns.
4. Theory plays an important role in directing the research objectives. The researcher would start with a broad explanation of what he hopes to find in context of these broad research assumptions.

5. Ethnography uses several sources of data collection and requires extensive fieldwork. The most common data collection methods include observation, interviews, artefacts and symbols.

6. The researcher relies on the participants’ insider views and builds theoretical themes from the interpretation of verbatim (or natural talk) [83] fieldwork and observations.

Ethnography as a research methodology has been used in Software Engineering and Energy studies.

1. Engineers are considering the social dimensions of energy use in an attempt to design energy conservation technologies [88]. Here the qualitative feedback received on user experiences with technology helps to provide requirements for future technology development.

2. To enhance the social capabilities of robotic interactions with humans, ethnography was used at a primary school to study a robot’s recognition of, and response to, children’s affective states [89].

3. The O’Leary’s study [90] used ethnography to gain a deeper understanding of the day-to-day reality of social practices in an organisation to extend the theoretical perspectives taken on managing IT projects.

4. An ethnographic study conducted at a small Software Development House reports on the practical work and implications for good software testing giving the constraints placed by limited resources and the dynamics of customer relationships [91].

3.5.3 Challenges experienced in ethnographic studies

Ethnographic research has some challenges. The transformation of complex social issues into text for analysis and reporting requires much effort and could be fraud with transcription error and bias [61], [80], [92]. The recordings must also be sufficiently broad and detailed enough. The original observations are often written in long literary versions that are quite time consuming and may limit the number of
observations finally being included in the study. The participant observer must also balance the objective collection of data with the subjective insight that comes from prolonged engagement and association with the people [80], [92-93]. Constant switching between listening and observation must be consciously monitored. The selection of a research site and access to key participants and a gatekeeper may further be difficult [61], [92]. The Passos study [92] specifically highlights that the collaboration process required that the study offer something to the research participants, which was not always possible.

3.5.4 Research site selection for this study

The research sites for this study comprise of two Commercial Banks, a Wealth and Investment Bank, and one Mobile Telecommunication Company, all based in South Africa. The fieldwork focuses on the Engineer involved in technical tasks at an execution level. This can be work done either in a project such as the design, development and implementation of Service Oriented Architecture (SOA) and Master Data Management (MDM) (Banks) or work in the IT Operations (all Banks and the Telecommunication Company) and Telecommunications Network Operations (at the Telecommunication Company), the latter which is characterised by more stable and repeatable processes.

The researcher made the observations and conducted the interviews during project implementations at these research participating organisations in the Banking and Telecommunications industries. The researcher’s role in these technology implementation projects ranged from Project or Program Manager to occasionally Business Analyst, Software Tester and Organisational Change Manager. Interviews were also conducted with permanent personnel responsible for project deliveries in these companies. These interviews supplement the field data with anecdotes of their own and were instrumental in the testing of the model.

3.6 Methods of data collection and analysis

Data collection is informed by the research interest. A researcher would have certain research interests and a set of general concepts to explore. These serve as departure
points to start the data collection and analytical thinking about the data. The research idea is usually general enough to yield data to start with, but the researcher may end up pursuing unanticipated leads. These must be evaluated for fit between the initial research interest and the emerging data. Emerging themes and questions guide additional data collection. This implies that data collection and analysis, or coding, occur simultaneously [86], [94].

The best data to use is well-documented descriptions of events, or results from other studies, to get the context and events leading up to such descriptions (intent). These descriptions allow the researcher to trace events, delineate processes, and make comparisons [86]. Data must have a direct application to the research problem, with irrelevant data being excluded from such research. Exclusion rules are explicitly stated.

Data must permit the balancing of all discovered facts of behaviour or action. This relates to the trustworthiness of the data and the selected data being included in adequate proportions or in relation to its significance in the research. If transferability is sought, attributes essential for comparative analysis must be reflected. The researcher must prevent criticism of invalid comparisons by loosely defining the characteristics that are to be compared. If such categories arise from the observation, these must be clearly defined. All of these categories must be addressed by the data selected for purposes of comparison [59], [86], [95].

The organisation of data should, as far as possible, separate or distinguish incident data from their systematic interpretation [81], [96]. Formal interpretation must be kept separate from the script, since most people will agree on the concrete but less so on the conceptual. If the research focuses on “what” happens, the “why” can be debated within theoretical constraints, thereby strengthening the theory.

### 3.6.1 Data collection

This study uses three source types of data. Participant observation is used to collect data pertaining to how skills gaps manifest itself in practice. This data forms the basis
of the Engineering Skills Management model. Unstructured interviews are used in two scenarios. An interview may follow an observation when more information about the observation is required however not all observations are followed by an interview. Secondly, unstructured interviews are used to test the model. Although the interviews centred on the model, the interviews could be interpreted as semi structured interviews with guideline questions asked in context of the overall scope and objective of skills management practices [81], [80]. The discussion starts and flows naturally based on the research assumptions stated for this study as well as the objectives of the model. The third form of data is documented occurrences of skills management challenges. These are incidences reported on-line, in blogs or web communities sharing employment or employment seeking experiences. The discussion on document analysis below also includes authorship, readership and reading as an activity to contextualise the value of documented occurrences of skills management challenges for this study.

I Participant observation

Observation research can vary from “complete observer” where the researcher is not known or acknowledged in the researched community (an example being the observation of behaviour in public places), to “participant observer” in a specific community (having a defined and acknowledged role), to “complete participant” to the point of almost neglecting his role as researcher (going native) [80]. This study uses the “participant observer” role. The researcher is an active member of the IT project communities and has a defined role as Project or Program Manager.

Observation requires the researcher to perceive the activities and interrelationships of people in the field through the five senses of the researcher [80:37]. Observation is a structured activity that requires well-organised note taking and detailed descriptions of context and events (factual, not interpreted). The purpose of observation data is objective recording of events or interactions. Observations search for patterns in these events or interactions. The research setting must be well described upfront to give the required context for interpretation. In this study, demographic information about the participants was not required and was therefore not recorded. Where
demographic details such as qualifications may contribute to interpret the observation, it was added.

II Interviews

Interviewing is the process of guiding a conversation to collect information [80]. To support ethnographic studies, interviews should be open-ended and not highly structured. Avoiding leading questions and interrupting the interviewee, or paying attention to non-verbal cues can prevent interviewer bias.

Recording of conversations [81] were considered and done for three interactions. However, two of the participants were not comfortable with the recording of the discussion content and were holding back. These recordings were not transcribed for coding purposes. The richer material was collecting during unplanned or unscheduled interviews where discussions on an observation happened spontaneously. Although all project teams were made aware of the study and that observations were being done throughout the project implementations, it is possible that at any given point in time when such a spontaneous discussions happened, the observed parties did not realise the value of this event for the purpose of the study. The onus was on the researcher to document this event and interaction as quickly and as detailed as possible, however this method is not flawless and may include interpreted and analysed data rather than raw data.

III Document analysis

The analysis of documents pertaining to a research topic is non-reactive, as the researcher does not have an opportunity to influence responses [80], [97]. It provides a rich alternative source of data to use for data triangulation purposes and is a relatively inexpensive method given the wealth of information available in the open domain on the Internet today.

Organisations and people have a way of representing themselves to themselves and to others through documents and records. The incorporation of these documented processes and products of self-description helps the researcher to understand the
setting [97], [98]. The organisation depends on the collective memory of what is captured in these documents as it constitutes the practices of its reality and represents the social facts thereof. Documents are however not transparent representations of the organisation or the people and cannot substitute other kinds of data in the understanding of routines and decisions making processes. Documents must be recognised and used for their value. These accounts cannot be described as accurate, but rather as an in situ construction of its reality [81], [97-99]. A document restricts, limits, and arranges what can and cannot be said about the phenomenon within its domain. In some respect it empowers the reader to create representations, and thereby to authoritatively pronounce on the shape and form of the world [99].

There are also negative aspects about documents. These include the absence of documentation in specific areas of interest, not stating what should obviously be stated, problems of deliberate deception, blindness to motives, oversimplification, or fabrication of content to avoid unresolved riddles, visible gaps, or unexplained conduct [81], [98].

Documents don’t stand in isolation. They refer to other documents as well as the activities and domains they represent [97]. The analysis of documents must therefore look beyond the separate texts and ask how they are related, to determine its deeper meaning. This is achieved by following the trail of the document to determine the sequence and hierarchy of these documents. This is referred to as intertextual relationships, which provide insight into how conventions such as shared language and format can point to something like bureaucratic authorship and assuming power and authority. A dense network of cross-referencing and shared textual formats creates a powerful version of social reality.

Documents decontextualise the reality. Although it keeps track of the time it refers to and was written, it can be circulated later for different purposes. The socially constructed reality is transformed by incorporating it into text. By writing it down, it is transferred from the specific and the local and made into facts and records, which take on an independent existence [81], [97].
Some texts become official and can become proof of events and identities [97]. They achieve an existence independent of their original site of production. The interlinkages in the document hierarchies create their own versions of legitimate authority, which requires a review of authorship and readership. It is important to understand the authorship (actual and implied) and readership (actual and implied) to understand the overall system of production, exchange, and consumption of documentary data. Public documentation often does not have a stated human author, but it may be implied as representative of the specific institution or organisation that created the document. The absence of a human author is a device for the construction of authoritative, factual, or official accounts. We can therefore inspect the text for authorship and look for how they claim whatever authority may be attributed to them [97].

Documentary construction also involves implied readers. It may be that only a restricted readership with specific competencies will be able to fully decode them. This is especially true of organisational documents where an understanding of the organisation and its working assumptions may be a prerequisite to a thoroughly competent reading [81], [97]. No text can determine or constrain precisely how it should be read or interpreted.

Reading is an activity, not a passive receipt of knowledge [97], [100]. Reading is a complex, interpretive activity employing a wide-range of sense-making procedures within the respective cultures involved. The reader brings a cultural knowledge, knowledge of similar text, personal commitment and involvement, and unique biography to interpretation of the text [97], [100]. Subjective, competent readers will therefore make more sense of cryptic text as they bring tacit knowledge and a wealth of experience to the reading activity [60], [97], [100]. Lincoln & Guba [60:196] describe tacit knowledge as that which is remembered somehow, minus that which is remembered in the form of words, symbols, or other rhetorical form. It is not possible to describe or explain everything that one knows in language form. Some things must be experienced to be understood. Tacit knowledge includes inexpressible associations that give rise to new meaning, new ideas, and new application of the old.
Tacit knowledge, like values, intrudes on every inquiry, regardless of whether the researcher recognises or owns it [60]. Inquiry involves three kinds of knowledge: propositional, practical, and experiential. Science as a product consists of propositional, shareable statements. But science as a process involves both practical and experiential knowledge. Practical knowledge is having the knowledge of how to do things, having the skills or proficiency, and goes with techniques and methods. Experience is knowing an entity, thing, place, or person through sustained acquaintance. The researcher’s conclusions are propositions about persons or things of which he or she has had experiential knowledge through direct encounters [60]. This context is important for this study. The researcher’s analysis and interpretation of the observations and documents are based on tacit knowledge in the field of skills management.

Communication can be thought of as consisting of six basic elements: a source or sender, an encoding process that results in a message, a channel of transmission, a detector or recipient of the message, and a decoding process [98]. One type of analysis is concerned with what the message of the communication is (content analysis). The other is concerned with the aggregation of different documents to gain better understanding of the context of the domain under study (aggregation analysis) [98].

Implied readers also link to the implied claims of authority in communication. The rhetoric (ornamentation of speech, effects of speaker, or persuasiveness of text) is used to bring the point across and draws on conventions familiar to the implied readers to get the point of view across [81], [97]. Reading the text has two aspects of importance. Firstly, the way the text is arranged predisposes the intended reader towards a set of relevancies, and secondly, the actual practice of reading actualises those relevancies. Text is therefore often designed to engage with a specific set of presumed relevancies amongst readers, hence text is often slanted towards particular categories of persons or implied readership [100]. While individual differences, culture, and experience influence the interpretation of the text, texts themselves contain instructions, which yield strongly preferred readings [81], [100]. The reader must employ congruent interpretive schemata in order to identify the message as
intended by the creator. This does not mean the reader agrees with the message, only that the message was understood [100]. The understanding of text, specifically “history to the present” of the chosen text, requires prior knowledge of the interlinking of the different texts and subject content knowledge of the specific texts [81].

3.6.2 Sampling in this study

This study uses convenient sampling of human resources in engineering or engineering related jobs. Research participants, and those observed, are either project team members or members of the organisation in which, and for whom, technology projects or technology operations are being done. The profile of research participants varies in terms of experience, qualification, level of seniority in the organisation, permanent versus contract worker as well as employed versus unemployed while actively looking for employment. This variation is used for data triangulation. Data triangulation is also done between the observation data and the industry documented data. Due to the fact that interview data does not constitute the majority of the raw data used for this study, a matrix of the research participant profile was not a feasible deliverable. It is worth noting that research participant experience ranges from a software development intern with less than one year working experience to a mobile network engineer retiring during the time the study was conducted. The research participant profile further includes developers and testers working on single projects to the CIO and Banking division Executive as sponsor for new technology adoption projects. Two other sources of good contracting data comes from permanent versus contract resources as well as candidates currently employed versus those who are in the job market looking for employment.

All parties interviewed or observed were aware of this study and that the study was done as part of the on-going project implementations. This communication was done verbally and includes consent from Executives responsible for the business divisions in which the research was done. The research participants have intimate knowledge of the struggle for the correct resources and regularly experience the effect of the lack of skills. Individuals interested in this study, or those that felt they wanted to share more personal experiences, proffered additional information. An example of such additional information is included in Annexure B.
Sampling only included those event or incidences in context of this study. The study aims to identify the organisational factors contributing to organisations experiencing skills gaps. The incidence of a woman being overlooked for promotion, because she has a flexi-hour work arrangement with the organisation, was documented. However, there are many examples of women progressing in the organisations where this study was done that were not documented as negative cases. The study is not concerned with incidences where skills are adequately managed but rather it attempts to identify factors or practices that contribute to the misuse or underutilisation of available skills or practices that are not optimised to make the most of scarce skills, thus contributing to distorting the current reported skills gaps statistics.

The observations and interviews are initiated by an event or occurrence in scope of this skills gap management study. Interviews were thus not planned and booked in advance. An example of an observation is a senior developer who has to complete a delivery handover document (Release Notes Observation included in Annexure C) but fails to complete the document, citing that he did not know what release notes were and that he should complete these. A scenario like this would be documented as an observation during the execution of a project and may trigger an impromptu interview to elicit more information, motivation or context for purposes of this study.

The trigger for an observation could be any of the following situations:

1. A stressful or demanding work situation;
2. Individual employee or contracting resource career complaint or comment;
3. Management or leadership attempt to address under performance or under delivery
4. An HR issues raised at a line management meeting; or
5. Project implementation status meetings highlighting delivery or performance issues.

The researcher was present during these events, either as a participant in the event or directly approached by individuals aware of the study. Unstructured interviews also include a network of professional colleagues with similar skills gap management
challenges to serve as additional sources to validate observations, codes and definitions.

The written observations include a context section to provide background required for a third party to understand the analysis and interpretation. The researcher is part of these project teams and have therefore context that is not readily observable from documented observations. This background or prolonged exposure to the on-going stresses and frustration associated with technology project implementations may lead to analysis and interpretation of the data that is not intuitive from the written observation.

Since the objective of this study is to identify the factors influencing the industry experience of skills gaps, recurring issues are not documented. It is the nature of qualitative research to collect and analyze data simultaneously. As new data becomes available, these are assessed against coded themes to confirm if it is a recurring theme, related to current themes or perhaps something new. Due to the prolonged observation and engagement with the researched audience, recurring themes occurred frequently and were not documented again.

3.6.3 Coding
Coding is done during the data collection process when codes are created to define what the data is about. Code creation is the process of assigning a researcher-generated word or phrase to concepts as they appear in the reviewed data. Coding is thus data-driven, with the data itself providing the applicable code [86], [94].

Coding is the pivotal point between collecting data and developing an emerging theory that explains the data. Line by line coding helps to avoid theoretical flights of fantasy and eliminates introducing own fears, motives, and unresolved issues into the sample data [86], [94]. Each idea should earn its way into the analysis, [86]. If the researcher is applying concepts from a specific discipline, he should be self-critical to ensure that the concepts work in this situation and would facilitate better understanding of what is happening in the data. Line by line coding helps one to think differently about the data. It makes the routine or mundane unfamiliar and new.
The choice of coding method is informed by the theoretical framework of the study [94]. Exploratory studies would use exploratory coding methods such as holistic or provisional coding while magnitude coding is useful for mix method studies. This study uses a combination of descriptive coding, and domain and taxonomic coding. Descriptive codes are codes that reflect theoretical definitions of actions and events, and general descriptions of more generic processes covering diverse conditions, which aid generality of the theory produced. These codes identify the topics contained in the data [86], [94]. “Domain and taxonomic coding is an ethnographic method for discovering the cultural knowledge people use to organise their behaviour and interpret their experiences” [94:157]. Although this study is not attempting to extract language meaning and exact folk terms, this method of coding is helpful to support the intended output of this study.

An ethnographic study can render its results as an ethnographic report using literary conventions [61]. The overall structure is a storyline with rich descriptions that provide a perspective of the participants. This method of reporting is used in Chapter 4 to describe what organisations do, or don’t do, to manage engineering skills. An additional element of reporting is added to make the results of this study useful to bring awareness of areas of improvement. The organisational factors that serve as vehicles in managing scarce skills are pictured in a taxonomy format, clearly separating the different domains, which need to be addressed. By using domain and taxonomic coding methods, the coding and analysis quickly zooms in on the main topics and domains of the fieldwork and help with the emergence of the higher-level themes while keeping related domain information together. It further helps to focus the coding effort and stay clear of causal analysis or affective coding (picking up and responding to emotion in the field notes).

Atlas.Ti was used during the literature review to capture the required professional skills. The frequently occurring skills served as a basis during the fieldwork to understand why these skills are sought and deemed important. Atlas.Ti was also used early in coding the observation data however the tool was found leading to cause and effect analysis of the observation data rather than allowing straight categorisation to
be done for purposes of developing a taxonomy. Observation data for this study was managed in MS Excel (codes and definitions) and MS Word (observations, interviews and memos). Observations and interviews were written up immediately when these occurred to remove the dependency on post event transcription that might lose context. The coding of the fieldwork for this study was done on paper copies of the observations and then captured and managed in MS Excel. Examples of a coded observation and an extract from the MS Excel spread sheet are inserted below to demonstrate how the coding was done.

**Figure 11: Coding example A**

P 3: Release Notes v2.pdf - 3:18
Codes: [Demotivating working conditions]

*While he was generally a positive person and had good working relationships with his immediate team, he did not feel like he "belonged in this company" and was therefore disinclined to put in extra effort*

The code *demotivating working conditions* is included in the subtheme Working Conditions, which is located within the domain Work Planning Practices.

**Figure 12: Coding example B**

P 3: Release Notes v2.pdf - 3:14
Codes: [Not aware of an incomplete view]

*They are already supporting the system. If I give them the scripts, they should be able to do it*

The code *not aware of an incomplete view* is included in Selection of Soft Skills, which is located within the domain Recruitment and Selection Practices.
3.6.4 Data Analysis

Stating assumptions upfront increases the confirmability of a study and sharing frameworks, trail of thoughts and all factors that influence the analysis and conclusion or perceptions of the researcher as these are forming during the study. It was important for this study to acknowledge that real skills gaps and real skills shortages exist. These skill constraints act as the triggers for organisations to recruit, develop and manage the skills as they do in practice today. This background is important to interpret current field observations.

Constant comparison was employed during the field observation analysis by continuously reading on-line blogs and short periodical articles referencing employment and employable skills issues. These were not coded but served as a secondary source to identify if the field observations made at the research participating organisations included in this study represented the general reported state. The codes in MS Excel were also kept in a very flat structure, later roughly grouped in Skills Acquisition, Skills Utilisation and Skills Development categories before the final taxonomy was drawn up and then refined over a period of four months.
Two industry consultants served as sounding boards or what Saldaña refers to as member checking [94]. Member checking is a useful strategy when the study uses solo coding. In solo coding there is only one researcher collecting and analysing the data. Participants and mentors can assist in validating the findings and revisit coding methods to look for improvements or alternative interpretations.

Memo writing is an aid during the analysis process to reflect on the emerging findings [94], [95]. The memo reflects on the coding process and the codes that were created. Saldaña refers to the process of “dump your brain” [94:41] about the study, its participants, the phenomenon or the process under consideration. Although there are various styles of memo writing and advice to keep memo types separate or even use memos as secondary sources for coding, this study used only analytical memos as a form of reflective awareness and as an aid to move between cycles of coding.

Several memos were done during the analysis stage of this study to reflect on the analysis process and how these concepts can develop into a more holistic taxonomy. These were mostly done on an iPad tablet as and when theoretical thinking was prompted. The reflexive self-awareness requirement was addressed through adding a memo section and a “what was expected section” to the written observation. There are certain deliverables, processes and governance practices that are followed in practice. Whether the research participating organisation has formal project methodologies in place or only observe basic procedures, these guide the delivery of a technology project and forms the basis against which the project teams need to operate.

Referring to the Release Notes Observation, it is standard practice in technology projects to include release notes as part of the handover to IT Operations. This requirement or practice would be listed in the observation in the section pertaining to what was expected so that it is explicitly stated as a knowledge expectation. Any circumstantial factors that might influence the interpretation of the observation are added to the memo section. In the Release Notes incidence, the Developer came from a small Cape Town based organisation that was acquired (as presumably not properly
integrated into the holding company), where they also followed very informal project implementation practices. Hence it is possible that in his prior experience, release notes were not necessary because he could practically sit right next to the IT Operations person he might have handed over to, or there may have been just one team that did all the work, all operating on tacit knowledge only. This form of memoing while completing the observations helped to contextualise the observations.

3.7 Conclusion

Chapter 3 provided a more detailed description of the research design and the research processes supporting this study. Both the theoretical concepts of the research design and the research process as well as the practical application of these theoretical concepts were given to demonstrate how the study output was developed.

Chapter 4 will now describe the field observation and analysis output using the ethnographic methodology detailed here.
Chapter 4

4 Human Resource Management Processes and Skills Management

4.1 Introduction
The coding and analysis of the skills management practices field data are discussed in this chapter. The codes that emerged from the raw data have been incorporated into a taxonomy of skills management practices in the organisation. The purpose of this taxonomy is to emphasise the organisational practices that are important vehicles for managing the presence of skills gaps in individuals, who are supposed to possess the required skills, or managing scarce skills where there is a legitimate shortage of skills. These practices emerged from the coding and analysis of the fieldwork where the skills issue manifested itself and where organisational practice gave rise to the visible presence of a skill gap, either by not managing the occurrence of the skills gap or by contributing to creating a skills gap that would not exist if the organisation practice was executed in a different manner.

The taxonomy developed in this chapter does not attempt to address the shortage of skills. Please refer to the definitions table in Chapter 1 for the working definitions for skills gaps and skills shortages. This study accepts that skills shortages exist and that organisations need to operate within this constraint. This makes the analysis of the fieldwork somewhat difficult, as it is the researcher’s belief that in many instances the research participating organisations are experiencing real shortage of skills. Organisations compensate for this shortage by assigning work to people who do not have the skills required for the job to be done. The implementation of an ESB project, for example, is inherently about data integration hence requires the services of a Data Architect. Attempting to do this ESB integration project without the services of a Data Architect will require another resource to assume this role. The resource assuming the role would, during the course of the task execution, exhibit a
skills deficiency because his performance is measured against the expected performance of a true Data Architect. The performance will not be evaluated against that of an MIS Developer, which is in fact the case of our research participant.

4.2 A taxonomy of skill management practices

The organisational practices affecting skills management objectives identified in this study cover the basic employment life cycle stages. There are skills acquisition errors during the attraction, recruitment, and the selection stages. Skills utilisation issues occur from the onboarding stage right through to the exit stage. Skills development processes during the employment period can also benefit from improvement.
Figure 14: Taxonomy of skills management in engineering jobs

**Engineering Skills Management**

**Recruitment and Selection Practices**
- Search and recruitment strategies
- Inadequate selection of professional skills and experience
- Technical competence in selection practices
- Managerial competence in selection practices
- Role of HR in selection practices

**Organisational Policy**
- Constraints on personal characteristics
- Constraints on personnel dismissal
- Constraints on personnel transfers
- Constraints on retirement
- Policy adequacy for resource management
- Policy adequacy for resource development

**Work Planning Practices**
- Task planning practices
- Work task organisation
- Work models
- Work team structures
- Working conditions

**Resource Management Practices**
- Performance management practices
- Reward and recognition practices
- Exercising personal preferences

**Learning and Development Practices**
- No directed self learning
- Insufficient self learning
- Adequacy of skills development capability
- Adequacy of skills development plan

**Resource Planning Practices**
- The resource plan
- Mismatches of resources
- Resource scheduling practices
- Exercising personal preferences
The field data spans six organisational practices that were identified as vehicles for managing skills. These are briefly given a working definition and context below to aid the detail discussion of the individual codes associated with these categories. These organisational practices are well defined and established in the Human Resource Management as well as the Business Management literature. Working definitions are obtained from this literature and are not redefined in this study.

4.2.1 Recruitment and Selection Processes

Recruitment and selection processes are often referred to as linked processes in the hiring of employees. These processes have different objectives. Recruitment is concerned with attracting people who might make a positive contribution to the organisation and who will apply for positions. Selection is the process of deciding which person to appoint and on what basis to do the appointment [101]. Recruitment and selection processes are also known as employee resourcing and staffing management [71]. These processes are characterised by hiring models consisting of systematic and objective ways to identify a suitable candidate. The recruitment and selection processes commence when a resourcing need has been identified and a job analysis and personnel specification have been completed for this need. The latter two artefacts help to define the minimum search criteria when engaging with potential candidates. During the recruitment and selection processes candidates may be subjected to resume reviews, interviews, psychological testing, and simulated assessment.

4.2.2 Organisational Policy

The study theme of organisational policy pertains to policies regarding the management of the human resources in the organisation. Policies are general guidelines or stated principles (intention) that aim to focus organisational behaviour and guide and manage employee rights and discipline [42]. Policies are implemented through procedures and rules. Procedures are the customary methods associated with the policy guidelines for dealing with specific processes and activities in the execution of the policies. Rules regulate and restrict behaviour of individuals.
It is important that policies be reviewed often to ensure that they stay valid and provide the necessary guidelines in a dynamic changing environment. The strategic HRM processes provide direction to the people activities in the organisation and thus add valuable input into policies to shape the principles required to plan and manage the human resource component of the organisation [41].

### 4.2.3 Resource Planning Practices

Human resource planning practices are concerned with the analysis, identification and availability of human resources so that the organisation can meet its objectives [41]. The crux of these practices is to make sure that the right people, with the right skills are available at the right time and place. The planner is responsible to convert future business plans into the estimated required workforce and to do an evaluation of the current workforce against this estimation to determine how the difference (shortfall or surplus) should be addressed. The outcome of the resource planning process serves as direct input into a variety of other organisational processes such as resource utilisation plans, training and development plans, outsourcing and redundancy management, organisation design and the provisioning of the human resource support services.

### 4.2.4 Work plan practices

Work planning practices as a single concept is not developed in the HRM literature where it is required to support job scoping and job boundary setting to support candidate or employee matching to available work opportunities. This is not a formal function for knowledge workers in the Organisation and the literature on how to plan knowledge work, where to divide a job for example or overlap work do not cover telecommunication network operations or software design and development jobs. The principle of having to plan work is common and is often taken for granted as something that should happen. Articles that rely on this planning to happen would either assume that it does happen and basic planning practices are in place as basis for further development in their work, or will argue that it is necessary to happen but do not attempt to give the actual guidelines or theories for the best way of doing this. The context of the fieldwork falls in the domain of organisation theory, which is included here as the characteristics resemble much of modern jobs in Technology and
Engineering and have a bearing on the fieldwork and how this main theme was developed.

Organisation theory focuses on the three schools of thought with regard to how organisations are defined and structured to support or enable its purpose [40]. These schools of thought include a Classical theory, a Neoclassical theory which is rather a revisiting of the Classical theory to account for deficiencies in the Classical theory with regards to psychological and behavioural issues, and thirdly the Systems theory of organisational design. The Classical theory depicts organisations as hierarchical and stable structures based on the principles of division of labour; cooperation toward delivery; strict authority through the principle of unity of command; and line versus staff functions to differentiate between core competencies and support services. The Neoclassical theory questions the functional principle of the division of labour as leading to demotivating working conditions and an increase in role interdependences toward more complex delivery. The principle of unity of command is further questioned as invalid in modern organisations as work output very often relies on relationships outside of the traditional superior-subordinate relationship. The Systems theory of organisational design resembles more closely the modern organisation and focuses on the interplay between its five component which is the individual; membership to small groups; small groups functioning in larger groups; which make up a formal organisation working in a physical setting (external physical environment and technology).

Muchinsky [40] asserts that the Classical theory can be credited with providing the structural anatomy of most organisations today and its features such as the division of labour (functionality) and unity of command are still very much imbedded in organisations that supposedly adopt the System theory in organisation design. Worren [45] prefers the term organisational architecture to organisational structure as the architecture would encompass other elements of the organisation such as the informal processes used to govern and coordinate work. This is especially relevant to accommodate the complexity of modern organisations that are moving towards coordination intensive, project based work environment characterised by delayering
of management levels and introducing horizontal, flexible and temporary cross functional processes [45].

The concept of team-based work is pervasive in modern organisational theory literature [40-41], [45]. Work is assigned to teams rather than individuals based on a number of criteria and mostly done in project context. Teams are relatively small groups of people (10-15) who have clearly defined objectives and distinct roles, and who need to work interdependently to achieve the work outcome [102]. Criteria that determine the usefulness of assigning work to teams include the completeness of the final deliverable; varied demands in the type and level of skills required; requirements for interdependences, autonomy, debating and sharing of information leading to the final decisions; the importance or significance of specific tasks towards the achievement of the objectives; and the need to transfer knowledge and develop resources. Specific individual skills are required to function as part of a team which include active listening skills, communication skills, self-monitoring, patience, tolerance and cooperation [102]. Successful work output from teams depends on proper individual task design, team effort, resources and organisational support toward delivery. The organisational support is especially important to allow task focus, participation, reflexivity, creativity and innovation. The organisational climate for team-based work must encourage risk taking, idea generation, trust, good and open communication, individual autonomy, and clear goals.

4.2.5 Personnel management practices

The literature speaks about Human Resource Management (HRM) practices as a more modern take on personnel management or people management, which traditionally did not include as much emphasis on employee development [71, 41]. HRM encompasses “all the management decisions and actions that directly affect or influence people as members of the organisation rather than as job-holders” [71:2]. This means that the management of people within their jobs, including job performance and allocation to tasks are the responsibility of the supervisor or line manager to whom the employee reports. The Human Resource Manager does not have authority over the employee in context of the job itself. In this sense, HRM underwent devolution of aspects of people management in that these tasks have
shifted to the line manager. The role of HRM personnel is to act as a consultant to the line manager and provide services in support of several objectives: [Torrington, 2008 in 71:3].

1. **Staffing objectives** – getting the right people, in the right jobs, at the right time (thus recruitment, selection, advising on sourcing models), and managing the release of employees during dismissals, retirement, redundancy and resignation;

2. **Performance objectives** – Providing policy, procedures and assistance to motivate employees to perform, train, develop and reward employees while also dealing with grievances and welfare support;

3. **Change management objective** – recruitment, selection and development of leadership potential and change management skills and the construction of a reward system enabling change;

4. **Administrative objective** – maintenance of accurate employee data

### 4.2.6 Learning and development practices

Human resource development, and more recently talent development, are more preferred terms to refer to the higher end of actively developing talent for the organisation. Talent development is defined as a set of processes that ensure that those employees, who have been identified as having potential, receive the right training, experience and skills development needed to progress [71]. The learning and development interventions can include formal and structured training but also more recently recognises self-learning. The focus is on facilitating learning and self-development rather than the traditional approach of arranging, developing and offering structured classroom based learning. Coaching is a non-directive form of development with the focus on improving workplace performance while mentoring is aimed at the transfer of knowledge, skills and experience to a chosen employee. The scope of mentoring is broader than the skills, experience and knowledge required for a specific job [71].
The remainder of this chapter will discuss these six main themes including its subthemes and individual codes. End notes are used to add a specific observation for clarity on the process of coding and analysis leading to the creation of the taxonomy.

4.3 Recruitment and Selection Processes

The recruitment and selection processes are the first of the six themes in terms of the employee lifecycle. This theme relates to recruitment and selection inefficiencies that contribute to skills gaps and skills shortages being experienced by the organisation. The observations from the field identified many instances of the selection of a person not suited to the job requirement. Similarly, there are vacancies at the research participating organisations that were not filled and remained vacant for an extended period of time when a placement could possibly have been made. The scope of the codes included in this section covers observations made during recruitment and selection processes or shortly thereafter where the new recruit was finding his feet in the new job. Observations of a poor person-job match related to longer term or tenured resources are covered further below in the skills utilisation cycle of employment.

Five subthemes emerged from the fieldwork related to recruitment and selection processes in the organisation. These are:

1. Search and recruitment strategies
2. The role of managerial competence in selection
3. The role of technical competence in selection
4. Inadequate selection of professional skills
5. The role of HR in the selection processes

4.3.1 Search and recruitment strategies

This subtheme developed quickly from the coded fieldwork. Seven codes loaded to this subtheme. These are:

1. Internal promotion based on a positive attitude
2. Internal promotion based on tenure
3. Internal promotion based on the closest match
The search and recruitment strategies followed by the organisation may contribute to the occurrence of skills gaps that otherwise would not exist. The significance of this observation is that at any given point in time a resource’s performance is being evaluated against expected performance when the background to his placement is not factored into the evaluation.

*Internal promotion based on a positive attitude* is a frequently occurring informal practice to find a needed set of skills. A resource is promoted into a role due to having a positive can-do attitude during a time of need. The resource is always willing to assist and is generally able to figure out the work to be done. The resource is self-managed and often involved in multiple projects. No skills matching is done and the assignment is very often temporary in nature, thus not following a formal appointment. There may further not be a formal position.¹ This ad hoc assignment practice is addressed again below in Resource Planning Practices.

*Internal promotion based on tenure* was observed in multiple departments at a Telecommunication Company. There was not a formal policy governing the retaining of senior positions for tenured employees, but it was a generally accepted practice that only full time employed personnel (thus no senior contractors) would progress up the corporate ladder in order of tenure. Senior position may be advertised internally to adhere to labour legislation requirements however applications from senior contracting resources were not included in the recruitment pool. This practice was confirmed during an organisational restructure initiative that resulted in each manager and senior manager being promoted one level up. This study did not attempt to do a verification of how well the promoted individual matched the new position’s requirements. The practice of promotion based on tenure and not using a skills matching process, is included in this awareness model as a practice requiring a more
consistent approach to proper skills matching. This practice was not observed at any of the Banks in this study.

*Internal promotion based on the closest match* is another frequently occurring internal promotion practice. A resource is promoted into a vacancy when he is intuitively the closest match to the skills requirement for the job and may already be doing part of this job on an ad hoc basis. In this scenario there has always been a formal position that required a new appointment. In cases of urgency, the position was advertised internally to adhere to legislation requirements, however the earmarked resource has already been made an offer and the affected teams re-aligned to make provision for a formal transition. A formal skills assessment is not done and the appointment may not be followed by a personal development plan and mentorship program.

*Key word matching* is still used frequently by organisations to delimit the recruitment pool. This code only covers incidences where specific technology key words, length of experience or education, or specific role titles are searched for in the resumes. The use of keywords in itself is a valid search strategy to narrow down potential resumes for further viewing. However, when executed by a person not familiar with the job, or done by a computer, an otherwise good resume may be excluded from the recruitment pool. The difference between a person with average skills, minimal education and 5 years poor experience versus a well-qualified, multi-skilled person with 4 years very good experience may be substantial when considering skills gaps and skills shortages in the bigger picture.

*Using search engines* such as PNET to obtain resumes is not often used by organisations themselves. These are more frequently used by recruitment agencies. Similar to keyword matching, very good resumes do not make the short list for further interviewing, mainly due to the enormous volume of competing resumes. It is perceived by candidates to be a first come first serve method of finding suitable employment. Alert emails from a search engine with links to submitted resumes may be ignored by the third day. If the client is urgently looking to fill the position, there is no guarantee that the best resumes are submitted in the first few days. The

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XI PNET Job Board [www.pnet.co.za](http://www.pnet.co.za)
recruiters work with the few hundred responses received on the first day or two. There may be credibility to employer claims that they cannot find suitable resumes. It is very likely that they stop receiving and reviewing resumes due to the large volumes received as a result of automated processes.

The *preferred suppliers list* plays a role in delimiting the recruitment pool. It is the custom in many organisations to have suppliers of human resource placement services pre-approved, which includes an overarching engagement contract and related fee structures. The negotiation is done upfront and individual resources supplied against this contract. Three technology candidates indicated that they had opportunities to interview for contract work at various large organisations. These interviews could not commence before the contractors found suppliers on the preferred list that would be willing to act as an intermediary.

Another contributing factor to filling a role with a resource that does not have the required skills and experience is *relying on contract house processes* to match skills to the job requirement. For contract positions, a job description and candidate specification are given to technology vendors, contract houses and labour brokers. These entities have contractors or consultants on their books and can provide, at short notice, an experienced and vetted contractor. Poor vendor management can contribute to the creation of skills gaps at the organisation. The line manager, or other company representative, would typically be the first level of a candidate selection. This engagement is based on the assumption that the contract house will do the necessary checking in terms of the adequacy of skills, experience and qualifications and that the account manager understands the specialised skills that are required. Organisations often only do skills and experience verification for their permanent employees, not for contractors. The organisation assigns work to the contractor on the assumption of certain technical or science skills as well as the ability to interact and work well with the team, which the contractor may not have and can thus not perform or deliver.4
4.3.2 The role of managerial competence in selection

Managerial competence refers to the skills and experience a manager is expected to have, both in order to take part in the successful selection of team members as well as to manage employees during their tenure. Five codes from the fieldwork make up this subtheme code. These are:

1. **Inability to recognise available skill**
2. **Inability to build a sustainable delivering team**
3. **Inability to mentor individual team members**
4. **Inability to assess learning needs in others**
5. **Inability to facilitate learning in others**

There are also two aspects to managerial competency in context of recruitment and selection. Firstly, managers are incorrectly selected and do not have the required managerial skills. The selection process thus failed to match a candidate to a managerial position. This mismatch has far reaching implication for managing scarce resources in the organisation. The inability of the manager to perform would contribute to the reported skills gaps. Secondly, due the manager not having sufficient skill, he fails in the selection of other team members.

The *inability to recognise available skill* relates to the manager not being able to identify available skill within the organisation that could be deployed to the current need, thereby avoiding a recruitment and selection process being initiated. Further, should the recruitment and selection process be initiated, the manager cannot accurately assess available skill in an external candidate, either through the review of a resume or an in person interview. There are two scenarios informing this code. The manager may not have an accurate and complete view of the work to be done and the associated skill required to get the job done. He therefore does not know what to look for in the potential resources being interviewed. Secondly, the manager may not have sufficient skill in the domain in which he needs to select a candidate. This scenario specifically considers the team leader or manager as the recruitment and selection agent and not an HR practitioner doing the recruitment and selection for a specific department.
The *inability to build a sustainable delivering team* has relevance in the selection process as the current state of the team determines largely what the skills gap in the team is that needs to be filled. The objective here is to supplement the team rather than to select more of the same skill. If the manager is not able to build a sustainable team and augment the team with the correct skills to supplement existing skills within the overall context of the total skill set required, this team will be in perpetual recruitment and selection mode and never achieve a state of performing and delivery. The manager is not only expected to have a fair technical capability to manage his team, but must also have skills in business finance, forecasting, enabling operational efficiencies, scheduling resources, removing blockages or constraints, and resolve political constraints to make the most of the team he has.

The *inability to mentor individual team members* encapsulates the organisation’s need for its managers to mentor their direct staff to ensure proper employee-organisation fit and personal growth and development of specific needs that the team members may have during their tenure. This skill in the manager is particularly important during the selection process, as a manager would be able to select a candidate that is not a perfect fit but who can be mentored to grow into the role.

In context of skills management, the *inability to assess learning needs in others* occurred frequently in the observations. When new technology needs to be adopted, it is expected that resources will identify the need to up skill themselves while working daily on the tasks required to adopt this technology. This type of learning may be self-study or class room training. A manager is required to be able to recognise which resources need to embark on this self-learning drive and further be aware of who in his team may not recognise this self-learning need and who may need help to engage in this learning. The selection process failed to place a person with people development skills in a managerial position.

The *inability to facilitate learning needs in others* extends the previous code by being able to consciously assist team members to realise the opportunities to learn, either through creating a learning experience on the job or being a facilitator or mentor for
outside learning. The perception of a skills gap could be perpetuated when a known learning need in the team is not addressed.

4.3.3 The role of technical competence in selection

Technical competence focuses specifically on the fact that there is technical content that the job holder needs to master in order to be considered a match for the job. The objective is not to list the technical competencies required by industry but rather what the effect is on the perception of skills gaps of not being technically competent. Two codes make up this theme and have been separated from managerial competence although they are both applicable to, but not limited to the team manager. These codes are:

1. Lack of technical foundation
2. Inability to recognise available skill

An often occurring incidence is the lack of required technical foundation in the job holder. This skills gap will be prominent throughout the life cycle of the employee to job pairing. Several observations suggested that the resource did not understand the fundamentals of the field he worked in. The degree of trial and error and sense making was often very visible and would go with comments suggesting everything is chaotic or unclear. The resource may even sound demotivated and overwhelmed. The field observations found evidence of people with unrelated education or self-taught course only.6

The ESB Developer was the most senior Developer on the team and was required to attend all interviews for additional resources. This person could not assess technical competency in interviewed candidates. A second shortcoming for an organisation when the job holder does not have the required technical foundation is the inability to recognise available skill. This is the same code as allocate to the role of managerial competence above but differentiated here as it is specific to a technical person who is supposed to be company technical expert, and who does not possess sufficient skill. A team leader or technical expert who does not possess sufficient technical skill cannot assess or recognise these skills in others and will make personnel selection errors.
4.3.4 Inadequate selection of professional skills and experience

There are specific professional skills that were not present in jobholders that suggested an occurrence of a skills gap. In the fieldwork context, the lack of these professional skills were often identified or pointed out by a colleague, manager or team leader when a task was not completed on time or was done incompletely or incorrectly. These skills relate to the professional skills as identified in the literature review. Six codes were generated from the fieldwork. The codes related to this subtheme are:

1. Inability to do critical self-evaluation
2. Not aware of an incomplete view
3. Not actively looking for the rest of the incomplete view
4. Inability to scope and sectionalise a problem
5. Resource has not done this job before
6. Not actively selecting for lifelong learning attitude

Analytical positions in Technology or Engineering disciplines require critical thinking. Does the output or final deliverable address the original scope and objective of the exercise? A shortcoming in critical thinking skills is the inability to do critical self-evaluation. The resource does not check whether the correct work was done, in the correct or most optimal way possible. This skills gap manifests itself in the form of incomplete work output that is visible to the team members. The incomplete work may also result in delivery delays for the team and may negatively affect the quality of the overall delivery.

There are two related concepts to the inability to do critical self-evaluation. There are resources that are not aware of an incomplete view. It is a form of lack of awareness of the job requirements as well as the environment in which the resource functions. This roughly translates to not knowing that you don't know. A good resource understands that there is more to be known (about the problem or context) and factors this incomplete view and the associated uncertainty into his decision making and delivery, if only to plan additional time to revisit deliverables to adjust for new insights.
The other concept is *not actively looking for the rest of the incomplete view* even when the resource acknowledges that there is, or should be, more for future consideration. The resource decides not to continue with a certain trail of investigation or analysis. In context of the field work supporting this code, tight timelines played a significant role in these decisions, as did role responsibility.

The *inability to scope and sectionalise a problem* occurred frequently. A resource is not able to assess the scope and nature of the problem and break it down into its constituent parts to allow for execution. It is very often assumed that the person scoping the problem has the technical foundation and previous exposure, if not repeated experience in the area under consideration. A frequently occurring skills gap is the inability to grasp the nature of the work to be performed. This uncertainty often presents itself as “the problem”. It may not be a problem for a technically skilled and seasoned person. It becomes a problem when these skills lack. While higher levels of engineering may result in a decent challenge for a trained and seasoned Engineer, problem solving in industry often takes the form of mid-level engineering challenges that are presented to unskilled and inexperienced resources. Organisational practices are not always geared toward actively assisting with the scoping and sectionalisation of problems. The adoption of a formal project implementation methodology, which could help to guide problem identification and resolution, are not always well implemented or enforced.

It happens frequently that a resource is given work to do that he has not done before. In lieu of a solid technical education and training foundation that would expose a resource to the know-how to enable him to scope and sectionalise the problem, years of experience can also be an option to recognise what should be done. In instances where the resource has not done this work before, mistakes will be made and the work will start later than anticipated and may take longer than required because the scope and complexity of the tasks were not understood or were underestimated. A degree of trial and error needs to be factored in however; a resource can be placed or selected incorrectly if the degree of experience in lieu of technical foundation training in not understood. The quality of experience has not been assessed in this study.
Organisations don’t seem to actively select for a lifelong learning attitude. In discussions with HR support staff as well as line managers responsible for the recruitment and selection processes, this attitude was not specifically tested, or interviewed for, although if the resume contained evidence of further and current study, it was favourably considered. The content and context of additional study did not seem to be important. This learning is differentiated from actual certifications or formal qualifications, which in the case of keyword matching on a resume would be minimal requirements for eligibility for an interview. The latter would constitute technical foundation rather than having a lifelong learning attitude.

### 4.3.5 The role of HR in the selection processes

The role of the HR function emerged later in the study as reflections on poor resource decisions questioned how this function could contribute to the improved selection and management of skills. Three codes emerged in the subtheme:

1. **Unfamiliarity with the job requirements**
2. **Focus on generic attributes**
3. **Recruitment administration is ill managed**

The role of the HR department, or in more recent decentralised implementation models, the HR partner assigned to a specific division, seems to have changed. Many of the HR partners observed as part of this study were performing an HR administration function and have supported the technology departments in the form of obtaining resumes from recruitment agencies and finalising the employment letters. **Unfamiliarity with the job requirements** may be as a result of the HR partner not being trained, or has little working experience in technology and cannot evaluate a resource. At best they obtain resumes and do a first round of validations to forward eligible resumes to the line manager.

When the HR partner attends interviews, their focus [was] on generic attributes such as the candidate’s experience in Microsoft Office products and his interpersonal and conflict handling skills. Although this scenario could also be labelled inability to recognise skill, what stood out specifically with HR partners is their reluctance to ask...
technical questions or even venture to the topic of technology. The content of their interviews focused solely on generic skills or on ensuring that the candidate had an unbroken employment record. Senior contract resources interviewing for permanent positions reported a tough time explaining that time was consciously taken off between assignments, as this constituted their annual leave, family time or self-development time. This observation aligns with the literature. Martin [41] points out that HRM has undergone a devolution in terms of their role. The literature does not indicate why this role changed. From the field observations it appears that the HR partner does not understand the complexity of the job to be done and can therefore not assist in a greater capacity. There is some tension in the literature as the annual skills shortage surveys suggest that HR should step up to the challenge of talent management and get involved in the skills debate [2]. Evidence from the floor suggests that they are not equipped to do so and are not working toward gaining that understanding to play the required role.

At times the recruitment administration is ill managed. This may be a function of the volume of applications the process needs to cater for and the fact that recruitment is not the only function for the HR team. This code caters specifically for candidate resumes that passed the first iteration of reviews and have been short-listed for further consideration and interviewing. Interview times are communicated incorrectly or not at all. Interviewers are double booked or not booked at all for the interviews. Incorrect resumes are presented to interviewers with different candidates attending the interviews. Feedback to the candidate does not always happen, especially when a position has been withdrawn. There may also be a delay in the final offer and signing of paperwork that could result in a successful candidate not accepting the offer.

4.4 Organisational Policy

Organisational policy contributes substantially to not making the most of the available skills. This section covers specifically where there is a formal policy governing certain resource decisions in the organisation. There are instances where there is not a formal policy but rather practices characterised by inconsistent occurrences of poor resource decisions. The latter is discussed under Resource Planning Practices and Personnel Management Practices where the practice is not governed by formal policy.
Six themes emerged from the analysis of formal organisational policy constraining the proper utilisation of resources or not enhancing the utility of the scarce resource capability that is available. These themes include:

1. Constraints on personal characteristics
2. Constraints on personnel transfers
3. Constraints on personnel dismissal
4. Constraints on retirement
5. Policy adequacy for resources management
6. Policy adequacy for resources development

### 4.4.1 Constraints on personal characteristics

The constraints on personal characteristics only rendered two broad codes namely:

1. *Resume is excluded from the recruitment pool due to age, gender or ethnicity*
2. *Resume is excluded from the recruitment pool due to not having a minimum qualification*

Perhaps most common in the South African labour market governed by employment equity policies, a candidate’s *resume is excluded from the recruitment pool due to age, gender or ethnicity*. This code combines any incidence of exclusion due to demographic reasons. A potential candidate submitting a resume may be excluded from the pool due to personal characteristics rather than qualification and experience.

There is much research being done about the effects of affirmative action policies and preferential selection on the availability of skilled resource [40], [103]. This study will not contribute towards that debate other than to identify the exclusion of qualified and experienced resources from the recruitment pool based on demographic criteria as contributing towards organisations reporting that they cannot fill a much needed position.

Another constraint on personal characteristics is the need to have a minimum level of education. A candidate’s *resume is excluded from the recruitment pool due to not having a minimum qualification level*. At two Banks, the HR recruitment process will not accept a resume of a potential candidate with less than an undergraduate degree.
The degree is unrelated to the subject field in which the position is advertised. Keyword searching on the level of qualification on resumes determines if the resume is shortlisted and forwarded to the department for which the recruitment is done. The fact that the subject area of the degree is considered unimportant for the initial recruitment eligibility suggests that the organisation is looking for a level of personal development, which is a valid placement strategy for the organisation’s talent management plan. This study did not attempt to define and measure actual personal development and means by which such personal development could be acquired. In context of positions going unfilled and people being placed in positions where they do not have the correct technical foundation, the policy may need to be revised as it may not have the full benefit it intended to have 8.

4.4.2 Constraints on personnel transfers

Constraints on personnel transfers is another contributing factor to organisations reporting skills issues when there is room to alleviate these problems. Another two codes emerged in this subtheme. These are:

1. Headcount freeze

2. Unavailability of policy and processes to transfer a resource

A headcount freeze is a function of organisational policy on headcount limitations in the organisation’s structure that forms the basis of annual funding. It results from the practice of defining an organisation structure and staffing it with permanent and contract personnel [40]. A headcount freeze contributes to the current skills dilemma when a known skills requirement cannot be filled due to the unavailability of an opening in the organisation structure. There is literally a cap on the number of people that may be employed, permanently or on contract, in a specific department.

Changes to the headcount and the specific roles or positions that were approved in the initial organisation structure are difficult to incorporate. When the contract portion of this staffing method is utilised, there is very little room to replace or exchange skills. The manoeuvrability to deal with the changing job scope demand is in the ratio of permanent to contract resources and the relationship with the contract houses to replace skills and get the replacements up to speed in the shortest time possible.
the event of an organisational unit being staffed with permanent personnel and these people do not have the required skills, replacement is somewhat more difficult and ultimately leads to skills decision making that is not aligned with the skills requirement.

The *unavailability of policy and processes to transfer a resource* contributes to the underutilisation of resources, which takes up headcount but is not adding value. This is differentiated from the unwillingness to do the transfer, which is discussed in Resource Planning Practices below. There may be a legitimate need to transfer a person and a potential place has been identified that would provide a better person-job fit, however the organisation does not have defined processes to transfer the person, including his associated headcount and budget into another division.9

### 4.4.3 Constraints on personnel dismissal

A consequence of the complex South African labour legislation is the difficulty to dismiss an underperforming or non-performing resource. This subtheme rendered two codes:

1. **Difficulty to relieve a resource of duty when he is not performing**
2. **Unavailability of policy and processes to enforce dismissal when required**

An issue many employers have is the *difficulty to relieve a resource of duty when he is not performing*. A resource is known to lack the required skill, attitude and or experience but is not dismissed. The resource is re-assigned to a team where he is kept busy with ad hoc work or left to underperform in the current role. There are a number of reasons contributing to the difficulty to let a person go. Some of those reasons such as having a positive work attitude and being willing to act in a minor capacity are discussed as factors of poor personnel utilisation further below. In some cases the manager or decision maker simply lack the motivation to engage in an uncomfortable discussion or may not have confidence that he clearly understand the job himself and can therefore not properly articulate what the person is not doing correctly in the job. The overall effect is that needed head count is filled with people that should no longer be in a position as they are not adding the required economic value while preventing the job opportunity being given to somebody more suited.
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The causation of organisation’s inability to relieve people from duty was not researched in this study. While it is generally accepted in the South African labour relations context that the dismissal processes are cumbersome, it may be possible that the management reluctance to dismiss may not be only due to avoidance of a difficult process but rather the *unavailability of processes and practices to enforce dismissal when required*. This can become especially difficult when proper performance management was not done or when no mentoring skills are available.

4.4.4 Constraints on retirement

Constraints on retirement may lead to the loss of good resources that are difficult to replace but at the same token, may result in older resources hanging around when their headcount could be used for somebody with skills more aligned with modern job requirements. Three codes were generated for this subtheme:

1. *Retirement is forced*
2. *Retirement is delayed*
3. *Avoidable early retirement*

The policy on retirement is strictly followed at the Telecommunications Company where fieldwork was conducted. Employees reaching the age of sixty have six months post their birthday to accept and affect their retirement. The six-month period allows for the identification and training of a replacement resource. The retirement policy did not allow any deviation and retirement [was] forced.\(^{10}\)

Retirement policy adherence is however inconsistent. At two Commercial Banks with similar policies on retirement, different adherences were observed. A very senior partner in his early seventies still had an office and would come in regularly, albeit to “upset the momentum of progress”\(^{11}\) While delayed retirement could be argued for in the case of the Senior Network Engineer, the opposite appears to be the case for the Commercial Banking partner. Delayed retirement could keep a position filled when a more suitable resource could be brought in with more relevant or current skills.
Resources may also decide to disengage earlier than real retirement age due to the lack of career opportunities or to avoid a demotivating working environment. These near retirement age employees take an *avoidable early retirement* and move out often leaving the team with a few hands short. There are no processes in place to manage or prevent the exit of older people with good skills and experience. Processes are required to identify how these people could be given short term or interim roles or at least go through a longer process of handover to avoid leaving the team with a gap.

### 4.4.5 Policy adequacy for resources management

The inability to properly manage resources often pointed to inadequate policies. This subtheme generated three codes, namely:

1. *Inadequate performance management policy*
2. *Inconsistent flexi-work policies*
3. *Inadequate policies on promotion for modern careers*

The *inadequacy of performance management policy* was observed. Three organisations at which this fieldwork was conducted confirmed that the policy existed but could not be followed to the extent that it should be. The reasons cited ranged from the job changing too frequently to hold the incumbent accountable, to allowing more managerial discretion to deal with underperformance in context of an over demanding working environment. The performance management execution is thus left to the line manager with very little formal policy and practice support from an HRM function.

There is evidence of *inconsistent flexi-work policies*, even within one organisation. While most organisations’ Technology divisions allow flexi-work, there is no consistency in how the policy is formulated and enforced, leaving it open to interpretation by the individual employees and their line managers. In the absence of consistent policy enforcement, underutilisation of resources can occur when resources take liberties. Counter wise, over utilisation and burnout can also occur when resources, working from home, do not observe normal working hours and feel obliged to continue working into the night for the privilege of working in a quiet environment.
Both scenarios have consequences for the long-term stability and tenure of skilled resources.

In terms of the flexible re-allocation of resources, often in an ad hoc manner as discussed in selection and recruitment strategies above, there appears to be inadequate polices on promotion for modern careers and the management of job-employee fit where internal promotions are made based on an immediate job need rather than the natural growth of the employee. Promotion policies only stipulate how long a person must be in a position before being promoted (where applicable) and the general requirements regarding the role fit. The current practice of internal promotion to address a pressing job change need is not covered by policies, hence there is no fail save clause or a return to current role clause built in should the resource not fit the new job. This constraint is very applicable to the scenario of gaining a poor manager and losing a good Engineer.

4.4.6 Policy adequacy for resource development

General guiding policies and principles with regard personnel training and development are not always in place. If these are in place, they may not be observed. Three codes emerged for this subtheme:

1. Policies do not cater for ad hoc or short notice people development
2. Misalignment between development policies and actual development needs
3. Development offered is unrelated to current job requirement

A resource is expected to use new technology in which he was not provided with training. Personnel development policies do not cater for ad hoc or short notice people development. The policy and it associated practices are not pertinently linked to the various business units’ strategic and tactical objectives with regard technology changes. The objective of this subtheme is not so much to point out that there is a misalignment between the objectives of the organisation and its ability to execute against them as it is important to have adequate human resource development policies in place to support dynamic business change that has become the norm. These development policies, when they are in place, help to identify and action the resource.
development needs; help to manage under performance while being trained; and in general move the organisation towards a learning culture.

A misalignment exists between the development policies and the actual development needs. The development policies may be very descriptive of what exactly is covered in terms of training and what is not. Any requests for development needs not catered for by existing policies are not approved. The essence of this observation is that the principle of requesting a revisit of the policy to cater for modern employee development needs is not always entertained.12

Development is offered unrelated to the current job requirement without any career development plan in place that could provide context to the learnership being offered. A Business Analyst was offered a learnership in the form of a master’s degree in African Leadership. There was evidence of this Bank considering expansion into Africa in future, but the Business Analyst was not on a development path for a role in a position related to the study field. There were also no conditions specified for this learnership other than having to pay back the learnership fees should the resource decide to leave the employment of the Bank before completing the studies. This development initiative appeared closer related to corporate social investment and the ability to claim back from the Skills Levy FundXII than actively developing resources for the current skills demand in the organisation.

4.5 Resource Planning Practices

This section discusses the findings of observed resource planning practices in as much as it influences the skills management objectives of the organisation. In some cases these are formal practices applied consistently, and in others, they are characteristic of ad hoc and at times desperate measures to get the job done. Organisational practices are not always governed strictly by policy but may develop as a function of leadership ethics. A few incidences of poor resource planning decisions were identified during the course of the field work collection. Various field anecdotes were offered by technology resources who felt they had skills and experience to offer but were unable

XII See South African Act contained in the Government Gazette 33756 dated 11 November 2010
to “convince” their managers to use these skills. Likewise, there are several observations of resources possessing skills that could fill a void in another team but for various reasons, the match was not made. The importance of this theme is that there are skills available in the organisation that are not being utilised. The context of resource planning is further focused on a proactive identification and planning of capacity and capability for future needs.

Four subthemes emerged from the analysis of this business management practice. These include:

1. The resource plan
2. Mismatch of resources
3. Resource scheduling practices
4. Exercising personal preference

### 4.5.1 The Resource Plan

The concept of a resource plan as developed in this study refers to any visible or shared plan in the organisation that helps inform business management of the available skills and the basis on which to assign and apportion work to the available capability and capacity. It assumes that some understanding of this human resource capability and capacity is available to the decisions makers. The fieldwork did not find tangible evidence of a physical plan. There was evidence at all four organisations of a well-shared meaning of the value of each person especially for both the very good and the very bad resources. Five codes loaded to this subtheme:

1. Skills are available but are not visible
2. Skill obsolescence
3. Over utilisation of resources
4. Skills offered are not utilised
5. Resource planning leads to unplanned promotions

**Skills are available but are not visible.** A skill matrix is a tool that can help an organisation to see the availability and configuration of the skill sets it has access to internally. This matrix is very often coupled with the personal development plans and may show which resources have an interest or aptitude for certain skills development.
The lack of a skills matrix appeared often in the observations. This code captures the result of a crises situation where a skills assignment must be made that requires the insight typically found in such a matrix. The decision maker is thus flying blind and would revert to skills assignment practices such as those discussed in the recruitment and selection of resources including promotion based on a positive attitude or tenure.

*Skill obsolescence* occurs where a resource does not stay current with technology changes in his chosen field. A resource is employed based on historic learning and experience but fails to keep up with the latest changes to the practices and technology. This resource however remains available for the organisation and will be assigned based on historic or perceived ability. Skill obsolescence contributes to situations of underutilisation and thus the perception of a skills gap. Skills obsolescence was observed in three instances in technology resources that did not stay current with technology changes. In all three cases, the resources were contract resources that did not stay current but did not realise that their skills were out-dated. In one case, the person was with the same research participating organisation for over five years, doing the same job. The other two contract resources had a career history similarity characterised by very short assignments with prolonged periods of no employment.

A poor resource plan can lead to *over utilisation of resources*. The resource plan is based on extreme long working hours. It is assumed that the critical resources are available in excess of fifteen hours a day, seven days a week and work is committed to on the basis on this assumed capacity. Over utilisation of resources occur when a small group of people are frequently used or relied upon to get critical work done. A positive can-do attitude or the inability to say no also contribute to a resource taking on an additional piece of work for which he may not be suited or for which he does not have sufficient time. The research did not unpack the tendency of resource to complain about the expected overtime but feeling that they were not allow to decline the work. In one observation a resource was actually in trouble on the Monday morning before normal working hours started for not responding to a late Sunday night email. This tendency to assume resources are available for such extended periods of time could be a function of the organisation culture or may be limited to isolated leadership ethics.
It also happens that *skills offered are not utilised* and actively incorporated into the organisation's overall resource plan due to constraints in doing this person-job fit. It occurred frequently that a resource is not given an opportunity when he asked for such an opportunity. This code reflects several resources' experience when they believed they could contribute but had a difficult time finding somebody willing to allow them a go at the task. The context to this code is similar to skills available but not visible. Here, the skills are being made visible, by personally offering the skills to a supposed decision maker, but the resource is still not being given the opportunity. The offering of skills appear to be an unofficial career discussion (HR view) rather than an active resource planning discussion (Business Management view). Skills offered may further be ignored (not utilised) due to personal characteristics. The researcher only confirmed verbally with the managers involved in these observations that the exclusion of resources based on personal characteristics such gender, ethnicity and age was not guided by policy but rather current practices.\(^{13}^{14}\)

The informal nature of doing *resource planning may lead to unplanned promotions* as discussed in the recruitment and selection of resources. The significance of this observation regarding poor resource planning practices is that in a time of need and where proper resource planning, skills pipeline management and people development practices are not in place, an internal person may be promoted into position that he is not suited for. It is evident from the field that although some of these re-assignments are meant to be temporary in nature, it is very likely that the job incumbent will just remain in the assigned position and when the annual performance review and increase discussions approach, a more permanent or formal appointment may need to be made. It is very difficult to rectify a situation of underperformance and possible demotion when the original promotion was done for the wrong reason.

### 4.5.2 Mismatching of resource

Resources are often incorrectly matched to a job. Four main mismatch scenarios were identified during the field observations. Although this mismatch is an error made during a selection process (formal or informal selection), the observations included in this section are based on an implicit or explicit resource plan in the organisation and
perceiving a person mismatch to the job, thus contributing to the perception of a skills gap. The four mismatch codes that emerged are:

1. *Job-experience mismatch*
2. *Job-knowledge mismatch*
3. *Person-role mismatch*
4. *Role conflict*

*Job-experience mismatch* highlights the value of experience where the resource appeared to have the technical foundation knowledge but lacked sufficient experience to complete the tasks by himself. In the example of the MIS Analyst being promoted to a Data Architect role (promotion based on being the closest match), the resource demonstrated foundation knowledge, but did not have enough experience to apply his data experience to doing a data architecture. The job-experience mismatch observation was also made twice with regard young resources in possession of a Chartered Accountant (CA) qualification, who were employed in senior positions without having trench level assurance and reconciliation experience.

A *job-knowledge mismatch* occurs when a resource does not have the technical or foundation knowledge to do the job. This observation was only made with regard contract resources and may be a result of poor recruitment practices and reliance on contract house processes to do skills validation. This code speaks specifically to the resource not having a basic understanding of the subject field or has very little exposure that was gained through experience (the resource can use the language and have played with certain technology only). This skills situation is similar to the recruitment and selection code “Lack of required technical foundation” however the context here is the grassroots level execution of work rather than technical leadership and people management.

*Person-role mismatches* were observed where personality and natural inclinations (or internal factors) are not factored into the employment decisions. The prime example leading to the development of this code was the introverted Process Engineer that was assigned to do end-user type requirements gathering. He was avoiding all contact with people. More general field observations identified differences in work method
or work time (time of the day when the person is more productive) as mismatches for specific roles with a few incidences of the lack of interpersonal skills that could contribute to a person not fitting well in a role, for example a Program Manager that could not build rapport with his internal stakeholders.\textsuperscript{15}

The code \textit{role conflict} is related to a person-role mismatch aimed at capturing external (political or management) reasons for a mismatch. Organisational Change Management and Internal Audit and Governance roles are typical of these incidences and require a hardy personality. The role itself is in conflict with bigger or other departmental objectives. This conflict is not managed by communicating clearly what the objective of the role is and how it supports the business rather than it being a tool to engage in a witch-hunt to expose non-conformance. This conflict becomes associated to the person currently filling that role and may prevent the person from actually delivering value-adding output thus contributing to the perception of a skills gap.

4.5.3 Resource Scheduling Practices

Resource scheduling practices consider how work is lined up or sequenced and assigned to people. Poor scheduling practices lead to over or under utilisation and in general could contribute to a demotivating working environment. Five codes emerged for this subtheme:

1. \textit{Over scheduling of resources}
2. \textit{Resource is spread too thinly}
3. \textit{Resource is tired}
4. \textit{Resource has significant idle time}
5. \textit{Ad hoc re-assignment to work}

\textit{Over scheduling of resources} occur frequently. A number of projects running simultaneously require the same scarce resources. The work is simply assigned to a resource regardless of the available capacity. The scheduling is managed on an ad hoc basis and often gets reprioritised based on “he who shouts loudest”. Key-man dependencies are reported as the reason for a project delay. This is interpreted as a skills shortage of a specific skill. This code covers the organisational practice of
scheduling on the fly and not managing scheduled times, commitment and expectations visually so that the lack of true capacity is measureable.

A consequence of over scheduling of resources is a *resource is spread too thinly*. Modern organisations that have ambitious technology roadmaps not aligned to current tactical capabilities often contribute to a resource being spread too thinly. A resource is assigned to too many tasks and while he is capable of technically performing all these tasks, the volume of work is too much and leads to the resource being perceived as underperforming on any single tasks when viewed individually, thus suggesting a skills gap in the individual. This code is related to the over scheduling of resource but looks at the phenomena from the individual’s perspective. It is not uncommon to see a key man’s calendar as having two to four meetings scheduled in the same 1-hour time slot. The resource must decide which meeting is more important.

*Resource is tired.* This code developed as a result of seeing many resources working extreme long hours for extended periods of time. They may even sleep at work and are at the office every weekend. The importance of this observation is the deterioration of the quality of work that they deliver and the subsequent perception of not “having skills”. Due to the over utilisation they make mistakes. When the management team looks monthly at project or operational statistics, they see a certain head count and expects a certain output. The total output (quality and completeness) is below what the headcount can deliver if they were to focus on less and work reasonable hours.

It may also happen that a *resource has significant idle time*. Poor work planning is more prevalent in project than operations mode where work tasks are being defined as they become apparent or where there is little to no repetition of tasks. The resource assigned can either initiate new or additional work when he identifies the next task or can wait for tasks to be assigned. The skills needed to help manage or prevent excessive idle time, is self-managed resources that can take initiative, which also implies the ability to scope and sectionalise a problem thus contributing to the sense making required to keep optimal momentum in the team.
A resource may be subjected to *ad hoc re-assignment to work*. The resource scheduling process is characterised by ad hoc re-assignment of work when people are haphazardly taken on and off work due to poor planning, crises management or poor stakeholder management. The result is that the resource cannot focus and deliver on a single task and the overall effect of poor scheduling shows in the monthly reviews of departmental output. Since this output will be lower than what is expected from the headcount, the perception of skills gaps exist when the underlying reasons for under delivery may rather be contributed to poor planning scheduling practices.

4.5.4 **Exercising of personal preference**

Resource planning practices are often done around the stated willingness of resources to do certain work or be available at certain times. It also factors in management’s discretion with regard resource decisions and risk management. Two codes are applicable to this subtheme:

1. **Unwillingness to share or redeploy resources**
2. **Skills are available but not offered**

A contributing factor to not having access to available skills is the *unwillingness to share or redeploy resources*. A resource may be underutilised in his current team either due to insufficient volume of work (a temporary situation) or a mismatch in the job-skill requirement. The manager or teamleader of this resource may be unwilling to let the resource go across to another team or share the resource for a limited period of time. The available skill remains unutilised while urgent work remains behind schedule due to not having enough of the right skills assigned to complete this work.

**Skills are available but are not offered.** Skills are available in the employed workforce but are not offered by the individual toward the organisation's goals. The workplace is more tolerant of individuality and the exercising of personal preference. The individual's right to exercise a personal preference in terms of what work is done, when this work is done, and how this work is done can extend to a situation where the resource’s skills are a matched to the job but the resource is not willing to get involved or take up more work. This does not include situations where a resource is already over allocated. The incidences captured in this code refers to available skills
(those resources that can take on more work), who have the required skills but whose skills are not actively planned and managed as part of an overall resource plan because the individual chooses to do other work.

4.6 Work Planning Practices

The Work Planning Practices theme caters for all the occurrences of work planning activities that are important in managing skills. This theme follows the Resource Planning Practice theme and focuses on how we define and manage the work itself and the environment and conditions in which the work needs to be done. The following five subthemes emerged from the analysis of the fieldwork:

1. Work team structures
2. Task planning
3. Work task organisation
4. Working conditions
5. Work models

4.6.1 Work team structures

The work team structure subtheme considers how the team structures can influence the utilisation of skills and contribute to the perception that adequate skills are not available to the organisation. Three codes emerged for this subtheme:

1. Frequent organisational structure changes
2. Dynamic role redefinition
3. Role clarity

In several organisations frequent organisation structure changes occurred. Organisation structure changes can be the result of a leadership change or an organisation strategic objective re-alignment. This structure change can be limited to certain functions in the organisation but may affect the entire organisation. These changes very seldom include a revisiting of all job descriptions, key performance indicators and skills assessment in the event that the job scope and boundaries changed. After such a team structure change, the resources are not given time to regroup, realign, and to build the social network to enable the work to get done. The
resources are not performing immediately due to this disruption and an overall perception can exist that there is not enough of the right people to get the work done. This perception of inability, which exists outside the affected team, can contribute to reported skills gaps when the disruptive effect of a structure may not be visible or accounted for.

*Dynamic role re-definition* occurs when the purpose of a role is change based on different definitions of the role being used. There is a tendency in industry to not pay attention to the definition and subsequent implementation of a role.

A job title is selected and resources assigned without checking the shared understanding or meaning of the role definition. In practice, the definition of the role may change dynamically as it is needed to encapsulate the change in the work requirement. In the case of a Business Analyst role, this role could mean the person responsible for eliciting requirements from the end users, collaborating with other Business Analysts to define complete business and functional requirements for system changes or re-engineering business processes to optimise workflow. The engagement is mostly with end users who have very little technical knowledge and who would state a problem in an operations perspective. This Business Analyst role would also be instrumental in an organisational change management, as the holder of this job would have a close relationship with the end user.

O*Net\(^{XIII}\) does not have a job description for this Business Analyst role described above but includes these functions in a role title of a Computer Systems Analyst, although their job description of the Computer Systems Analyst does not do the end user type work. In industry, both of these Business Analyst descriptions are valid and only a concerted effort to formally acknowledge and communicate the definition adopted by the organisation can prevent the creation of a skills gap that would otherwise exist. Those with knowledge of the Business Analyst role definition above would not be skilled in doing the technical specifications required by the Computer Systems Analyst role. The Computer Systems Analyst role again would not have the end user engagement capability. When this differentiation is not understood at a managerial level, the organisation may be staffed with end user engagement type...

\(^{XIII}\) O*Net website where job descriptions can be viewed [http://www.onetonline.org](http://www.onetonline.org)
Business Analysts when the O*Net Computer Systems Analyst type Business Analysts are actually required to give effect to the technology roadmap.

A lack of *role clarity* contributes to the perception of skills gaps. Due to the haphazard assignment of resources to tasks, it is not always clear when a person is responsible or accountable for a certain work output. This assignment could be done by the management or it could be self-initiated as in the case of a team member realising a task is required that was never defined and included in the overall delivery plan. This lack of clarity leads to an inconsistency and incompleteness in the overall delivery that leaves the impression of an immature team lacking basic delivery skills. This is more prevalent in a project context than an operations context where there is a tendency to employ on a permanent basis with more formal job descriptions that capture recurring activities. Role clarity, when the role becomes ambiguous, requires well-developed communication skills to stay aligned with regard to the changing scope of the work to be done as well as the role changes that may occur as the team members make sense of what the job actually requires.

### 4.6.2 Task Planning

Changes in task scope and dimensions can contribute to a perception of skills gaps. Similar to the organisational structure change, the resource is disrupted in his task execution, loses traction and valuable focus and momentum. If an observation is made at any point during this disruptive change, the resource may be perceived as being unable to do the task or cope with the work. Three codes loaded to this subtheme:

1. *Role-focus changes*
2. *Task-time changes*
3. *Role-boundary changes*

*Role-focus changes* occur when the objective and focus of the role and its assigned tasks change during the execution of the tasks. It can occur as a result of poor or desperate work planning. In this scenario there are too few people to assign to dedicated tasks. Willing and able resources that can quickly move between tasks and re-align to new task demands are often ad-hoc re-assigned to new work without
necessarily being relieved of current work. The role and its purpose stay the same but the focus changes and may become diluted, typically when working on several projects, but doing the same type of work. The resource is now associated with new responsibilities and deliverables and may not deliver the quality and within the required and agreed timeframes.

*Task-time changes* can contribute to the perception of a skills gap in that the time required to complete the task is changed, either shortened or additional time added. When effort assessment is done on technology tasks, provision is often made for a degree of learning through trial and error to get the final job done. This effort estimation may be far off in the event of a lack of experience or may need to change due to delivery expectation changes received from stakeholders. If the time to task completion is changed during the task execution it may be perceived that the resource is not capable of completing the work due to capability rather than a change in stakeholder expectation.

*Role-boundary changes* occur when the original scope of the task was incorrectly assessed or underestimated and the tasks literally morph into something bigger. An example from the field is a data analysis task on a project that became a data architecture task with associated deliverables. The role incumbent remained the same but over a six month period the boundary of the task changed from completing a data mapping deliverable to designing and owning the organisation’s canonical data model. Responsibility and accountability for specific tasks and deliverables thus change during the execution of the tasks. The larger risk for a poor delivery perception is a poorly defined role rather than the resource himself. The team and internal clients are wondering what the role should do and transfer that questioned value contribution of the role to the person currently occupying the role.

### 4.6.3 Work Task Organisation

Work task organisation concerns the practices we use to stay aligned and manage the work task amidst dynamic team processes. This component relies substantially on good communication and strong interpersonal skills especially when the team is newly formed and lacking tested working methods or when the team experiences
frequent disruptive changes. Poor team communication often results in the rework of deliverables which contributes to the perception that there is a skills gap. The discipline and structure around working methodologies are lacking, which leads to a misalignment between teams, their objectives and their contribution to the overall goal. Two codes make up this subtheme:

1. **Alignment by corridor update**
2. **Frequent reworking of tasks**

A feature of many projects which adopt a more informal project management methodology is the habit of *alignment by corridor update*. This was an in vivo code that captured the essence of how teams stay aligned. Project scope changes or solution design changes are communicated informally by members of the team as they interact with other members of the team. Those who interact more often are more likely to be “on the same page”\(^{17}\) or “in the same movie”.\(^{18}\) The team discipline and or time are not available to document and manage the project scope and effort by formal project methodology. Due to significant changes in the scope, approach and work methods, the only way to move in the same direction is to continue talking with each other. A more formal version of the corridor talk is a daily stand up or huddle. The entire team meets every morning for thirty minutes in the middle of an open space and talk about the project. Limited notes and actions are taken to guide the next stand-up or huddle. This is a standard practice observed at many research sites. This method can contribute to the perception of the skills gap when all members of the team do not participate in each stand up or do not actively look for corridor updating time. A team member who happened to be out of circulation for a few days could be blamed for “not being in the movie”, which implies that the movie changed and team member is still working on old deliverables or against an outdated scope and approach.

In context of continuous scope and approach changes, *frequent reworking of deliverables* could create the perception of a skills gap. A deliverable is complete or near completion and must be redone due to a scope or design change or even a methodology change that requires new or different steps and templates. When this change is not properly managed through a change control process and communication
to the stakeholders and decision makers, the rework appears to be due to resources underperforming or not being capable of doing the job.

4.6.4 Working Conditions

Working conditions is a hygiene factor of employment that may affect the willingness of resources to remain with the organisation or could negatively influence the quality of delivery. Two codes cover the field observations for this subtheme:

1. Demotivating working conditions
2. Inordinate demands

Demotivating working conditions were observed frequently at all the organisations. While open plan offices contribute positively to staying aligned and keeping the communication channels open, it does not support Design Analysts and Developers working against the clock.

Figure 15: Developers locking themselves into a quiet room

Source: Photograph taken in February 2013 of a printout taped to the door of a meeting room being turned into a temporary quiet room.
Political environments, difficult internal clients, friction with team leaders and managers and working long hours, including weekends, are examples of factors contributing to demotivating working conditions and negatively affecting the quality and quantity of work output.

_inordinate demands_ is a concept code assigned to instances where extreme long hours and family sacrifices were expected. It may become habit to check email over the weekend, even respond to email when time allows. This habit can however become the norm and even be expected. Working over weekends may be expected for short periods of time just prior to a project delivery. Unless weekend work is a condition of employment, it is not ordinarily expected to work several weekends in a row. No provision is made for childcare support and personal time. Demanding work is a frequent feature of technology projects however, in some companies it can turn into inordinate demands.

4.6.5 Work models

Flexi-hours is a feature of technology jobs, most noticeably the ability to work at different locations and times, although the time or when aspect is very often defined by the delivery expectations and the need to work longer hours to get through the work. Flexi-hour work is the only concept of work models that emerged from the field observations. This is kept under the heading of work models to align with the literature on this topic. Two codes make up this subtheme:

1. _Unmanaged flexi-hours_
2. _Flexi-work models are not aligned to the resource plan_

There are unfortunately individual resources that abuse the flexi-hour benefit and may not contribute a full day’s worth of effort. It is accepted that resource effort will even out over a longer period of time and some shorter working days could be expected. There are instances where _unmanaged flexi-hours_ could lead to resources not contributing in the quantity and quality they should and negatively affect the delivery of the team thereby leaving the impression of a skills gap in the team when the skill is actually available but not properly utilised. Resource utilisation and performance
management are addressed in Resource Planning Practices and Resource Management Practices respectively. Properly defined work models and associated policies and practices are topics to be considered when the full value of scarce skills need to be incorporated into the organisation’s delivery mechanisms.

It can also happen that the *flexi-work model is not aligned to the resource plan*. The resource plan, when available in the form of a department schedule or project schedule, often assumes a forty hour work week with deliverables typically estimated in man weeks of effort. Budget is tied to the planned effort and cash flow managed on a monthly basis against a specific work output. Actual effort is usually more than planned effort, resulting in resources working on average longer than the planned forty hours. Effort is expected to even out and the flexi-arrangement allows for long days and short days. There is a perception shared at an executive level when monthly budget meetings review delivery against budget that project delays are due to the shorter work days (focusing on the days that resources work less than their eight hour capacity) further leaving the impression that the resources do not have a positive work attitude and being able to do the job.

### 4.7 Resource Management Practices

The objective of the resource management practice topic is to identify and improve utilisation of resources when over or underutilisation becomes visible on the floor. Contrasted to resource planning practices above, which attempts to identify and plan for capacity and capability in the longer term, resource management practices should deal with ad hoc or unexpected resource utilisation issues such as an unplanned break in a project or the temporary delay in the release of funding for base station upgrades that results in unplanned idle time of the resources.

Three subthemes emerged from the analysis of fieldwork for resource management practices. These include:

1. Exercising personal preference
2. Performance management practices
3. Reward and recognition practices
4.7.1 Exercising personal preference

The workplace is becoming more tolerant of individuality and personal preference. Individual employees are allowed to exercise a freedom in selecting which activities to do and when to do them. This freedom is often allowed beyond what is necessary to enable the work to continue and may affect the basis on which performance management is done. The HRM processes may not be geared towards guiding and rectifying the personal preference selections when these negatively influence the productive contribution of the resources. Three codes load to this subtheme:

1. Resource is unwilling to change flexi-hours when required
2. Uncontrolled selection of preferred work
3. Unwillingness to share or redeploy a resource

In several observations resources adopted a flexi-hour work model to accommodate family and travel arrangements. In all of these observations there was a degree to which the resource was needed at specific times but was not available. The team is suffering a loss, which can be perceived in the broader context as a skills gap. In many instances resources would make themself available when informed of the team need. There are however instance where the resource is unwilling to change flexi hours when required. When this unwillingness is outside of the eight to five workday, work is rescheduled for the next day. This unwillingness however becomes a delivery constraint and contributes to the perception of a skills gap when the resource is not available during what would be considered normal working hours. Skills are thus available but cannot be put to use when needed.

Uncontrolled selection of preferred work was observed several times. A resource is allowed freedom to choose what work to do. This is a function of loose work arrangements or a lack of clear job boundaries and objectives that need to be figured out and be established. A piece of work needs to be completed but unless there is a visible urgency for that output, it may be neglected in favour of other more important or interesting work. Those stakeholders who are waiting for this deliverable may perceive the team or individual responsible for this work as being unable to do the work. The overall delivery does not happen and is attributed to a lack of skills. This scenario could be extended to work model preferences too were resources may be
required to travel to another location to complete work but refuses to do so due to being personally inconvenienced by such travel. This individual not willing to travel will not be able to deliver and secondly, the team, which he should be assisting, now needs to do the work without him. A larger than necessary skills gap becomes visible in the organisation.

The *unwillingness to share or redeploy a resource* that was discussed in Resource Planning Practices is relevant in this subtheme too as an example of how the exercising of personal preferences at work can contribute to the perception of a skills shortage when a skilled person may be available but is withheld from a task where the person may be able to add more value than in his current role. In the context of resource management, this unwillingness may stem from a sorter or more ad hoc scenario of underutilisation and the uncertainty of when the team’s current work assignment will resume. The team leader or manager does not want to commit resources to other work but would rather let the resource sit idle or utilise the resource on administrative tasks.

### 4.7.2 Performance Management Practices

The individual instances of underperformance may not be recognised in the bigger organisation dysfunction as a lack of clear performance management principles. Where individual under performance becomes visible it may be attributed to a resource skills gap (the person cannot do the job). This subtheme consists of four codes:

1. *Slack human resource management processes*
2. *Resource does not focus on his job*
3. *Failure to address under performance timeously*
4. *Managerial inability or unwillingness to do proper performance management*

*Slack human resource management processes* associated with informal work practices allow for resources to be less productive than what they could be. This equates to a disparity between the delivery performance expected for the number of resources assigned versus the actual delivery performance achieved. Industry leaders perceive this disparity as the result of skills gaps and not as the result of poor resource planning.
or management. Slack human resource management processes refers to inconsistent management practices between departments, including the inconsistency that could be introduced with the decentralised HR Partner model where these partners do not enforce, or assist management with the enforcement of a standard approach to performance management. Inconsistency can also occur within a department where some resources enjoy privileges while others don’t. The field observations supporting this code identified excessive personal breaks, both in length and frequency. These include smoke breaks or visits to the cafeteria, frequent personal activities during work hours and in selected cases, individuals walking around networking or talking with colleagues in an open plan office. This is time that could be allocated to work output. By not tightening the performance management process, the full economic value of this team is not ensured.

A resource may be distracted from his work either by issues in his personal life or hygiene factors at work such as promotion that does not come, conflict with his manager, or a disinterest in his work. The resource does not focus on his job and is not delivering to the value of the headcount he fills. The resource is assumed capable of doing the work, but does not do the work or do the work well enough to add the required value. A perception may exist that the resource lacks the required skill when in fact his performance and delivery is not managed. In the context of loose working arrangements or a lack of clear job objectives, no performance management can be done and becomes even more difficult when the resource has a positive attitude and well developed interpersonal skills. He is generally a good guy and willing to do gopher type work.

Failure to address under performance timeously occurs frequently but always in context of demanding and difficult to define jobs. In an example a new Business Analyst recruit who did not perform satisfactorily within the three month probation period, action was taken immediately to rectify the problem with a very good outcome for the organisation. In several other examples this three month probation period was not used optimally, which closed the window to replace a non-performing resource with a more suitable resource. The significance of not addressing the failure to perform early is two-fold. It firstly keeps a role filled that cannot be made
available to a more suitable resource while the current resource is not adding the economic value expected. Secondly, this behaviour sets the standard for the level of performance and work ethics acceptable, which could lead to demotivating working conditions for those resources that do go beyond the call of duty.

Managerial inability or unwillingness to do proper performance management refers to instances where the manager identifies the need to address a performance issue with an individual resource but is reluctant to do so. This reluctance may also stem from a change in the role definition or the lack of clear boundaries that he may be uncertain as to how to handle. In the case where resources have the freedom to choose what work to do and when, performance management becomes very difficult as the performance is not linked to predefined and assigned tasks. Performance management is the result of a general appraisal based on the attitude of the resource and not the actual technical performance, hence the skills requirement of having a positive attitude. A positive attitude points to the willingness and ability to deal with dynamic role definition changes and being able to keep on making sense of the job requirement while continuing to contribute productively.

4.7.3 Reward and recognition practices

Reward and recognition practices can create undesirable behaviour in resources and contribute to resources leaving the organisation or not offering to assist with tasks that require an available skill set. Two codes emerged for this subtheme:

1. Recognised for crises management
2. Rewarded for excessive overtime

Resources are often recognised for crises management. Recognition for such periods of extra effort is required but becomes the norm in organisations and lead to negativity in other team members. It is perceived that a resource that can function well in times of extreme pressure and uncertainty is a good resource worth looking after. The strategy is sound but the working conditions are negative and not sustainable. The observation made here relates to the effect the recognition has on the rest of the team. In the field observations this recognition lead to resentment in the team members who perceived the organisation’s leadership as being unfair,
demanding and contributing to demotivating working conditions. Those team members who felt they were in control of their specific environments and who were trying to order and manage their engagement with a demanding environment were not recognised for such well-planned and managed effort. They stayed under the radar but “those who ran around like headless chickens got a pat on the back”.

One organisation where fieldwork was done had a reward and recognition nomination web application where any staff member could nominate somebody who went beyond the call of duty. A frequent reason for nominations was for resources that worked excessive overtime. Resources are rewarded for excessive overtime, which creates the perception that skilled resources are those who are willing and able to work extreme long hours for extended periods of time. In these observations, the resources in question worked on multiple projects and literally did the job of two or more resources. This recognition strategy could be useful to secure the services of skilled resources if they are regularly recognised and remunerated for such overtime. It is however not a sustainable strategy and may mask the lack of real capacity that should be addressed.

4.8 Learning and Development Practices

4.8.1 Insufficient self-learning

There are ample examples in industry of human resources not able to assess that they need to learn new technologies and methods and actually engage in that learning. This tendency to neglect self-learning responsibility was evident in both permanent employees as well as contracting resources. Contracting resources refer to resources obtained through labour brokers and exclude consulting houses contracted to deliver a turnkey solution. Five codes make up this subtheme:

1. Lack of motivation and willingness to continue learning
2. Failure to identify a gap in the skill set offered
3. Learning is perceived to be class room training only
4. Learning is perceived to be expensive
5. Unwillingness to take up a development intervention offered
There were several resources in the observation that did not display a positive attitude towards identifying areas of personal development or content learning and actively engaged in such learning. The lack of motivation and willingness to continue learning was more prevalent in resources with young families as well as those in operational type jobs. These resources understood that further learning was required but now was not the time. Project based resource were more inclined to learn new technologies or methodologies.

A resource may acknowledge the need to learn a new technology or skill but does not assess the full development need correctly. Failure to identify a gap in skill set offered occurs when the resource realises that he cannot do the immediate job at hand but he is unable to articulate which aspects of the job he can and cannot do and can therefore not identify what learning he should do.

Learning is perceived to be class room training only. Resources regard learning as requiring class room attendance. Contracting resources prefer to do self-study rather than attending classes as they do not earn income if not working. Only key dependent permanent employees identified the need to attend class room based training as problematic. They often do not get permission to attend. These key dependent resources would have liked to attend class room based training as they do not have the capacity after work hours to engage in self-learning.

Learning is perceived to be expensive. Resources regard learning as requiring substantial financial outlay and can therefore not engage in self-learning. This view was prevalent in contracting resources that have no opportunity of an employer paying for their training and development. A related view was observed in permanent employees. If the organisation was paying for their studies or training of any kind, they will attend, regardless if it is something they are interested in. Attending training is viewed as a social event of a few days out of the office while a learnership or degree being funded by the organisation is something they get that they otherwise would not have had as they would not pay for this degree themselves.
Sometimes learning opportunities are offered but an unwillingness to take up offered development intervention follows the offer. The resource either states that he is not interested in engaging in a specific required learning activity or when given a learning opportunity, declines involvement or participation.

4.8.2 No directed self-learning skills

Directed self-learning is the ability to identify both the correct content as well as the best and most reliable source of learning material [104-105]. The individual understands the learning path or sequence of learning as well as the cumulative effect of learning and practical experience. Four codes emerged for this subtheme:

1. Failure to identify a gap in scientific foundation skills
2. Inability to determine learning objectives
3. Unclear career objectives
4. Unguided learning

Failure to identify a gap in scientific foundation skills happens when a resource’s technical skills are out-dated or non-existent and he cannot cope with new scenarios for which he does not have the theoretical foundation. Either in the current job or when given an opportunity to move into a new role for which he does not have the right scientific foundation knowledge, an assessment must be made of the scientific skills missing and what to do to bridge that gap. The observations are limited to where a resource did not have a formal technical education (he only has self-taught technology skills) and he was not able to identify the content for further or continuous development.21

A resource is aware that learning must take place but is not able to determine what content should be mastered, how the learning should take place or where to start this learning journey. The inability to determine self-learning objectives was observed in resources who were expected to, or who were interested in, learning new technology skills. These resources knew so little about the subject field that they could not ask the right questions to guide the learning planning.22
Unclear career objectives contribute to the failure to identify learning content as well as the learning path. The person has an idea of the general field of interest but has not researched the different roles or jobs available in that general area and has no specific career objective that provides the anchor for the learning content and learning path. These observations were made of business operations personnel interested in moving into Technology project jobs.

Unguided learning was observed in several research participants. The concept of unguided learning covers situations where a resource needs to learn a new skill on the job but is not given the boundaries, support or guidance to do so. Directed self-learning requires guidance, either self-guidance if the person has these skills, or when learning is facilitated at work, through a mentor. When the learning is not guided by somebody with a holistic view of skills development required and the path to achieve this learning, it may lead to grasping at whatever study material or information that is readily available without successfully acquiring the skills needed.

4.8.3 Adequacy of skills development plans
Skills development planning in general was not high on the agenda of any of the organisations in scope of this fieldwork. One organisation in scope of this study had a leadership development program aimed at the middle management level which was fairly stable in content and offered for a few years running. It included topics such as conflict resolution and self-management skills. A holistic development strategy and associated plans were not visible on the floor although some organisations in scope of the fieldwork claimed to have a talent management strategy. Six codes developed from the fieldwork for this subtheme:

1. Personal development plans are not in place
2. Learning is unrelated to the job requirements
3. Personal development is not linked to organisational needs
4. On the job relearning is not in place
5. Mentorship and guidance practices are not effective
6. Learning opportunity is not available
An observation made often in terms of individual resources is that their *personal development plans are not in place*. The purpose of the personal development plan is twofold. It should firstly identify the skills gap between the skill set offered and that required by the job and plan how this gap will be closed. Secondly, the resource’s career path should be mapped and training and development required to progress to the next career point, factored into this plan. None of the Banks in scope of the fieldwork had formal personal development plans for its permanent employees, although the Investment Bank offered learnership programs with major tertiary institutions for which an employee could apply and motivate for acceptance. Only a limited number of people were selected each year.

Several observations were made of people doing further studies, either formal study through a tertiary institution or as part of a self-learning drive. In several cases the *learning is unrelated to job requirements*. A female System Analyst graduated with a master’s degree in microbiology. She was enrolled for an undergraduate degree in environmental studies and was active in her sub-urban area to save a marshland and its bird life. A Product Development Manager for Business Telecommunication Services completed a degree in criminology. The Microbiologist was actively looking for a career change out of technology projects while the Telecommunication Product Development Manager found criminology interesting.

*Personal development is not linked to organisational needs.* This code is associated with the code *learning is unrelated to job requirements*. This is differentiated from the former code as the personal development is technology and business management related and can add value to the organisation if properly identified and factored into the resource planning processes. If formal personal development plans were in place and the resource management plan was holistic and future oriented, these studies can benefit the organisation.

Learning can happen on the job by shadowing another resource or having a buddy assigned to monitor and assist the learner. The observations found that *on the job learning is not in place*. Ad hoc learning happens when resources themselves initiate the learning. No organisation in this fieldwork had a formal practice of utilising on
the job learning opportunities. When this observation was discussed with a CIO, the view was that the Developers are all senior resources and should be capable of self-learning. There was not a perceived need to make this a formal practice.

*Mentorship and guidance practices are not effective.* It occurred regularly in discussions with technology staff that an individual wished for a mentor or line manager that could give guidance on subject matter as well as personal growth challenges. They were aware of the advice on how to secure a mentor but found it challenging to find a suitable and willing mentor or to get commitment from a chosen person. The Telecommunication Company in this study had a formal mentorship program for executive level employees only. The senior manager level could motivate for a mentor. The program lasted three years and was closed out.

It may happen that a resource indicates interest in developing skills that can be beneficial to the organisation but a *learning opportunity is not available.* This could be due to the training and development capability not being place, as discussed further down, or the management not being willing or able to arrange for a learning opportunity. The learning opportunity could take the form of secondment to another team, mentoring the resource unofficially if there are no official practices, or buddy the resource to shadow someone who has these skills. Self-managed resources with a well-developed lifelong learning orientation will find avenues to explore to do this development but those without a well-developed lifelong learning orientation may never return to learning.

### 4.8.4 Adequacy of skills development capability

During the observations a few incidences were highlighted where resources were motivated and ready to do on the job learning or gaining practical skills that required training and development investment that were not available (planned and approved) or in place (capability has not been established yet). Two codes emerged for this subtheme:

1. *Inadequate training time and budget allocation*
2. *Training infrastructure is not in place*
Inadequate training time and budget allocation is a general concern especially when the resources are required to attend training off-site. The perceived business or project impact of not having key resources available results in training not being approved or even budgeted for. Where budget and training days are planned and approved, resource often end up not attending the training, or not the entire training session. It has also occurred several times that resources return to the office during lunch breaks or after training classes to attend to project or operational work. The misalignment between development policy and budget allocation was addressed under the main theme Organisational Policy. The objective in this subtheme is the poor focus on the learning and development execution where funding could be diverted or withheld when the leadership does not give commitment to training and development initiatives.

A training and development constraint identified during the testing and training phases of technology projects is that training infrastructure is not in place which results in the recipients of new technology or significant changes to business processes, practices and policies not being given the required training to ensure that they make the transition. This training infrastructure does not only refer to classroom based training capabilities but may include the inability to produce proper training manuals, complete change communication packs and the capacity to communicate changes and enforce the adoption of this change.

4.9 Conclusion
Chapter 4 provided a detail account of the coded and analysed field observation data. These coded themes and sub themes were combined into a taxonomy of management practices that are important in the management of skills, specifically in the technology and engineering disciplines where this research was done.

Chapter 5 introduces Management Theory to support the Skills Gap Management Model developed in Chapter 6. It was found during this fieldwork that an additional focus on business management might be needed to explain perceived inadequate people management practices.
1 {Nthati} At the Investment Bank, there were no formal Organisation Change Management roles with associated headcount; however one project desperately required such work to be done. A Program Manager with a good working relationship with the business unit affected by this project was asked to fill this role. The promotion was based on her willingness and not any assessed competencies in the field of organisational change management.

2 {Researcher personal experience} An experienced Program Manager received an auto email from a Big 4 Consulting firm offering information on a Project Administrator position that might have been of interest.

3 {Marilyn} In a discussion with a recruiter looking for a Business Analyst for a fixed line Telecommunication Company, she ignored alert emails from PNET with links to submitted resumes by the third day. She receives on average 80 resumes per day on the first 4 days. When time allows she will go through resumes submitted after “her cut off” to see if there are any resumes worth adding to their database. The keep a database against which they run the new position advert before going out to press.

4 {Tarryn} Tarryn was required to complete a process diagram to explain the roles and responsibilities of change control for the [wholesale billing] program, which consisted of 7 work teams. The flow diagram was 1 page only. By version 13 of this diagram, the project manager contacted [Companyname] to ask for a resume for this resource they placed as a junior BA. The resume was not representative of the individual doing this work.

5 {Tshepo} An Investment Banking research participating organisation with a graduate internship program, placed an intern developer within a development team where the manager lacked the required mentoring skills. The intern’s response to an interview question related to how he found the exposure and pressure on an iOS integration project (IPAD Sales App) to differ from the Online (Internet Banking) project he came from, suggested that he did not get any guidance, explanation of the project or personal objectives defined. He “was playing with JAVA code and stayed out of the way of the busy developers”

6 {Development team} A resource had self-taught JAVA skills and was educated as an optometrist. This resource was required to complete, in a very short period of time, the solution architecture for a JBOSS ESB middleware solution. On the same SOA project, the development team consisting of four developers of which two developers had in excess of twenty years development experience each; there was no formal software engineering qualification amongst them. This team delivered the first foundation release of real time core banking system integration.

7 {Chris} A field example of the shortfall in delivery expectation is a resource that had to learn how to do a data mapping between two integrating systems. The data mapping deliverable did not contain the field formatting and conversion detail. It only mapped the actual data entities obtained from the mainframe data dictionary to its intuitive match in the legacy systems. The resource did not evaluate the usefulness of this deliverable in context of the project’s overall objectives and the SDLC phases that would require such detail later. The team that was dependent on this deliverable could not immediately continue with their work as the deliverable was incomplete.

8 {Degree} At a Commercial Bank, the HR recruitment process will not accept a resume of a potential candidate with less than an undergraduate degree. The degree is unrelated to the subject field in which the position is advertised. Keyword searching on the level of qualification on resumes determines if the resume is shortlisted and forwarded to the department for which the recruitment is done. At the Investment Bank, an internal application was received for a Business Analyst position advertised in the Project Management Office. The resource came from a business operations area where a number of business re-engineering projects were underway and would have been able to contribute greatly with subject matter expertise while needing training in process modelling and technical writing skills. The resource was in her third year of a BCOM degree but could not be interviewed until she finished the degree, which was the minimum requirement for this division. The role went unfilled since no external
candidate matched the subject matter expertise required. The fact that the subject area of the degree is considered unimportant for the initial recruitment eligibility suggests that the organisation is looking for a level of personal development, which is a valid placement strategy for the organisation’s talent management plan. This study did not attempt to define and measure actual personal development and means by which such personal development could be acquired. In context of positions going unfilled, the policy may need to be revised or processes put in place to deal with exceptions.

9 {Renell} The need for such transfer processes is acknowledged but it is “not something we do”

10 {Forced retirement} Employees reaching the age of 60 have six months post their birthday to accept and affect their retirement. The six-month period allows for the identification and training of a replacement resource. In one observation a Senior Network Engineer turned 60 years of age in March 2012. The resource was not ready to retire and would have liked to stay on and contribute more towards his retirement savings. The retirement policy did not allow any deviation and retirement [was] forced. The process to identify a replacement was stalled in the hope of overturning the policy requirement; hence no replacement resource was identified and trained. Discussions were held for the Senior Network Engineer to return as a consultant, however, this was taking long and became a negative experience for the Engineer who ended up pursuing an alternative career. The line manager of the Senior Network Engineer described the event as a loss of 35 years’ worth of experience that could never be replaced.

11 {Nedbank} A very senior partner in his early seventies still had an office and would come in regularly, albeit to “upset the momentum of progress”. The partner did not grow with the Commercial Bank and did not understand the change in technology approaches; hence much time was spent unnecessarily to keep him up to date. While delayed retirement could be argued for in the case of the Senior Network Engineer, the opposite appears to be the case for the Commercial Banking partner. Delayed retirement could keep a position filled when a more suitable resource could be brought in with more relevant or current skills.

12 {Training policies} At the Telecommunications Company, each Senior Manager had a standard KPI to have each of his team attend 5 days of training. The content and nature of the training was not stipulated but there were specific exclusions of what training would not be funded. In the case of the Fraud Management team, its members required formal GSM Fraud certification. This was regarded as a formal qualification that would not be funded by the organisation. Enough budget was given to send the team on intermediary MSExcel training only, 3 days each.

13 {Rocky} A female resource was overlooked for an opportunity which appears to be gender related. The female developer applied for a team leader role, which was given to a male counterpart who did not apply for the role, and did not want the team leader position. He filled the role for 2 months, and then resigned as his career objective was to focus on technical development challenges and not to manage people. The female developer also resigned four months later to pursue a technical team leader role elsewhere.

14 {Jacque} A female system analyst applied for a SOA design role on a high profile project at the company she has been employed at for eight years. This was an informal application for a team exchange that was declined as she had family responsibilities (collecting her child from day care at 5 PM) that would prevent her from being available for the team after hours). The role remained vacant for 3 months after which the female system analyst picked up the role out of team desperation for a resource.

15 {Peter} A seasoned telecommunication project manager who worked as a fix line technician before progressing to an IT project management career was approaching his project management work as he would manage a team of technicians in the field. He lacked business finesse and the ability to listen to customer requirements and often missed unspoken cues or political agendas. Peter remarked one day that he wished a project could be executed as a fault repair job card.

16 {Freddie} A Business Analyst was not able to do the end user engagement business analysis tasks and tried to reverse engineer the business processes for client on boarding processes (Banking
Although the task should have taken less than 3 weeks, the Business Analyst was working on this deliverable for over four months, adding very little value to the team. When his team leader was asked if the person could be relieved to assist another team who may find his skills more beneficial to their scope of work, the team leader responded “I would rather hold on to the 10% I am getting from him rather than have nothing” (F. Van Eyk, 15 May, 2013). The team leader’s rational was that he could use the Business Analyst as a gopher on ad hoc tasks. A larger portion of this resource’s capability could have been used at the organisation but due to the team leader, and ultimately the line manager’s unwillingness to find a better fit for this person, the resource was underutilised and the organisation the worse for it.

The Application Architect of the Bank also taking on technical design responsibilities for a SOA project reviews several design documents and frequently refers to team members not being “on the same page”. The can see by the content of the technical document that each author has a different idea of how integration services should behave and thus be designed.

An executive at a Bank where she managed an EDW project in the final stages of cutover had frequent project approach changes in an effort to get the system finally handed over and into production. The system was practically operational but the internal clients would not formally receive this system as it had severe data integrity problems. In an attempt to satisfy these internal clients she would make certain commitments and then come back to the office to change the team’s focus or approach. Those who were present knew about the change, others would not. Some of these approach changes would be made on a Friday night at a small team gathering in the local pub. On Monday morning those not present at the pub session would not be in “same movie”.

At a Telecommunication Company, a meeting invitation was sent by the General Manager at 9PM on the Sunday night for a meeting to be held at 7PM on the Monday morning with all her Senior Line Management direct reports. It was assumed that all six here resources would be on-line to see the meeting invitation and would be available to attend the meeting at 7PM.

A Wealth Bank was implementing a fraud detection application at Group level. The Wealth division, due to it being in a remote location and substantially smaller than the other divisions, were often excluded from Group level planning and consultation but had to adopt any policies or practices as these were implemented at Group level. This lead to urgency and chaos to adapt to Group expectation at a late hour. A hand full of people was always in the middle of sorting out this chaos and was often recognised for their ability to handle such chaos. They were also recognised for running around like headless chickens to accommodate these last minute demands rather than pushing back to Group to be consulted properly and timeously and to offer to adopt the new practices but with extra time allowed.

An optometrist technician by training was working as a senior developer at a Wealth Bank. He had no formal software development training but had exposure to several self-taught development language. During a SOA implementation he was assigned the role of Solution Architecture. He never fully mastered the role.

An Organisational Change Manager wanted to learn about data analysis to get a better understanding of the project issues we faced and how she could help to intervene with the internal clients to try and obtain “requirements”. The project lacked existing a data architecture or canonical data model as well as the services of a Data Architect that could help to define the basis for real-time system integration. The perception in the team was the business must “provide data requirements” in the form of what data they capture and what data they want to be sent to the mainframe.
Chapter 5

Exploring Management Theory for relevance

5.1 Introduction

This study referenced the literature on the development of resource employability skills and the nature and demand of industry-required skills. In this regard, the focus was on professional skills such as communication and problem-solving skills and why these skills are required. The taxonomy that emerged in Chapter 4 depicts however inadequate Human Resource Management practices. These are visible representations of resource decisions that do not make immediate sense. These observations were not directly attributable to personal or professional skills as suggested by the literature but may be construed as skills required to navigate an ambiguous working environment characterised by constant change.

The resource assignments and decisions made in practice suggest that we do not always know what skills we need and we can further not exactly determine what skills we have and how best to use them. Even if there is some degree of certainty regarding the required and acquired skills, the additional variables being juggled during any given day at work do not readily lend themselves to sound resource decisions. It is therefore not surprising that a poor job-person fit will occur or that skills gaps are evident. Skills gaps in industry may occur as a result of inadequate business management practices, specifically poor human resource decisions.

The emphasis of this chapter is on the management practices that appear to be ineffective thereby leading to skills management problems. The inefficiencies in the Learning and Development Practices area for example suggest a lack of planning, while the Work Planning Practices in this study are characterised by planning and organising shortcomings. There are further general assumptions about organisation capabilities, which support day-to-day human resource decisions that require reconsideration.
This chapter takes a critical look at existing theoretical constructs of management practices, organisational structures and operating models to assess the usefulness of current knowledge to explain and enhance our understanding of skills management. There is an abundance of theories available, all individually addressing some aspect of business management. There is however not a unifying theory for addressing the resource management of highly skilled resources and scarce skills. The constructs covered in this chapter will support the theory development in Chapter 6.

5.2 Management Practices

The study of the evolution of Management Theory covers work from the Classic approaches to management in the early nineteen hundreds to the more Contemporary approaches since the nineteen sixties. These two approaches then also signify the schools of thought regarding what the best approach is to the productive attainment of organisation objectives through people [106-107].

A brief overview of the Management Theories is given below to understand the evolution of these theories and how this evolution contributes to the current challenges in Management Theory. Two Management Theories are then selected for further review to identify theoretical components still relevant today.

5.2.1 Approaches to Management Theory

The Classic approach to Management Theory considers the immediate pressing needs of the organisation during this early period, specifically related to the organisation’s own efficiencies. These theories do not take the external or macro environment into consideration. The focus is on the performance improvement of individuals and the organisation. Taylor’s Scientific Management approach, characterised by time and motion studies, focuses on individual contribution to productive endeavours while Fayol’s Administrative Management Theory introduces the five basic functions of business management (or “administration” as the term was used by Fayol) namely planning, organising, commanding, coordinating and controlling) to improve the productive performance of a complex organisation.
Human relations entered the Management Theory domain during the depression years in the early nineteen thirties when job sharing became an option to prevent the retrenchment of workers while also allowing woman to enter the workforce to increase domestic earning potential. The Hawthorne studies, as well as Maslow and Mcgregor’s Behavioural Theories, formed during these years as the basis for motivation to work and perform in the job. Operational Research (OR) and Quantitative Management Theory close off the Classic approach. These theories build on the planning and controlling functions of business management and still serve as decision support techniques today (production scheduling and inventory control).

The Contemporary approach to Management Theory is distinguished by the inclusion of the external or macro environment due to the increasing instability introduced by external forces such as WWII. Contemporary theories consider uniqueness and situational factors with significant focus on quality. The Systems Approach to management emerged in the nineteen fifties to address shortcomings in how departmental interaction and the interaction between the organisation and its external environment influence management decisions. The organisation is a group of interrelated parts and should be viewed as a whole while giving sufficient focus to each individual element to allow the whole to function optimally. The Contingency Approach extends this theory to introduce situational approaches. An effective method in one situation may not be the best method for another situation due to uniqueness. Factors influencing management decisions and actions can include the external environment; the organisation’s inherent capabilities; uniqueness in the organisation’s workforce and values; as well as the technology deployed.

The Total Quality Theory (Deming) and Six Sigma Theory (Pyzdek), advocate that quality involves everyone and quality must be managed. Due to the change in the external environment, quality becomes a strategic lever. Six Sigma as a management system helps the organisations to govern its efforts to ensure sustained improvements. These two theories support Fayol’s basic functions of manage in the form of a definition of quality and the monitoring of quality during the execution process while controlling the improvement systems through the correct compensation, policies,
procedures and budget. Branching off from these two theories, but supporting the quality movement is the Re-engineering Theory (Hammer and Champy) and the Learning Organisations Theory (Senge). Drastic improvements may be required that go beyond steady increases in productivity. The learning organisation adds the human element to the system’s approach in recognising the value and commitment of learning to further the productive success of the organisation.

Current and near-future theories of management are in the making [106]. The Contemporary approach to Management Theory ends with theory enhancement made during the nineteen eighties. The current management challenges are not adequately addressed in recent theories [106], [108]. The new competitive edge is the human assets and this brings challenges to the modern business manager to fit the human assets correctly into a business environment that is characterised by disruptive change and globalisation. The management challenge today is firstly to understand the business reality and then to find the most optimal management practices relevant to the current challenges.

The work of managers is becoming more complicated and vexing [108]. As organisations become leaner, managers are tasked with more responsibilities much earlier in their careers. The matrix nature of organisations also leads to managers having several bosses, to whom they are accountable, each with their own agendas and needs. The political reality of organisations further necessitates a well-developed network of relationships and an ability to reconcile between the multiple interests and conflict that exists. The need to influence without having formal authority and being able to scan the environment for change and opportunity require conceptual skills, self-awareness, empathy and discipline. The focus of modern management research is on the profile of the manager. What must they learn and what must they experience in order to develop the skills required to be a successful manager today?

To this end there is strong debate in business schools as to the scope and nature of the Management Theory being taught [109] with clear camps supporting more Classic approaches to management while others support the Contemporary view. The basis for this divide is the rigour or the relevance of theory. Relevance of theory supports
the practical issues at hand while rigour supports the notion of exactness, completeness and precision. This divide can be traced back to theories developed within the two main approaches. The Classic approach, which focuses on the immediate needs of organisations in terms of its own productive success, supports the relevance of theory argument while the rigour advocates are those that support the TQM and Re-engineering movement. The concern in mainstream management research today is to what extend the current management sciences have gone too far with the rigour approach to the exclusion of relevance [109]. These two camps must integrate, share and transfer knowledge while not assume that someone writing for practitioners do not produce work of rigour while the work of a scientific scholar has no practical value.

The need to revisit the progression of Management Theory to inform modern management practices lead to recent comparisons between noteworthy Management Theorist and their contributions with emphasis on what they have contributed that is still relevant today while having the rigour to apply to modern challenges. Two key Management Theorists often compared are Fayol and Mintzberg. Although their work is several decades apart and each has a clear and separate following, there are similarities and overlap in their approaches with both containing elements of usefulness today to address modern resource management challenges, [109-113].

The basic contribution of each of these two Theorists is summarised below to serve as reference for the remainder of this thesis.

5.2.2 Fayol’s Theory of Administrative

Henri Fayol (1841 – 1925) became known as a Management Theorist with the publication of his book *General and Industrial Management*, a very early attempt at defining management [110]. Fayol’s focus is on the function of management rather than the behaviour of a Manager. It is a functional description of the work that must be done as developed from practical experience including the management principles that form the foundation of what management is believed to be [111].
Fayol defined five functions of management that should guide the execution of management. These five functions are still often referenced in current management textbooks [106-107], [114]:

1. **Forecasting and Planning** – Looking forwarding and making provision for the future and drawing up plans.

2. **Organizing** – Building a structure and providing it with everything it needs to operate. The focus here is mainly on human resources and includes ensuring proper plan execution; establishing a single guiding authority; clear delineation of duties; maximising personnel deployment; maintaining discipline; supervising human and material order; and harmonising and co-ordinating of activities.

3. **Command** – Directing and maintaining activity among personnel with the objective of achieving maximum contribution to the interest of the business. This requires a thorough knowledge of the capability of personnel; eliminating the incompetent; be well versed in the agreement binding the organisation to its personnel; conducting periodic audits; providing unity of direction through regular focused discussions; and being aware of the detail without getting engrossed in the detail.

4. **Co-ordination** – Unifying and harmonising activities and efforts for successful results. Roles and responsibilities are clear to allow effective execution of work. Schedules are adjusted and departments are informed of their obligations.

5. **Control** – Seeing that everything occurs in conformity with established rule and expressed command. Identify and rectify weaknesses and problems. Independent and impartial audits to maintain control and discipline.

Fayol’s work is supported by his Principles of Management which some believe should be adopted again to prevent recurring problems such as poor quality of work, poor financial conditions, failure and decline in business [110], [115-116]. These principles, together with the basic functions above, support what most organisations aspire to apply during operations management activities.

1. **Division of work** – by specialising, individuals can do more and better work.
2. Authority and responsibility – Responsibility is the consequence of authority. The manager must have both and to be successful must be of high moral standing and intelligence.

3. Discipline – The relations between management and the workforce that speaks about respect; clear and fair agreements; and sanctions or penalties for poor behaviour. Failure in organisational discipline is a function of poor leadership.

4. Unity of command – assumes that a person only has one boss that he is responsible to, to prevent conflict of interest, loss of discipline and eventual instability. It is Fayol’s view that people cannot adapt to dual command.

5. Unity of direction – one head and one plan that guide activities towards the same objective.

6. Subordination of the individual interest to the general interest – Personal interest may sometimes come before group interest, which will lead to management difficulty.

7. Remuneration – Fair remuneration that is to the satisfaction of both the individual and the organisation.

8. Centralisation and decentralisation – The location of decision-making and control in the organisation. Centralisation means the top management team retains the decision-making power and control while decentralisation means this authority is given lower down the ranks.

9. Scalar chain – Line of authority that supports unity of command. When this chain gets too long, communication between people may be affected. People should interact at their level and inform superiors of their agreement and only call on the scalar chain if disagreement exists.

10. Order – A statement of the organisation chart and areas of responsibilities. It also refers to a place for everything and everything in its place, however complex this may be. For human resources, the right man in the right place requires precise knowledge of the human requirements and resources and a constant balance between these requirements and resources.

11. Equity – Equity and equality of treatment of all personnel to ensure devotion and loyalty and should be done in line with discipline.
12. Stability of tenure of personnel – Personnel need time to develop the necessary job skills and succeed at doing their jobs and is especially true for managers that need more time to development the repertoire of skills required for the job.

13. Initiative – The ability to define and implement a plan. It is a great source of satisfaction for individuals and a great strength of the organisation.

14. Esprit de corps (the sense of essence) – Harmony and union amongst personnel. Coordinate efforts and encourage keenness to foster the morale of the workforce.

A review of Fayol’s management functions and principles of management suggests common sense behaviour expected from modern management. Efficient execution is only possible when there is clear direction, clear roles and responsibility, accountability and equity. When the observations supporting the taxonomy in Chapter 4 are used to test against these principles, several conflicts are noted. Order as defined by Fayol is today experienced as much more chaotic in modern organisations. Unity of command as an absolute one-person line of responsibility does not exist as such anymore. Division of work for knowledge workers are also much more difficult to define as it would be on a production line. The nature of work in modern organisations may need a different interpretation of this potentially still useful set of principles than currently suggested in the literature.

5.2.3 Mintzberg’s Theory of Management

Fayol’s work is less often referenced today than that of Mintzberg, presumably because of the passing of time. Mintzberg is still alive and is actively publishing his own work. The choice of terminology may further account for the apparent disuse of Fayol’s work. The use of the term “administration” rather than “management” is ascribed to the lack of the word “management” in the French vocabulary in the early Twentieth century while “commanding” would be an inappropriate word to use in modern times. The concepts are understood and where needed, translated properly to represent “management” and “directing” respectively [110].
There may be a different explanation for why Fayol’s five functions of management appear to only have theoretical value today. Mintzberg refers to the difference between Fayol’s work and his own work as focusing on what managers really do rather than looking for evidence that they are planning, organising, coordinating and controlling in the abstract sense [117]. Mintzberg’s observation of what managers really do during the day yielded a perspective of the managerial job as fragmented and constantly being interrupted [117]. The average manager jumps from task to task.

In an attempt to better define what managers really do if they are then not planning, organising, coordinating and controlling, Mintzberg identified ten principle managerial roles. Managers are required to move quickly between these different roles during the day to handle the disruptive and fragmented reality of a day at work.

These ten roles are grouped into three main areas:

1. Interpersonal roles
   a. Figurehead – Ceremonial role of association
   b. Leader - Ceremonial role as the head of the group
   c. Liason – Network of relationships internal and external to the organisation through which a private information system is built

2. Information roles
   a. Monitor – To keep tabs on what is going on
   b. Disseminator – Transmits essential information to subordinates
   c. Spokesperson – This is the public voice of the unit

3. Decision roles
   a. Entrepreneur – This role seeks to adapt the unit to the changing conditions, very often through juggling projects
   b. Disturbance handler – Reacts to events and changes occurring beyond foresight or control
   c. Resource allocator – Decide how best to deploy human, intellectual, time-based and physical assets
   d. Negotiator – Ensure a smooth process flow
Applying the field observations in Chapter 4 to Mintzberg’s view of what managers really do, it is equally evident that the Managers in scope of the fieldwork were indeed jumping from task to task, doing very quick context changing to handle the multiple demands at the office. Resource decisions made on the fly to address an urgent or unplanned need fit neatly into Mintzberg’s roles of Disturbance handler or Resource allocator while a CIO attending a design workshop to guide solution delivery is an example of the role of Disseminator.

The field of Management Theory is vast but very generic with regard to human resource management. It does not address the management challenges of finding and managing highly skilled technical resources. It is further not evident by doing such a narrow review and application of known Management Theory what the context of the resource decisions today is. Context refers to business elements such as the technical and operating environments that give effect to the management practices, resource compliment decisions and operating models adopted by the organisation.

5.3 Organisational Structure

Mintzberg’s first work was on the structuring of the organisation to describe how organisations function. In his book *The Structuring of Organisations* [118] he introduces the five different organisation configurations that determine organisations’ success and failures. An organisational structure is the formal configuration of people with regard to the allocation of work, responsibilities, authority and mechanism of task execution [119]. If an organisation attempts to do work for which it is not structured, it will make resource assignment errors because it may be taking on work that it should rather outsource. A full review of Mintzberg’s organisation structuring is outside the scope of this discussion but a short summary will suffice. Mintzberg differentiates between five organisation configurations as described further below.

Each of these organisation types can further be differentiated in terms of basic dimension being the (1) key part of the organisation that drives the organisation to attain success (2) the prime coordinating mechanism, which determines how work is executed; and (3) the type of decentralisation used to allow decision-making
involving subordinates. The prime coordinating mechanism is of interest to this study as it influence the definition of skills required for task execution.

The key part of the organisation can be:

1. The strategic apex or top management;
2. The operative core are the workers who actually do the work;
3. The middle line which is the middle and lower management echelon;
4. The techno-structure are Analysts, Engineers, Researchers and other specialised staff;
5. The support staff are generalists providing indirect support.

The prime coordinating mechanisms are:

1. Direct supervision which means one person is responsible for all work of others;
2. Standardisation of work processes where the content of work is programmed;
3. Standardisation of skills mean the kind of training required to do the job is specified and provided in the job context;
4. Standardisation of output means that the output of the job is defined and controlled;
5. Mutual adjustment is when work is coordinated through informal communication.

Distribution of power can be:

1. Vertical decentralisation where power is distributed down the chain of command or shared with an immediate subordinate;
2. Horizontal centralisation where power can be shared between line and staff including support staff;
3. Selective decentralisation is the degree to which decision-making is shared within different units in the organisation.

The five organisation structures are:
1. The Simple Structure – For example a small family owned business, which is managed by the strategic apex and uses direct supervision as its prime coordinating mechanism;

2. The Machine Bureaucracy – For example a steel factory, which has a techno-structure to execute the work and uses standardised work processes as its prime coordinating mechanism;

3. The Professional Bureaucracy – For example a Bank, where the operative core does the work and it uses standardisation of skills as its prime coordinating mechanism with non-routing work done by a handful of professional people;

4. Divisionalised Form – Large corporation such as a group of companies with diversified business, uses the middle line manager to make decisions with little coordination between entities;

5. Adhocracy – For example Software Development Houses with support staff to do the work and uses mutual adjustment as means of coordination.

Below is a context diagram of Mintzberg’s five structures and the associated 3 dimensions for ease of reference.

![Figure 16: Mintzberg's organisational structures and basic dimensions](source)

<table>
<thead>
<tr>
<th>Structural Configuration</th>
<th>Prime Coordinating Mechanism</th>
<th>Key Part of Organization</th>
<th>Type of Decentralization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple structure</td>
<td>Direct supervision</td>
<td>Strategic apex</td>
<td>Vertical and horizontal centralisation</td>
</tr>
<tr>
<td>Machine bureaucracy</td>
<td>Standardization of work processes</td>
<td>Technostructure</td>
<td>Limited horizontal decentralisation</td>
</tr>
<tr>
<td>Professional bureaucracy</td>
<td>Standardization of skills</td>
<td>Operating core</td>
<td>Vertical and horizontal decentralisation</td>
</tr>
<tr>
<td>Divisionalised form</td>
<td>Standardization of outputs</td>
<td>Middle line</td>
<td>Limited vertical decentralisation</td>
</tr>
<tr>
<td>Adhocracy</td>
<td>Mutual adjustment</td>
<td>Support staff</td>
<td>Selective decentralization</td>
</tr>
</tbody>
</table>

Source:[119:4]

### 5.4 Operating Model

Software Engineering introduces us to the concept of enterprise architecture as the organising logic for business processes and systems, reflecting the integration and standardisation required for execution and technology investment decisions [120].
This architecture identifies the processes, systems, data and customer interfaces required to enable efficient and effective delivery. It also supports the operating model. An operating model is the necessary level of business process integration and standardisation required for turning inputs into outputs. This operating model is selected at the enterprise level and may be different for different divisions or regional level. This model helps the organisation respond to external influences in an agile and competent manner.

The organisation must select only one operating model that best support what they do most of the time as there may be challenges from time to time that might suggest a more suitable model for that particular situation. This selection defines amongst other things the development of process and IT system capabilities, which ultimately determines which strategic initiative it can and should support as well as the skills quantity and location.

The operating model has two dimensions, namely process standardisation and process integration. Process standardisation determines the degree to which a process is similar regardless of where, when or by whom the process is executed. Efficiency and predictability increase with an increase in process standardisation. Process integration determines the degree to which data is shared between processes and business units. Process integration facilitates coordination, transparency and agility.

Given these two dimensions, Ross [120] describes four types of operating models. Every organisation will fit into any one of these four types in order to deliver its goods and services.
1. Diversification (independence with shared services). This model is suited to organisations where the business units or divisions have few common customers, suppliers and methods for doing business. This works well where management can have limited control over each business unit. This model requires synergy from related processes, even generating work for each other. It may also consider economies of scale but each business unit grows and exists on its own.

2. Coordination (seemless access to shared data). This model supports a high level of coordination between business units and these business units share one or more of customers, products, suppliers, and partners. Some process integration exists and may support cross-selling and integrated customer service. Business leaders are autonomous but typically make decisions considering the wider organisation and realise common benefits.

3. Replication (standardised independence). This model is intended for organisations with high process standardisation but lower integration needs. The success of this model is the degree to which the process looks exactly the same regardless of when and where it is executed. There is very little need for
sharing of data or coordinating with other business units in the execution of daily business.

4. **Unification (standardised, integrated processes).** This operating model is characterised by high process standardisation and high process integration. There is no variability in business units across the organisation but differ from the Replication model in that it also tightly shares data. This model is well suited for global organisations with interdependence between business units.

Growth and expansion are supported differently depending on the choice of operating model. High process integration (Unification and Coordination models) makes the data sharing and assimilation of acquisitions difficult. These are better suited to organic growth. High process standardisation (Unification and Replication models) would support the easy replacement of old with new processes during an acquisition.

As a result of growth and expansion, but also initiated by significant changes in the operating and technical environments, it may be necessary to change the operating model. This requires organisational transformation to move from one model to another, which will disrupt management practices and organisational behaviour. Such transformation does not happen often but may be required to improve the organisation’s ability to deliver its goods and services.

### 5.5 The need for unifying existing business theory

The Manager’s reality as described by Mintzberg is a very accurate description of modern business. Considering that Mintzberg’s model is based on observations of what Manager’s actually do, he is describing the response of Managers to the stimuli they receive on a daily basis. The question that must be asked is which was first: the stimulus or the response? Logic holds that the response comes from the stimulus but what if the stimulus is a result of the lack of an adequate response? Response will be covered in detail in Chapter 6.

The unification required in Management Theory is the structure and scope of Fayol’s discipline in Management functions with Mintzberg’s roles and response mode to support modern business challenges. This will necessarily lead to a different
interpretation of Fayol’s Principles of Management through an adjustment in role behaviour and response as proposed by Mintzberg. For example, due to the matrix reporting and project nature of complex work, communication is affected in terms of having the latest update. Instead of focusing on “communication” as a professional skill as the literature suggest should be incorporated into the educational curricula, the need for communication may be better addressed through Fayol’s concepts of planning and coordination. Should such planning and coordination be done with the rigour it was done before, Mintzberg’s roles of Disseminator and Disturbance handler will in all likelihood be less chaotic.

As will be pointed out in Chapter 6, the choices of organisation structure and operating models may be intuitively obvious. Not many organisations will make a grave error of selecting an incorrect form, however the lack of rigour in the implementation of the selected model leads to variation that have a direct impact on how people are selected and assigned.

The unification of all these theories cannot be attempted wholly in this study but some work will be done towards that goal. Chapter 6 will use each of the constructs explored in this chapter to show how these contribute to creating skills gaps in practice.

5.6 Conclusion

This chapter discussed general Management Theory for its relevance in understanding business context. This theory was introduced to this study when the field observations suggested that there is a business context contributing to poor utilisation of available skill.

Chapter 6 follows with a Skills Gap Management Model to explain the demand and supply of skills and how the organisation interacts with its external environment while aiming to satisfy it skills needs to respond to market demands.
Chapter 6

6 Skills Gap Management Model

6.1 Introduction

This chapter brings together the actual business management practices and the real skills issues observed in the fieldwork. The objective is to show how real Skills Shortages (Ss) and actual, and sometimes inadequate, business management practices contribute to creating and magnifying Skills Gaps (Sg). This study differentiated very early on between the concepts of Ss and Sg and indicated that these concepts are often used interchangeably when they mean something very different. The definition for Sg suggests a shortfall in performance delivery from people who are expected to have the skills to do the job but who cannot meet the performance outputs expected of the job. This study adopts this same definition and offers a Skills Gap Management Model to describe the dynamics of managing skills in practice that lead to us observing, or perceiving, that the skills are not suitable or sufficient.

The model was shaped by further analysis of the codes generated by the fieldwork. This analysis considered both perceived lack of skills as well as other organisational factors as possible reasons for underperformance or difficulty to get the job done. Each of the model components is a described and relevant premises stated. Where applicable, the codes generated from the fieldwork are included to demonstrate how the model component was developed. The model focuses only on the human resource component of the business environment. It is acknowledged that the business domain is large but that larger business domain is not the direct focus of this study.

The model considers Ss as an input. There are not, for instance enough qualified Engineers entering the market [4-5], [10], [28]. Unless there is a drastic change in the careers and subsequent field of study chosen by all school leavers as well as a substantial investment in educational facilities, this situation is likely to remain a constant, at least for the immediate future. The model also assumes a minimum level
of competence in those resources that are employed in designated positions. Much of the fieldwork suggests that a real Ss is compensated for by the employment of candidates without the required functional and technical foundation skills.

The model builds on the Management Theory reviewed in Chapter 5 while also developing the concept of Natural Level of Competence and Capability (NLC) as a construct to explain the dynamics of skills gap management in the workplace. The model is developed and explained in three stages. Firstly, the organisation is contextualised. The primary and secondary focus of the organisation is positioned in the organisation’s external environment. This context is described in ideal conditions. The second stage develops skills demand and skills supply equations for the organisation. The last stage of the model introduces a new working definition for SG and demonstrates how SG is created in the workplace.

Abbreviations applicable to this Chapter are repeated in an endnote at the end of this chapter.¹

6.2 The Environment and the Organisation

6.2.1 Description

The environment refers to the external influences on the organisation. This macro environment determines what the organisation needs to respond to and when such response is required.
The Operating Environment (O\text{E}) describes the industry in which the organisation operates. This environment is characterised by specialised needs for services and products while the organisation also produces specialised services and products for its clients. This industry context informs the business acumen required by the people working in that industry. The O\text{E} is further governed by industry regulation, which influences the standards and boundary for delivery. In modern business, this environment is characterised by constant change and an increase in client demand for specialised, customised services at an affordable price, which may be disruptive to the organisation. The O\text{E} shapes the organisation structures and how it operates to deliver its goods and services.

The Technical Environment (T\text{E}) comprises of the collection of all practices, technologies and methods required by the organisation to process the inputs into outputs. The T\text{E} excludes all human factors. The T\text{E} determines the technical requirements for the organisation in order to deliver its goods and services. Similar to the O\text{E}, the T\text{E} is characterised by continuous change and technological advancement.
This is a formal environment influencing all organisations whether technology is its core business or not. This is as a result of the all-encompassing nature of technology in the modern organisation.

The Education System (Es) provides the skills and competencies required by the organisation to deliver its goods and services. The Es does not only refer to educational institutions but rather the general education system providing skills and competencies which extends to industry specific facilities and institutions providing more practical learning and experience. Business (as the assemblage of organisations that together form the market) has the opportunity to influence the quantity and quality of skills produced by the Es but is not in control of what is produced Es.

The basis of this model sees Sg created as a result of the external influences on the organisation and how the organisation responds to these external influences and manages itself internally.

6.2.2 Premises

1. The organisation will always endeavour to deliver the products and services demanded by the OE through the transformation of inputs into outputs or outcomes. The OE defines the business acumen required by personnel;
2. The organisation will follow and adhere to the guidelines and regulations stipulated by the OE;
3. The TE represents the collection of technologies, techniques, tools and codified practices and guidelines relevant to the organisation. Organisations will not only use current technologies, tools and practices but they will also be affected by scientific and technical advancements and changes in the relevant TE. The TE shapes the Domain of Expertise (DoE) required by personnel;
4. The TE also includes the standards bodies that define, veto or govern the codified practices and guidelines that may include a code of conduct;
5. The Es and Labour Market (LM) represent the collective of skills being offered to the organisation to satisfy its skill needs or demands. The LM encompass people that already possess the skills at the required levels of proficiency while
the Es include people whose skills are being developed at different levels of proficiency;

6. The TE informs the Es and LM about technological, procedural and qualitative changes and advancements to be incorporated into the skill sets. The Es and LM will in response adapt to the new requirements.

6.2.3 Assumptions

1. A key assumption is that the mix, quantity and quality of skills offered by the Es and LM is constant. This assumption emanates from two facts:
   a. It takes the Es between two and five years to develop skills in people at the desired level of proficiency. The adoption of change and advancements informed by the TE only increases the aforementioned timeframe. In business, three to five years is considered long term;
   b. Assuming full and unrestricted cross-border labour mobility, the quantity of skills available globally is also a constant without the timeframe considered and considering current international news and accounts, is already committed to other work.

6.3 Organisation’s Core or Primary Focus

6.3.1 Description
The core or primary focus of the organisation is to utilise its resources to transform inputs into outputs or outcomes.
For purposes of skills management, there are two constructs of importance, the Skills Mix and Allotment (SMA) as well as the Production Techniques and Tools (PTT).

SMA refers to the collective set of knowledge and skills at the different levels of quality and proficiency (the Skill Mix or Sm) that are possessed by the people employed by, or being available to fulfil the need of the organisation (the Skill Allotment or Sa) for skilled persons. SMA includes all the practices, guidelines, procedures, methodologies, tools and machinery that the organisation possesses or has access to and that are required by the organisation to transform inputs into outputs. The TTe shapes the SMA and the PTT as it provides the codified practices and guidelines for its proper use and application and informs the necessary technical requirements. In practice there are different PTT that can be used to achieve the same results at different levels of effort and quality. Each combination of PTT could have different requirements with regards to SMA. The organisation will use its SMA to apply and utilise the chosen PTT to produce the desired outputs or outcomes.
6.3.2 Premises

1. An organisation will endeavour to produce the outputs or outcomes as close as possible to the quality specification expected by its target market that is part of the OE;
2. In order to produce the required outputs or outcomes an organisation will utilise PTT that best fit its current SMA, in adherence to the standards and guidelines emanating from the TE;
3. An organisation will strive to have the correct SMA to achieve the outcome, within the constraints imposed by the Es and LM as embodied in the SS;
4. Both the SMA and the PTT are affected by changes and advancements in the TE that the organisation may or may not adopt;
5. In an ideal state, the organisation can produce the expected outputs or outcomes in an effective and efficient manner across five production factors, namely quality, effort, cost, time and income;
6. One or more of the five production factors described above will be negatively affected if the organisation operates in conditions where either:
   a. The SMA and the PTT are incongruent, or;
   b. The SMA and/or the PTT are inadequate or below the levels of proficiency and adherence required by the TE to operate.

6.3.3 Assumptions

1. The PTT selected are relevant and current;
2. The investment in PTT is adequate.

6.3.4 Relevant field observations

Many of the fieldwork-generated codes relate to concerns in the SMA component of this model. The following codes relate to the primary focus of the organisation that gave effect to the development of this component of the model as important for skills management.
Chapter 6: Skills gaps management model

Production Tools and Techniques:
Observations from the field suggest that people are assigned to work based on their knowledge of certain technologies and tools, which the organisation selects to use, or conversely, the organisation adopts for which the current resource complement might have exposure and some knowledge. In either case the resource decision is not based on a solid pre-defined adoption of technology based on the Te requirements but rather the closest Sm the organisation has to technology and tools that might do the job at hand. This may lead to holding on to the aged workforce in possession of such knowledge. Proper learning and testing infrastructure to fully master the technology and tools in operation may not always support these resource assignments.

14 - Frequent reworking of tasks
17 - Inability to build a sustainable delivering team
19 - Inability to do critical self-evaluation
20 - Inability to facilitate learning in others
23 - Inability to scope and sectionalize a problem
31 - Internal promotion based on the closest match
44 - Not actively looking for the rest of the incomplete view
48 - Over scheduling of resources
53 - Policies do not cater for ad hoc or short notice people development
54 - Recognised for crises management
58 - Resource has not done this job before
59 - Resource has significant idle time
60 - Resource is spread too thinly
61 - Resource is tired
66 - Retirement is delayed
68 - Rewarded for excessive overtime
73 - Skill obsolescence
78 - Task-time changes
79 - Training infrastructure is not in place

Skills Mix and Allotment:
A large number of codes developed from the field observations relate to SMA deficiencies. All these codes are listed below. These codes range from a Ss compensated for by the appointment of a lesser skilled person to a specific task, to insufficient focus on skills identification and development to complete the required mix in line with the business objectives.
5 - Development offered unrelated to current job requirement
9 - Failure to identify a gap in scientific foundation skills
10 - Failure to identify a gap in the skill set offered
14 - Frequent reworking of tasks
16 - Inability to assess learning needs in others
18 - Inability to determine learning objectives
19 - Inability to do critical self-evaluation
21 - Inability to mentor individual team members
22 - Inability to recognise available skill
23 - Inability to scope and sectionalise a problem
29 - Internal promotion based on a positive attitude
30 - Internal promotion based on tenure
31 - Internal promotion based on closest match
32 - Job-experience mismatch
33 - Job-knowledge mismatch
36 - Lack of required technical foundation
38 - Learning is perceived to be expensive
39 - Learning is unrelated to the job requirements
41 - Managerial inability or willingness to do proper performance management
42 - Mentorship and guidance practices are not effective
43 - Misalignment between development policies and actual development needs
44 - Not actively looking for the rest of the incomplete view
46 - Not aware of an incomplete view
51 - Personal development is not linked to organisational needs
54 - Recognised for crises management
58 - Resource has not done this job before
61 - Resource is tired
65 - Resume is excluded from recruitment pool due to not having a minimum qualification
67 - Retirement is forced
74 - Skills are available but are not visible
75 - Skills available but not offered
76 - Skills offered are not utilised
81 - Unavailability of policy and processes to transfer a resource
82 - Unclear career objectives
85 - Unguided learning
88 - Unwillingness to take up a development intervention offered

6.4 Supportive or Secondary Focus

6.4.1 Description

The Management constructs introduced in Chapter 5 are unified in this model as the secondary or supportive focus in context of skills management. Each of the three constructs provide valuable, and still useful support for proper resource management and resourcing decisions.
Organisations cannot only rely on skill and technology to assure the delivery of outputs and outcomes. Depending on the OE there are actions to be taken with regard to how to organise the resources available to achieve better utilisation and how to best serve the OE. The Organisation Structure (Os) refers to how the different resources and responsibilities are organised to achieve the stated goals. Whether the organisation is a Commercial Bank, a Mobile Telecommunications Provider or a boutique Software Development House, the nature of the work it does and the industry in which it operates all contribute to deciding the best way to be structured to allow for execution. The resulting structure is normally depicted in the form of a collection of divisional units with objectives, responsibilities and accountabilities as well as a structured list of positions and associated roles necessary to fulfil them. This depiction will also include the interactions between divisional units necessary to achieve the organisation’s goals. The OE shapes the Os as it informs the business acumen required by the organisation and also suggests its areas of expertise and the functional domain or department to be resourced and managed to support processes for work execution.
The Operating Model (OM) works with the Os. An organisation needs to establish a consistent way of serving its target market and the OE that is congruent with its chosen Os and the OM as described by Ross [120]. The OM is seen as structured forms of how and where an organisation will use its resources to execute and deliver the outputs or outcomes. Organisations need to decide what resources, methods and processes to use and at which location to best serve the OE. As with the Os, the OE also shapes the OM as it informs the OM what skills, in what quantity, are required at which location for the organisation to be able to perform accordingly.

The Management Practices (MP) refers to how the organisation and its people are managed in context of the organisation’s objectives and chosen form and structure. It is the decisions and actions taken by management to ensure productive attainment of the organisation’s goals. Fayol’s management functions and Mintzberg’s managerial roles and the reality of management are applicable in this context. MP in this model focus specifically on the decisions and actions pertaining to people, their work and their work environment. MP therefore accounts for the planning, organising and controlling of the SMA as well as for planning, organising and controlling responsibility for the PPT.

The OM influences MP as the quantity and location requirement of resources will influence staffing decisions while the Os and subsequent job descriptions will guide placement and training decisions. Finally, both the OE and the TE guide and influence MP in terms of how best to respond to or adapt to changes in both environments.

6.4.2 Premises

1. The organisation’s OM and Os are aligned and are congruent with the OE;
2. The MP are congruent with the OM and the Os;
3. The OM and the Os influence the SMA directly through the planning, organising and controlling management functions (Fayol) and associated management roles (Mintzberg) which are accounted for as MP;
4. The OM and Os changes can take significant time to implement and can create disruption in the functioning and performance of the organisation due to its direct or indirect linkages to MP and SMA.

**6.4.3 Assumptions**

1. Organisations are aware of the different OM and the value and challenges of each;
2. Organisations are capable of assessing the best suited OM and can effectively transition to the correct model;
3. Resource planning and management receive due attention and investment.

**6.4.4 Relevant Field Observations**

**Organisation Structure:**
A number of field observations suggested that the Os and the job descriptions in use might inhibit proper work performance. The following codes lend support for including the Os as a component of this model.

7 - Dynamic role redefinition
13 - Frequent organisational structure changes
15 - Headcount freeze
63 - Resource planning lead to unplanned promotions
69 - Role clarity
70 - Role conflict
71 - Role-boundary changes
72 - Role-focus changes
76 - Skills offered are not utilised
79 - Unavailability of policy and processes to enforce dismissal when required
87 - Unwillingness to share or redeploy a resource
81 - Unavailability of policy and processes to transfer a resource

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XIV The context here is that the person offering the skills may be offering skills associated with a different domain of expertise, thus not being accepted and utilised, e.g. a Project Manager with the IT Department offering the HR Department to assist with Organisational Change Management during an Operating Model transformation initiative.
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Operating Model:
Observations related to where and for whom work was done (when not done for a direct line of reporting) questioned the support provided by the OM to enable work performance.

1 - Ad hoc re-assignment to work
4 - Demotivating working conditions
11 - Flexi-work models are not aligned to the resource plan
27 - Inconsistent flexi-work policies
28 - Inordinate demands
40 - Learning opportunity is not available
48 - Over scheduling of resources
49 - Over utilisation of resources

Management Practices:
MPr as this model suggests are those support functions aligning the people aspect with the business objectives to enable efficient and effective execution. MPr then also have the potential to create discord and tension resulting in the lack of people support as well as workplace stressors that inhibit full utilisation of available skills.

2 - Alignment by corridor update
3 - Avoidable early retirement
6 - Difficulty to relieve a resource of duty when he is not performing
8 - Failure to address under performance timeously
12 - Focus on generic attributes
17 - Inability to build a sustainable delivering team
20 - Inability to facilitate learning in others
24 - Inadequate performance management policies
25 - Inadequate policies on promotion for modern career
26 - Inadequate training time and budget allocation
30 - Internal promotion based on tenure
34 - Keyword matching
35 - Lack of motivation and willingness to continue learning
37 - Learning is perceived to be class room training only
39 - Learning is unrelated to the job requirements
41 - Managerial inability or willingness to do proper performance management
42 - Mentorship and guidance practices are not effective
43 - Misalignment between development policies and actual development needs
45 - Not actively selecting for lifelong learning attitude
46 - Not aware of an incomplete view
47 - On the job learning is not in place
50 - Person-role mismatch
51 - Personal development is not linked to organisational needs
52 - Personal development plans are not in place
53 - Policies do not cater for ad hoc or short notice people development  
55 - Recruitment administration ill managed  
56 - Relying on contract house processes  
57 - Resource does not focus on his job  
59 - Resource has significant idle time  
60 - Resource is spread too thinly  
61 - Resource is tired  
62 - Resource is unwilling to change flexi hours when required  
63 - Resource planning lead to unplanned promotions  
64 - Resume is excluded from recruitment pool due to age, gender or ethnicity  
65 - Resume is excluded from recruitment pool due to not having a minimum qualification  
66 - Retirement is delayed  
67 - Retirement is forced  
68 - Rewarded for excessive overtime  
69 - Role clarity  
70 - Role conflict  
71 - Role-boundary changes  
72 - Role-focus changes  
73 - Skill obsolescence  
74 - Skills are available but are not visible  
75 - Skills available but not offered  
76 - Skills offered are not utilised  
77 - Slack human resources management processes  
78 - Task-time changes  
79 - Training infrastructure is not in place  
80 - Unavailability of policy and processes to enforce dismissal when required  
81 - Unavailability of policy and processes to transfer a resource  
82 - Unclear career objectives  
83 - Uncontrolled selection of preferred work  
84 - Unfamiliarity with the job requirements  
85 - Unguided learning  
86 - Unmanaged flexi-hours  
87 - Unwillingness to share or redeploy a resource  
88 - Unwillingness to take up a development intervention offered  
89 - Use of search engines  
90 - Using preferred suppliers list

6.5 Skills Management – Supply and Demand Management

6.5.1 Introduction

The constructs above describe the structural components of the Skills Gap Management Model. The model mechanism uses the analogy of the refraction of light through water to describe how the environment and the organisation work together to do skills management that ultimately result in a degree of Sg appearing. Skills
management is the process from recruiting and selecting skills from the Es and Lm (left bottom corner of Figure 20), including the processes in the secondary and core focus area in the business context of the organisation, to the management of Sg (top right corner of Figure 20).

Figure 20: Skills Gaps Management Model

The Skills Gap Management Model in Figure 20 is designed for ideal or balanced conditions where all the components maintain a good level of congruency and the organisation can optimally produce the outputs or outcomes and can properly adapt to change. This model assumes a certain capacity and level of proficiency in the SMA for the organisation to produce the required outputs or outcomes. This section describes what this level of proficiency could look like to aid the definition of the organisation’s skills demand and to further manage the skills supply to minimise Sg. It is important to note that the SMA includes all the human resources the organisation needs in all its departments such as Finance, HR as well as its total managerial compliment. SMA does not only cover engineering and technology skills.
In order to manage skills it is important to first establish how skills are identified and applied to the tasks at hand. There are two aspects to consider, namely the organisation’s needs (demand), which is translated into job descriptions and subsequent role creation in the Os as well as the individual’s skill and proficiency (supply), which are then mapped to the organisation’s need. The study problem statement captured in Chapter 1 refers to organisations, which report that it cannot find suitable skills while there are numerous accounts of candidates reporting that they cannot find suitable employment. The study scope picture from Chapter 1 is added here again in Figure 21 below for reference. The focus of this Chapter is on quadrant 3 – Skills bouquets on offer and quadrant 4 – Job behaviour changing.

6.5.2 Describing Demand

The challenge for the organisation is to be able to define at what level of capability and level of proficiency to position each role in the SMA to meet its output or outcome objectives. Job descriptions today resemble a combination of the traditional job
descriptions and job specifications and mostly depict the tasks and activities typical of a specific role at a point in time [57]. Organisations struggle to clearly define the problem statement for the longer term to be addressed and therefore struggle to produce a more complete profile of the role against which candidates can be matched hence the need to find people that have done exactly that job before [17], [54] or one that can figure the job out and make it happen [13], [16-17].

Job descriptions in practices often include reference to concepts from competency frameworks based on job dimensions such as the scope of domain knowledge and personal attributes in support of job execution [57], [121]. These competency frameworks work on the basis of increasing competencies ranging from basic knowledge and limited experience to full domain knowledge and practiced mastery. The foundation of the organisation’s SM should be a full set of job descriptions to cover the full scope of each different DoE to serve its chosen OE and applicable TE. A DoE is a specific discipline or sub discipline with a specific body of knowledge such as Software Engineering and Enterprise Architecture. Each domain may, and normally does, require a variety of skills to address the totality of its challenges and demands.

There are two important features of the DoE namely dynamism and vastness. The DoE is not static and evolves as a result of scientific and theoretical advancements as well as empirical improvements emanating from the day-to-day application of research and existing skills and techniques. The DoE is vast due to the number of combinations of theoretical constructs, techniques and procedures that can be applied to solve a problem or produce an outcome. For example, electricity generators and electrical motors use the same concept of electromagnetism although the techniques and methodologies needed to build either of them may require different but related skills.

Regulatory and standards bodies, and codified practices and codes of conduct also form part of the fabric of a DoE in order to restrict the vastness of a domain and to prevent any serious consequences of misusing skills or failing to adhere to minimal standards when exercising them. The formation of the standards bodies and codified practices is in response to the need for rigour underpinning the theoretical framework of the DoE. The DoE is a crucial component of the TE and the driving force in determining the technical requirements and levels of mastery to be achieved in the
definition of the organisation’s SMA and the selection of the organisation’s PPr as depicted in previous sections.

The diagram in Figure 22 below depicts a theoretical position of different jobs in a Software Engineering DoE ranging from entry level jobs where basic domain knowledge and limited experience will contribute to code debugging work, to high domain knowledge and extensive experience required to support complex analysis, design and system build activities with new and emerging technologies. The axes are based on work done by Bloom used frequently for learning and competency assessment [121]. Bloom’s Cognitive abilities include, in sequence of mastery, Knowledge, Comprehension, Application, Analysis, Evaluation and Synthesis. The Levels of Competence used in Figure 22 include both Bloom’s Affective and Psychomotor abilities. The Affective skills grow in order from Receiving, Responding, Valuing, Organising and Characterising. The Psychomotor abilities are Perception, Set (the ability to respond), Guided Response, Mechanism (learning has become habitual), Complex Overt Response, and Origination.

Figure 22: Range of Job Descriptions in Software Engineering
The Level of Competence increases with experience. At a progressive level of experience a person can develop techniques and practices to identify new challenges associated with his DoE and he is able to apply novel ways to solve problems and to produce outcomes not seen or heard of before. There is however a marginal acquisition of knowledge and skill over time and such skill increase assumes a minimum required level of knowledge typically associated with formal education. It is also true that some people will not increase their skill over time but may repeat the same experience year on year without learning anything new. Should an organisation require low functional knowledge but years of repeated experience, such a job would be positioned towards the bottom right corner.

6.5.3 Describing Supply

A person can develop a great variety of skills. The effectiveness, efficiency and relevance of these skills are determined by the context in which the skills are used and by the nature of the problem statements to solve. The problem statements and expected outcomes for which the skills are relevant are directly related to the DoE. Skill mastery within a certain DoE is achieved in accordance with personal aptitudes, means and desires. Skills development and learning abilities is a progressive and evolutionary process and human cognitive capacity is limited [121]. A person can only acquire and retain so much knowledge and can therefore only master a finite number of the skills required in a DoE as depicted in the Proficiency Model below in Figure 23.
The proficiency curve is presented as an upwards-sloping and levelling curve to account for the fact that the cognitive abilities of individuals can increase with practice and techniques but not in an infinite or linear manner. The area below the proficiency curve represents the cumulative proficiency, or competence and capability of an individual. It also depicts the cumulative set of problem statements and outcomes that can be addressed in the specific DoE. This is designated as the area of Natural Competence and Capability. For a given job, the jobholder is expected to be at least competent and capable in the Natural Competence and Capability area of the DoE. Figure 23 depicts only one DoE. An individual may have two or more DoE with different levels of proficiency as suggested, and observed in the fieldwork, as described in Figure 21.

As a person develops skills in a specific DoE, over time this person should be able to solve a bigger set of problems and produce higher outcomes due to the accumulation of skill. As a result of the limited cognitive human capacity there will be areas and topics where a person would be both marginally competent in terms of knowledge and know-how and marginally capable in terms of actual practice. Those topics are depicted in the Proficiency Model as the area of Marginal Competence and Capability above of the proficiency curve.
Below the area of Natural Competence and Capability is the area of Voluntary Marginal Competence and Capability. While similar to the area above the proficiency curve in terms of encompassing topics and skills in which a person is marginally competent and capable, here the person actively chooses not to be proficient in such theories and skills although he may be well aware of them and may even have a very good understanding of these theories or techniques. This is not lack proficiency due to natural human limitations. The person may choose deliberately not to strive for and achieve a level of proficiency in certain subjects or may select a tertiary degree that offers most of the subjects of his preference and excludes others. It is also possible to divide the DoE in sub-domains in such a way that some of the skills and knowledge encompassed in the area of Voluntary Marginal Competence and Capability for a Graduate Engineer for example become subjects for Natural Competence and Capability for a National Diploma holder.

A person must develop skills and accumulate competence and capability to at least a 60%-70% certifiable proficiency to be considered a competent and capable professional in a DoE, as indicated by the 70% mark of proficiency on Figure 23. This point is represented in the model by the horizontal line labelled 70% of DoE knowledge. The 60%-70% level has both empirical validity and relevance as most of the tertiary education institutions around the world set the acceptable pass rate at 60%-70% for degrees in Engineering and Medicine. When a person reaches the 60-70% of domain expertise he has accumulated sufficient knowledge to have the foundation to recognise most of the problems and demands of his chosen DoE.

Above the 70% mark of proficiency is the area of Highly Specialised Competence and Capability. This area includes more advanced and complex theoretical frameworks, practices, techniques and methodologies that will require a person to have a very good grasp of the fundamentals of the DoE, in order to understand new constructs. Due to the complexity of the skills and knowledge included in this area it will also require a focused effort with a narrower scope of the DoE in order to master this domain and may require engagement in formal postgraduate coursework to develop the necessary

\[\text{MIT: } \text{http://web.mit.edu/catalog/overv.chap5.html}\]
\[\text{Ryerson University: } \text{http://www.ryerson.ca/currentstudents/essr/gradescales_ugrad/}\]
skills and acquire more knowledge. This area forms after the minimum level of capability and proficiency was reached and it represents the specialised knowledge and skill that are available to an individual to further master his DoE.

6.5.4 Mapping Supply to Demand

Using the same theoretical position of the different jobs in the Software Engineering DoE as depicted in Figure 22 above, the mapping of the assigned skills to the available jobs in the organisation’s skills matrix can be shown as in Figure 24 below.

Assumption:

An assumption underlying the Skills Gap Management Model is that the scope of competence and capability has been defined for each role in the SMA for the organisation (demand is clearly stated and is measurable) and that each role has been filled with a person who has a Natural Level of Competence and Capability profile matched to that of the role requirement (supply is accurately mapped to the demand). Where a skills match could not be made towards the Natural Competence and
Capability level, development plans and training plans are in place for those employees that can bridge the gap. Alternatively, that policies and processes are available to replace such employees not meeting the minimum proficiency requirement.

6.5.5 Law of Natural Level of Competence and Capability

The Proficiency Model for a DoE suggests a minimum level of competence is present in the SMA as required by the OE and TE. An organisation has a Natural Level of Competence and Capability (NLC). It is the sum total of the roles contained in the SMA and the scope of the Natural Level of Competence and Capability of the actual employee profile fit against that total requirement, assuming that each role was filled with a person meeting the 60-70% proficiency requirement.

The organisation’s NLC has the following rules:

1. No person will know everything. It is not possible to know everything there is to know about a DoE. This is due to the speed of change and the complexity of processes and technology in modern organisations. There will always be new information available to factor into decision-making. This factoring will always require focused attention to find and assimilate new information and the inclusion of new information will always happen at a lag to this development;

2. The total or aggregate competence and capability for the organisation will be lower than the 60-70% resulting in an overall lower aggregate proficiency curve. A handful of specialists cannot compensate for the general shortfall in the competence and capability of a large number of employees. This statement assumes that technology will remain increasingly complex and disruptive and that there is still large gap to bridge to achieve the 60-70% mark;

3. The NLC is directly related to the DoE of the individual and the line of business of the organisation. An individual will actively choose to specialise in one subdomain and not in another. Organisations, by virtue of their business objectives and target market, define the lines of business and the subsequent DoE required;

4. A NLC assumes a 60-70% certifiable competence against the codified practices as the basis of competence. A 100% of domain knowledge is not possible due
continuous development in the domain. Marginal Competence and Capability will exist and is equal to at least the portion exceeding the rule of saturation (anything above 70%) but may be more where the actual competence and capability is less than 60%;

5. Achieving the correct SMA at 60-70% proficiency is a healthier state than the current observed state and will enable the organisation to improve its output objectives but when such a state is achieved, will inspire the organisation to increase the competence and capability level and/or move to adopt or develop new technology;

6. Organisations will resource initiatives with skills in a way that satisfies the need within their NLC. Organisations do not increase the skill level consciously beyond the current level of its own competence. Skills assignment is done within the current mental model or theoretical framework of delivery and within the constraints of the maximum competence of the person(s) making the resource selection and assignment decisions. In principle, it requires skill to identify and manage skill.

7. The organisation will reduce the complexity of the problem or oversimplify the problem to fit the skills it can find. This is a function of two factors. Firstly the competence of the person(s) doing the problem assessment can lead to reduced complexity to that which he can see or understand (unknown unknown). Secondly, the complexity and scope of the problem may be reduced to fit the skills available to do the job (known unknown).

Figure 24 above implies that a one to one match exists between the job and the person assigned to that job. The match is at the person’s Natural Level of Competence and Capability.

The equation for the Organisation Skill Demand can be stated as follows:

$$SD = \sum_{k=1}^{l} (O_k \times NLC_k)$$

Where:
SD: Skill Demand as defined in the job description for the SMA for the department or DoE

l: Total number of jobs/roles/positions in a department as required to achieve the organisation’s output objective

Ok: Optimal compliment or number of individuals for the Jobk/Rolek/Positionk

NLCk: Required Natural Level of Competence and Capability for the Jobk/Rolek/Positionk

Applying this formula to the department or DoE of Software Engineering, assuming three distinct jobs with a need for two junior resources to help with debugging and basic coding, one mid to senior resource to do analysis and design, and three senior level resources with advanced skills and experience, the formula can be stated as follows:

\[ SD = \sum_{k=1}^{3} (O_k \times NLC_k) \]

\[ SD = (2 \times NLC_1) + (1 \times NLC_2) + (3 \times NLC_3) \]

Headcount = 6

The aggregation of the different optimal compliments in the example scenario above is 6 (three distinct jobs with two, one and three positions each). This skills demand can also be stated as the headcount as approved for purposes of the Os)

Skills supply in practice is rarely a pure one to one match to the job. However, the ideal compliment, given a clearly articulated need, can be represented in the following equation for the Organisation Skill Supply:

\[ SMA = \sum_{i=1}^{n} \left( NLC_i \times \left( \frac{\sum_{j=1}^{m} JF_{ij}}{m} \right) \right) \]

Where:

SMA: Actual SMA for the Department or DoE

n: Total number of individuals in the Department

NLCi: Actual Natural Level of Competence of an individual in the Department
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\[ m: \] Total number of Jobs/ Roles/ Positions that an individual is expected to fulfil

\[ JF_{ij}: \] Job fit or match, expressed as a ratio, of the actual Natural Level of Competence in relation to the Job/ Role/ Position, that an individual is expected to fulfil

Using the demand of six Software Engineers as in the example above, the assignment of these resources to the actual demand can be represented in the formula below. This formula states the job fitness of the Natural Level of Competence and Capability offered by the jobholder. A Natural Level of Competency and Capability at the 70% mark can be considered to be 1 or the ideal match.

\[
SMA = \sum_{i=1}^{6} NLC_i \times \left( \frac{\sum_{j=1}^{m} JF_{ij}}{m} \right)
\]

\[
SMA = (NLC_1 \times 1) + (NLC_2 \times 1) + (NLC_3 \times 1) + (NLC_4 \times 1) + (NLC_5 \times 1) + (NLC_6 \times 1)
\]

\[
SMA = NLC_1 + NLC_2 + NLC_3 + NLC_4 + NLC_5 + NLC_6
\]

SMA Headcount = 6

As in the case with the Organisation Skill Demand equation above, if the organisation is able to fit every available position with the ideal candidate profile, the Organisation Skill Supply will be equal to a full match to the Organisation Skill Demand profile of 6 people with an adequate Natural Level of Competence and Capability.

SMA Role fitness = 6

The role fitness in an ideal skills supply condition will be equal to the skills demand profile.

### 6.6 Skills Gaps

A skills gap occurs when the Natural Level of Competence and Capability is lower than that required by the job to which the person is assigned. The equation for Organisation Skills Gap below measures the shortfall in performance delivery due to the lower than required Natural Level of Competence and Capability for the job.

---

6-26
\[ SG = \sum_{i=1}^{n} \left( NLC_i \times \left( \frac{\sum_{j=1}^{m} (1 - JF_{ij})}{m} \right) \right) \]

Where:

- **SG**: Skill Gap for the Department or DoE
- **n**: Total number of individuals in a Department or DoE
- **NLC\_i**: Actual Natural Level of Competence for the individual
- **m**: Total number of Jobs/ Roles/ Positions that an individual is expected to fulfil
- **1 - JF\_ij**: Job mismatch, expressed as a ratio, of the actual Natural Level of Competence in relation to the Job/ Role/ Position, that an individual is expected to fulfil

Inferior skills assignment can be the result of several real business challenges and Ss but may equally be done due to inadequate planning, poor resource management and the unavailability of suitable policies to ensure an optimal workforce compliment.

### 6.6.1 Scenario 1 – Level of job fitness is less than 1

The Natural Level of Competence and Capability is less than 1. In this scenario a job is filled with a person who lacks the required knowledge and experience at a Natural Level of Competence and Capability to fill the position properly. With full job fitness set at the 70% mark, any shortfall in performance delivery is expressed as a ratio to the skill required by the job.
Figure 25: Theoretical depiction of a Skills Gap

For purposes of this scenario, assume that the person fulfilling position 2 as depicted in Figure 25 has a job fitness of 0.5 (or 50%) then the Organisation Skills Gap can be calculated as follows:

\[
SG = \sum_{i=1}^{6} \left( \frac{NLC_i \times \left( \frac{\sum_{j=1}^{m} (1 - JF_{ij})}{m} \right)}{\right)
\]

\[
SMA = (NLC_1 (1÷1) + (NLC_2 (1÷1) + (NLC_3 (0.5÷1) + (NLC_4 (1÷1) + (NLC_5 (1÷1) + (NLC_6 (1÷1)
\]

SMA = NLC1 + NLC2 + NLC3 + NLC4 + NLC5 + NLC6

SMA Headcount = 6
SMA Role fitness = 5.5

In this scenario the expected aggregated optimal compliment is achieved but a lower level of job fitness is realised.
6.6.2 Scenario 2 – Substitution

A crucial role is matched to a person lacking a full skill set but the organisation decides to pull another resource in to complete the work. The resource (or headcount) is taken from another job and is thus not available to complete this other work.

Figure 26: Substituting one resource for the lack of another

Developing the formula:

\[ SG = \sum_{i=1}^{6} \left( NLC_i \times \left( \frac{\left( \Sigma_{j=1}^{m} \left( 1 - JF_{ij} \right) \right)}{m} \right) \right) \]

\[ SMA = (NLC_1 (1÷1) + (NLC_2 (1÷1) + (NLC_{3,1} (0.5÷1) + (NLC_{3,2} (0.5÷1) + \right. \\

\[ \left. (NLC_4 (1÷1) + (NLC_5 (1÷1) \right) \]

\[ SMA = NLC_1 + NLC_2 + NLC_3 + NLC_4 + NLC_5 + NLC_6 \]

SMA Headcount = 6
SMA Role fitness = 5
In this scenario the substitution of resources with lower job fitness result in not achieving the optimal compliment for the available jobs even though the full headcount was utilised.

### 6.6.3 Scenario 3 – Compensation

In the third scenario one resource doubles up to compensate for the lack of capability in another resource without being taken off his primary job. The \( S_G \) formula considers the fit against the job to be done (in this case the remainder that the original resource cannot do) as well as the utilisation (how many unique jobs he is expected to fulfil). A person’s total utilisation over two or more jobs increases but at the cost of a lower skill level for the organisation.

**Figure 27: One resource compensating for the lack of another**

The developed formula for this scenario will look as follows:

\[
S_G = \sum_{i=1}^{6} \left( NLC_i \times \left( \frac{\sum_{j=1}^{n} (1 - JF_{ij})}{m} \right) \right)
\]
SMA = (NLC₁ + 1) + (NLC₂ + 1) + (NLC₃ + 0.5) + (NLC₄ + (0.5 + 1)/2) + (NLC₅ + 1) + (NLC₆ + 1)
SMA = NLC₁ + NLC₂ + NLC₃ + NLC₄ + NLC₅ + NLC₆

SMA Headcount = 6
SMA Role fitness = 5.5
In this case the full headcount was used to achieve lower job fitness than will be achieved with resources with the required Natural Level of Competence and Capability. This formula suggests that while Compensation might be an interim fix to get a specific job done at the required deadline date, it is not a long-term strategy as it does not increase the Organisation’s Natural Level of Competence.

6.6.4 Scenario 4 – Leaving a required position vacant
Not filling a role does not mean that the work is no longer required. The work must still be done and is often picked up by others. This is a form of compensation at a lower headcount.
The developed formula for this scenario is as follows:

\[ SG = \sum_{i=1}^{6} \left( NLC_i \times \left( \frac{\sum_{j=1}^{m} (1 - JF_{ij})}{m} \right) \right) \]

\[ SMA = (NLC_1 (1+1) + (NLC_2 (0.25 + 1 ÷2)) + (NLC_4 (1+1) + (NLC_5 (1+1) + (NLC_6 (0.25 + 1 ÷2))) \]

\[ SMA = NLC_1 + NLC_2 + NLC_4 + NLC_5 + NLC_6 \]

SMA Headcount = 6
SMA Assumed role fit = 4.25

When a job is left vacant the optimal compliment for the Organisation’s Skill Demand is not achieved and the actual headcount is lower than approved for the Os. Not filling a position and requiring current staff to compensate for the missing team member reduces the Organisation’s Natural Level of Competence in excess of the reduction made by employing a less qualified person.
6.6.5 Testing a few field codes

A selection of codes is tested against the formulas. The objective is to see how skills gaps were formed.

13 - Frequent organisational structure changes

The demand is restated over and over with significant enough changes in the scope of the job to motivate for a structure and headcount change. Where the functional structure (departments) change, it may suggest lack of clarity of the DoE in question.

15 - Headcount freeze

Often a function of cost control, demand is stated but supply cannot be approved. The Organisation Skills Supply above will not be filled with a one to one skills fit resulting substitution, compensation while losing a role, or compensation while retaining a role.

63 - Resource planning lead to unplanned promotions

The substitution scenario above can lead to unplanned promotion where a person is assigned to a role for an unplanned or interim need but may end up retaining the role.

69 - Role clarity

71 - Role-boundary changes

Both the substitution and compensation scenarios lead to concerns in role clarity and role boundary changes for both the individual as well as the team members working with this individual.

76 - Skills offered are not utilised

The Organisation Skills Supply equation requires a full assessment of the available skills in the entire organisation to increase the skills match to each available job. The higher this match, the lower the Organisation Skills Gap result will be.

80 - Unavailability of policy and processes to enforce dismissal when required

81 - Unavailability of policy and processes to transfer a resource

87 - Unwillingness to share or redeploy a resource
The Natural Level of Competence and Capability is less than 1 in the role the person currently occupies but this person remains in the position while not adding the value of 1 full person thus increasing the Organisation’s Sg.

64 - Resume is excluded from recruitment pool due to age, gender or ethnicity
The Organisation Skills Supply is affected by a smaller recruitment pool from which a full match can be made. It is still technically possible to achieve a full compliment match provided that sufficient qualified resources are available from the approved age, gender and ethnicity groups.

65 - Resume is excluded from recruitment pool due to not having a minimum qualification
This is an attempt at reducing the level of mismatch between the individual’s Natural Level of Competence and Capability and the job requirement. However, the fieldwork suggested that the DOE of the qualification is not relevant. This study shows that the field of study is relevant to improve the possibility of an adequate match between the individual’s Natural Level of Competence and Capability and the job requirement as stated for the specific DoE.

66 - Retirement is delayed
This is a strategy to keep the Organisation Skill Supply equation as close to perfect as possible. This is a short term strategy. Retirement planning should be incorporated into the Organisation Skill Supply management process for early identification and replacement strategies to be effective.

67 - Retirement is forced
The forcing of retirement reduces the Organisation Skill Supply, at least temporarily while a similar and suitable person can replace the retired person. Retirement planning should be incorporated into the Organisation Skills Supply management process for early identification and replacement strategies to be effective.

68 - Rewarded for excessive overtime
Compensation results in people working additional hours to attend to two or more jobs. Some people might be more capable of context switching and handling multiple jobs
and may for a period of time cope with the additional demand. This is not a long term strategy and from the formula suggested, shows that the overall contribution is not entirely positive in the long run.

### 6.7 Conclusion

Chapter 6 developed the Skills Gap Management Model to demonstrate how the organisation works with the Technical and Operating Environment in which it operates to manage skills. The Skills Gap Management Model suggests that Skills Gaps are the result of how the organisation structures and operates itself amidst a known and constant Skills Shortage. To manage the occurrence of Skills Gaps the organisation must state a clear and accurate Organisation Skills Demand in context of the Domain of Expertise applicable to each job. These job profiles are then matched to individuals based on Organisation Skills Supply, which is the competency and capability the organisation has available or has access to from the Labour Market.

The Skills Gap Management Model assumes a minimum level of competency and capability in people at 60-70% mark of proficiency to ensure an adequate job fitness ratio. An organisation will achieve a Natural Level of Competence and Capability when it aims to achieve an adequate job fitness ratio in all the available jobs. Where an appointment to a job is made and the individual does not have an adequate job fitness ratio, a Skills Gap will be created.

Chapter 6 also used a selection of codes generated from field observations to demonstrate how the Skills Gap Management Model explain Skills Gaps being created through not attaining a sufficient job fitness ratio in an appointment or by compensating and substituting resources.

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1 Abbreviations applicable to this Chapter

<table>
<thead>
<tr>
<th>ABBREVIATION</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>OE</td>
<td>OPERATING ENVIRONMENT</td>
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<tr>
<td>TE</td>
<td>TECHNICAL ENVIRONMENT</td>
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<tr>
<td>ES</td>
<td>EDUCATION SYSTEM</td>
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### Chapter 6: Skills gaps management model

<table>
<thead>
<tr>
<th><strong>Acronym</strong></th>
<th><strong>Description</strong></th>
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<tr>
<td><strong>DOE</strong></td>
<td>DOMAINS OF EXPERTISE</td>
</tr>
<tr>
<td><strong>LM</strong></td>
<td>LABOUR MARKET</td>
</tr>
<tr>
<td><strong>SMA</strong></td>
<td>SKILLS MIX AND ALLOTMENT</td>
</tr>
<tr>
<td><strong>PPT</strong></td>
<td>PRODUCTION TOOLS AND TECHNIQUES</td>
</tr>
<tr>
<td><strong>SS</strong></td>
<td>SKILLS SHORTAGE</td>
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<tr>
<td><strong>SG</strong></td>
<td>SKILLS GAP</td>
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<tr>
<td><strong>OS</strong></td>
<td>ORGANISATIONAL STRUCTURE</td>
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<tr>
<td><strong>OM</strong></td>
<td>OPERATING MODEL</td>
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<tr>
<td><strong>MP</strong></td>
<td>MANAGEMENT PRACTICES</td>
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<tr>
<td><strong>SM</strong></td>
<td>SKILLS MIX</td>
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<tr>
<td><strong>NLC</strong></td>
<td>NATURAL LEVEL OF COMPETENCE AND CAPABILITY</td>
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Chapter 7

7 Study Conclusion and Contribution

7.1 Introduction
The purpose of this chapter is to reflect on the study and summarise the study contributions. This study set out to understand why so many organisations report that it cannot find suitable candidates when there are so many candidates looking for employment. The study problem statement suggested that there are organisations reporting that it cannot find suitable candidates while there are candidates with formal qualifications and experience not finding suitable employment. The study approached the fieldwork from the perspective of understanding what resource decisions organisations make to fill its jobs.

The fieldwork found evidence of inadequate skills management. Chapter 4 provided a taxonomy of skills management practices that look similar to general Human Resource Management Theory. The focus of chapter 4 was on how organisations mismanaged available skills. The fieldwork generated ninety-one codes describing instances of inadequate human resource management decisions. This fieldwork lead to a review of Management Theory to find guidance on why the traditional management functions of planning, coordinating, commanding and controlling don’t seem to work as well as it is assumed to work. Management Theory further introduced concepts of Organisation Structure and Operating Models, which assisted in contextualising the organisational challenges in managing resources as observed in the field.

7.2 Contribution 1 – Addition to ethnography studies in Engineering
This study provides a rich description of human resource management practices as applicable today and it is a description coming from the field, by people engaged in the struggle for adequate skills on a daily basis. The ethnographic research methodology incorporated the researcher as a participant observer thus already involved in the culture to be studied thereby lending credibility to the observations
while being privy to detail and underlying currents not necessarily visible or available to outside researchers engaged in research and analysis based on negotiated terms. This study contributes to the body of research available that uses ethnography, and by extension qualitative research methodology, for research in the Engineering discipline such as those referenced for this study [88-91].

Could this study be done differently? Is it possible that some industry data was misinterpreted and lead to a study being developed that does not address a valid concern? Anything is possible and there might be readers such as Greenberg [13] and Cappelli [19] who are of the view that current skills gaps and skills shortage reporting is unsubstantiated and the lack of qualified people is a myth.

The primary study self-assessment used in support of the qualitative and interpretive nature of this study is the benefit on member checking [94]. These are people who act as sounding boards and who have subject matter knowledge, or theoretically rigorous and critical evaluation skills, in other words, those that can determine if you really know what is happening out in the field and those that challenge the logic and arguments presented. This study went through several iterations of concept and definition clarification to remove ambiguity; reliance on, and building of theoretical concepts on industry reported data that might not be representative of a larger view; as well as ensuring that concepts developed are context or incidence independent.

Other data collection techniques could yield similar results than those achieved through observations. The study would remain a qualitative study and would still fit within constructivist-interpretive paradigm because that is the paradigm to which the researcher prescribes. The challenge was to turn negative and sometimes emotional observations into constructive and neutral contributions to the theory. The fieldwork did not attempt to count or keep record of observed instances of inadequate skills management. Annexure D attempts to capture a general view of how often the researcher encountered the incidences related to the final list of codes generated in this study. An event either was observed only on one occasion; or at least twice; or often (regular occurrence).
7.3 Contribution 2 – Working definition for Skills Gaps

The Skills Gap Management Model adopts the definition of a Skills Gap as the shortfall in performance delivery in people expected to have the skills to perform at the job but the model does not attribute this shortfall to a lack of predominantly professional skills as often suggested in the literature. Through the mechanism explained in the model, there are several factors leading to organisation decision making regarding its Skills Mix and Allotment, and subsequent utilisation, that contribute to a performance shortfall that may have very little to do with the person’s lack of communication or presentation skills.

The Education System’s response of adding professional skills to the curriculum in response to industry skills challenges may be misplaced. Such professional skills will certainly add to rounding off the total skills package the candidate offers but not at the cost of reduced focus on core competency. Industry can do very little with people below the 70% mark of proficiency in his Domain of Expertise. It needs one person at 70%, not two people at 35% proficiency each.

This study is contributing towards replacing the definition of Skills Gaps as a lack of skills in the individual with Skills Gaps being the result of the organisation processes and management practices. The objective is to transfer ownership of Skills Gap Management to the organisation to improve the way it staffs and manages itself given the current skills constraint. The rationale is that if organisations become more articulate in what they need and insist on a proper match while being aware of the core competency shortfall, including a plan to bridge that shortfall, then the Natural Level of Competence and Capability (as developed in chapter 6) of the organisation will rise and will influence the Labour Market and the Education System with a longer term view on skills development needs. The message to organisations is to avoid engaging in skills practices, which compensates or substitutes for the lack of skill and rather measure and manage the actual gap in competence.

7.4 Contribution 3 – Skills Gap Management Model

Chapter 6 developed the Skills Gap Management Model to demonstrate how the organisation works with its External Environments, the Labour Market and the
Education System to manage skills. The Skills Gap Management Model suggests that Skills Gaps are the result of how the organisation structures and operates itself rather than mainly due to a shortfall in performance delivery predominantly due to a lack of professional skills in the individual as suggested in the literature. The Skills Gap Management Model further suggests that an organisation should develop a clearly articulated Organisation Skills Demand. This implies properly scoped job descriptions to cater for the full range of the job to be done against which a proper skills match can be made through the Organisation Skills Supply which is the pool of resources that the organisation has access to, be they already employed at the organisation or available from the external Labour Market.

The Skills Gap Management Model acknowledges that a Skills Shortage exists and that the organisation operates within this constraint. The model does not attempt to address ways to reduce this shortages but provides the formula for determining the organisation’s exact need while being able to measure its exact supply to allow for the calculation of the job fitness ratio of the appointee to the job. With a more articulated definition of a Skills Gap, skills management interventions can be focused more effectively.

A main contribution of this study is a different take on managing human resources in Engineering and Technology jobs. Organisations must make a more concerted effort to clearly define the job (improve the job descriptions with reference to the Operating and Technical Environments in which it operates). These jobs must then be filled with candidates whose profiles match those job requirements. The immediate reaction is “but there is a Skills Shortage, the perfect candidate fit does not exist”. This is only true because organisations have not taken a firm stance toward not employing a lesser-qualified person. Jobs are not always scoped and defined correctly and organisations do not measure, document and manage the gap in competence and capability between the consciously well-defined job and the best fit it is able to make. The formulas offered in chapter 6 could be criticised for being of theoretical relevance only. However, for as long as organisations don’t put rigorous job descriptions and selection practices in place, the reported Skills Shortage and Skills Gaps will continue. The Skills Gap Management Model requires a mindset
change in organisations to strive for a good fitness ratio between the job and the individual and to put the interventions in place to drive change towards a general increase in the competency and capability of the organisation, or as developed in chapter 6, the Natural Level of Competence and Capability of the organisation.

### 7.5 Contribution 4 – Industry agnostic research data

Although the fieldwork observations were done in the Banking and Mobile Telecommunication Industries, the focus was on people, their work and how they were managed. The codes generated from the fieldwork are industry agnostic as it describes a human action. Member checking [94] of these codes by volunteers in the retail, manufacturing and medical aid administration industries confirmed applicability of these codes and concepts in these industries. This behaviour in people and their Managers is something they have witnessed or experienced before. The list of codes and descriptions contained in Annexure D to this study can form the basis for further research into specific areas of people management not necessarily associated with the Engineering and Technology industries.

### 7.6 Contribution 5 – Confirm the usefulness of current HRM Theory

Chapter 4 introduced a taxonomy of resource management practices from the field observation directly attributable to how organisations make resourcing decisions. This taxonomy was created from taking each uniquely identified occurrence of a resource decision and ordering these into theoretical concepts. These concepts are not dissimilar to HRM Theory. Although the objective, and approach taken during the analysis of the fieldwork, was not to fit these observations into a pre-defined theory, lower level code such as promotion based on tenure or retirement is forced very quickly pointed to HRM practices and principles.

Through several iterations of theoretical coding and analysis, the themes emerged and recognisable concepts from HRM Theory were established and adopted as such. This taxonomy is a complete representation of all the observations made during the fieldwork. Each observation found a place in the overall taxonomy. The taxonomy serves to illustrate that resource decisions in practice do represent the basic HRM
Theory in principle as organisations do recruit, do make promotion decisions, are faced with learning and development dilemmas and need to plan and structure work. It can be argued that HRM Theory is still relevant but may be interpreted or practiced different to how it was intended.

The industry agnostic data coupled with the use of existing HRM Theory helps to ground the field data in a known theory thereby strengthening its re-use for further studies in HRM Theory as well as general Management Theory.

### 7.7 Contribution 6 – Contribution towards unifying Management Theory

The review of Management Theory in chapter 5 highlighted the current discord in this discipline. It also showed work done toward unifying the views on Management and the need to re-use older theories and views such as Fayol’s [111], [116] which might still have relevance today.

This study supports the views of the authors arguing for the re-use of still relevant Management Theories [109-110], [113] for the management of modern business challenges. This study also concludes that a more holistic view needs to be taken on organisation management and the contribution of the chosen Organisation Structure and the Operating Model on improving the utilisation of the organisation’s human resource compliment. Through using Management Theory as well as theory on Organisation Structure and Operating Models, the Skills Gap Management Model developed in this study contribute towards unifying these theories for purposes of improved human resource management principles, but more in general, the improvement of business management.

### 7.8 Future work

The Skills Gap Management Model at first appears unachievable given the current skills shortages. It can further be said that such a perfect state is of theoretical value only. The researcher was however pleasantly surprised during the final weeks of compiling this end product at the number of organisations working towards a job fitness ratio as suggested in this model, or at least adopting some of the suggested
practices. The Mobile Telecommunication Company in scope of the fieldwork recently implemented a rule that the jobholder must have a minimum of a Bachelors’ degree for any managerial position. Added to this, the degree has to be in the correct Domain of Expertise for this job as suggested in the model in chapter 6. Similarly, several Senior Managers and Executives responsible for the capability of technology teams have embarked on an assessment of their teams’ current capability.

An implementation of the nature required to support this model obviously comes with challenges. To progress the ideas offered in this study, there is work required to develop an implementation roadmap as well as additional research on specific topics to build a solid foundation for industry adoption. We need to acknowledge and accept that the implementation of change in recruitment and selection practices or in the way we manage performance and skill utilisation will take time. Organisational change management will also be required for this change. It is interesting to see people perceiving the job requirements that must be defined to be equal to what a person with the perceived correct qualification can do or have been able to do ten years previously. Stakeholders and owners of the business cases for technology delivery will be hard pressed to accept new practices that might mean lower delivery or output in the short-term.

There is work done in recent years to improve work analysis techniques and to extend this to teams [57], [69-70]. Concurrent with this, there is work done to develop Engineering skills profiles and competency frameworks [18-19], [21], [23], 36-38. In parallel to these efforts, work is required to improve the structure and alignment of job descriptions and job specifications to the organisation’s strategic, tactical and operational objectives. A framework is required against which to judge if the job description adequately captures the context and complexity of the job while giving both the current and future skills needs. This is no small feat and is probably the Achilles Heel of making the Skills Gap Management Model practical.

Skills assessment techniques and tools might be affected by any drive towards establishing a job fitness ratio. In the absence of clearly articulated and valid job descriptions, organisations very often conduct subjective skills assessment that might
include a battery of personality and psychometric tests that may not be aligned to the real job need. Objective and measurable skills and performance criteria are required and although some industry benchmarks for specific techniques and tools might exist, the uniform adoption may be ambitious, if achieved at all. Organisations are after all profit-oriented concerns and will do what is necessary to increase the input to output ratio of their area of immediate control. Related to the tests we use is also test taking proficiency and the scope of the test that could include content in the individual’s Voluntary Marginal Competence and Capability area.

Defining a Domain of Expertise may be challenging too. What exactly does Software Engineering include and exclude and what is required to get industry to adopt that exact definition to structure its job descriptions and assessment tools accordingly. Further, there may be a need to start slower and at a lower base to avoid organisations feeling overwhelmed by the size of the measured skills gaps. The proficiency in the management layer may be so diluted that an accurate job description could be difficult to define due to the manager not being able to read the technical environment and know what the job needs. A useful approach may be reverse engineering to determine what “good resources” are able to do. Notwithstanding, the fact that a measure is determined between a job scope and the candidate currently filling that job, the organisation is moving towards managing a job fitness ratio and thus the quality of the skills as well as the output delivered.

### 7.9 Looking back on the study

This study is not without its shortcomings. Some of these study shortcomings, when initially reviewed for improvement, actually helped to develop the Skills Gap Dynamics model.

1. This study was conducted in an Engineering discipline and focused on the Engineer in practical work in industry. The study was planned to obtain fieldwork from current consulting engagements the researcher had in the Banking and Telecommunication industries. This study did not attempt to keep a documented count of incidences of inadequate resource decisions, but rather to describe any incidences of poor resource management decisions that
were encountered to understand how these contribute to the perception of skills gaps. The volume of field incidences obtained from the Banking industry far outweighs the field incidences from the Telecommunication industry. This may be a function of the convenient sampling approach of this ethnographic study in relation to the researcher’s contracted consulting work. However;

2. When the taxonomy concepts developed in chapter 4 were discussed with Senior Managers in a Telecommunication Network Operations division, they understood the concepts as valid concerns and had visibility of these in other divisions of their organisation but could say that some issues such as promotion based on tenure or lack of technical foundation were not applicable to their Network Operations division. Although this was initially seen as a sampling and transferability shortcoming, this review helped to develop the concept of NLc and pointed to the possibility that the observations being made were of people that are in fact not Engineers.

3. The profile of the Software Engineer for this study was assumed to include a person holding a formal software engineering qualification. Only a small number of the research participants had a formal software engineering qualification. These resources worked in teams where many team members had no formal degree qualification or had degrees unrelated to their technology jobs such as Zoology or Clinical Psychology. Some field observations were thus made not of Engineers as such but resources in engineering jobs without the required formal qualification. This insight helps to strengthen the premises in the Skills Gap Management Model of resource skills need at a 70% mark of proficiency in the exact Domain of Expertise.

4. The sampling was done at organisations, which got some resource decisions wrong. Although positive outcomes were not documented or analysed, there may be organisations that do much better resource decisions in context of the technical and operational environments in which they operate. Observations in such an organisation may not find the incidences recorded in this study but may render different issues not yet identified.

5. The study sample is South African. Our Education System allows the awarding of a matric certificate with a pass mark of 30% in Mathematics and
Science. A similar industry sample in another country with a higher pass mark and better general schooling system may yield different field results.

7.10 Conclusion

There is no silver bullet available to address a consistent shortage in skills but there are ways to improve the effects on the organisation while not having the skills it needs. It may sometimes be too easy to declare non-availability than it is to define, measure and manage this non-availability of skills. We cannot manage what we cannot measure. It is hoped that the ideas developed in this study can contribute to further research in management practices geared towards adequate management of the available talent pool and thereby improve the feedback to the educational institutions and general labour market mechanisms to continually increase the competencies and capabilities to stay aligned with increasingly complex jobs to be performed.
References


http://www.consultingcafe.com/articles/power-shift-independent-consultants-stepping-ahead?goback=%2Egmr_2272610%2Egde_2272610_member_249859565


# A. Publications from this study

Parts of this thesis have been published.

### PUBLICATIONS

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<th>Book Chapter:</th>
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Other publication on resource competency published before the fieldwork for this study commencement of this study:

<table>
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<tr>
<th>9 Essays contributed to a Book:</th>
<th>Status: Published</th>
</tr>
</thead>
</table>
B. Example of a personal anecdote

From: Wetselaar, Jacqueline
Sent: 26 October 2012 10:59 AM
To: Romo, Guera
Subject: Thoughts on the skills question

Hi Guera

I’ve been doing some thinking on the question of the skills gap we were speaking about the other day and I had some thoughts I’d like to share with you.

If I understood you correctly, your premise is that the skills are there, they are just not recognised. I was wondering whether part of the problem is the package modern business expects its skills to come in.

I know for instance that there are more women graduating from university than men (particularly in countries like the States and as far as I’m aware women are doing better at school than men in this country too (better pass marks for matric) so I’m assuming we will follow that trend). This means there are more highly developed skills in a female employee than in the male one. Yet business continues to show a preference for male employees (particularly when we get to the strategic level).

But it doesn’t end there …

The statistics around single parenting are getting pretty scary. I don’t know the exact numbers, but if I remember correctly the UN classifies approximately 60% of families across the globe as being “single parent” families. And most of these families are headed by women, who of course are in the workforce as single parents. This complicates things further, because a single parent has different needs in the workplace than someone who is young and single for instance. I have seen business overlook the possibility of utilising someone’s skills because they are unable to be at the office from 8am to 6pm.

Once again the skills are there, but not in a package the business recognises. And these trends are likely to continue: more women in the workplace, more skilled women in the workplace and more single parent families.

In my opinion, if business was more flexible and open-minded in looking for skills, they would find them in what they would consider to be the most unlikely places – but where they would find them wouldn’t surprise me at all 😊

And maybe all of these things are behind the growing trend towards more flexible work conditions.

Let me know what you think ….

Jacque
C. Example of a documented observation

9 February 2013
Observation and Interview content
“Release Notes”

Observation

One week prior to the delivery date of a SOA development component, the developer asked the Project Management Office for a template for the release notes saying he does not know what release notes are and why a developer should be documenting these. He also requested proof that he ever agreed to do this work, which was provided in the form of status meeting minutes. He then accepted the work should be done and returned 2 days later with an estimation of how long it would take him to complete this documentation. He needed an additional 3 weeks.

Observation Context

A SOA project is nearing the end of the Development Phase. The senior developer responsible for one of the integrating line of business systems completed a technical specification for the development that should be done. During the weekly status meetings it was confirmed that the solution handover to the IT Operations team would include all code locked down, all release notes, scripts, etc. documented and stored in a central location. The delivery date for this work was confirmed and the progress tracked for 8 weeks running.

Other contextual factors

1. The developer did not attend all the status meetings due to work pressure;
2. The developer also acted as the development team leader but assumed the role inconsistently;
3. The developer worked for a company that was acquired 18 months previously. There is evidence of poor human resource integration into the new holding company;
4. There is also evidence that this acquired company, based in Cape Town, had very informal IT practices;
5. The developer had in general a positive attitude towards the development work but was negative towards the IT leadership and was currently looking for alternative work but was bound by a relocation agreement that had not yet expire;
6. The Development Phase was 3 months overdue.

What was expected?

1. It was expected that the developer owned the team leader role including the commitments he made wrt delivery. Even if he did not attend every status meeting, he still received the meeting minutes. The scope of the delivery was pertinently stated, since there was concern about the handover criteria and procedures between teams due to immature SDLC processes;
2. It was further expected that he realised earlier he did not know what release notes were, went to find out and came back timeously with a new estimation of effort. It was
not expected that he would realise the scope or magnitude of the work when prompted one week before the due date;

3. It was expected that as a team leader he would think wider than his immediate development deliverable and understand and appreciate his contribution to the overall delivery and the impact of development delays on the IT Operations team.

**How does this observation relate to skills gaps?**

1. It is assumed that a senior developer knows what release notes are, why, when and how these should be done;
2. It is assumed that a senior member of a SOA team can think for himself, and his immediate team, while having an appreciation for the overall project/program delivery requirement and his contribution towards that delivery.

**Interview content**

(If/when observations is followed up by interview)

Project Manager (PM): “You confirmed that the handover to IT Ops will include all documentation, scripts, and be done in a formal handover document that is to be reviewed by the Head of IT Ops prior to the final delivery date. There now seems to be a misunderstanding with regard what should be completed. What do you realise now that you did not realise before?”

Senior Developer (SD): “I thought the handover document was the technical specification for the system as well as the technical design documents for the ESB. Those documents they already have.”

PM: “The IT Ops team must implement the new solution and support it. How will they implement the new functionality if they do not have an implementation guide?”

SD: “They are already supporting the system. If I give them the scripts, they should be able to do it. Besides, very little changed and they can get the background of the functionality change from the technical spec.”

PM: “We are one of several teams making changes to that system. As an organisation we also do not have mature change control processes or stability in our IT Ops team. The reason for a formal document was twofold. Firstly to make sure nobody has to guess about the new functionality, implementation and support requirements. And secondly, to manage roles and responsibilities with regard the quality and completeness of this team’s delivery.”

SD: “My job is to make the system changes. I don’t do documentation”.

PM: “Who do you believe should be doing the documentation?”

SD: “I don’t know. The IT Ops team can their own documentation if they need it. It is not my fault they don’t know what they are doing”.

**Impressions from the interview**

1. The developer was physically tired and demotivated;
2. While he was generally a positive person and had good working relationships with his immediate team, he did not feel like he “belonged in this company” and was therefore
disinclined to put in extra effort;

3. He felt that the documentation was not his responsibility and would not have been necessary if competent people were to work with him on this project;

4. He had no respect for the IT Ops team and believed they had no competencies. This view is not without merit. The IT Ops team was staffed with very junior people who would do better in a help desk environment. The most senior member of the IT Ops team was frequently absent. The IT Ops team should have been a full member of the SOA project team but never made the transition properly, hence the emphasis of having all design, development changes and solution insight properly documented.
D. Codes and coding

Atlas.Ti was used very early in the study to code both the literature relevant to this study to identify the core concepts to explore in the fieldwork as well as an early attempt to code the field observation documents. Due to the value of Atlas.Ti being in the relationships between the codes to determine a hierarchy in the codes, Atlas.Ti was abandoned as the fieldwork was trying to understand "what there is to know", not why or how influenced. MSExcel and blank sheets of coloured paper served the analysis better.

Below is an extract of early coding in Atlas.Ti. This is followed the Excel spreadsheet and snapshots of the manual analysis.

All (20) quotations from primary document: P 3: Release Notes v2.pdf

(Z:\Desktop\Release Notes v2.pdf)

HU: DPHIL Fieldwork
File: [C:\Users\Guera\Documents\Scientific Software\ATLAS\TextBank\DPHIL Fieldwork.hpr6]
Edited by: Super
Date/Time: 2013-07-19 13:48:17

P 3: Release Notes v2.pdf - 3:1 [One week prior to the delivery..] (1:93-1:297) (Super)
Codes: [Resource has not done this job before]
No memos

One week prior to the delivery date of a SOA development component, the developer asked the Project Management Office for a template for the release notes saying he does not know what release notes are

P 3: Release Notes v2.pdf - 3:2 [why a developer should be docu..

why a developer should be documenting these. He also requested proof that he ever agreed to do this work, which was provided in the form of status meeting minutes.

P 3: Release Notes v2.pdf - 3:3 [He then accepted the work shou..

He then accepted the work should be done and returned 2 days later with an estimation of how long it would take him to complete this documentation. He needed an additional 3 weeks.

P 3: Release Notes v2.pdf - 3:4 [The developer also acted as th..

The developer also acted as the development team leader but assumed the role inconsistently

P 3: Release Notes v2.pdf - 3:5 [The developer worked for a com..


The developer worked for a company that was acquired 18 months previously. There is evidence of poor human resource integration into the new holding company.

There is also evidence that this acquired company, based in Cape Town, had very informal IT practices.

The developer had in general a positive attitude towards the development work but was negative towards the IT leadership and was currently looking for alternative work but was bound by a relocation agreement that had not yet expire.

The Development Phase was 3 months overdue.

It was expected that the developer owned the team leader role including the commitments he made wrt delivery. Even if he did not attend every status meeting, he still received the meeting minutes.

It was further expected that he realised earlier he did not know what release notes were, went to find out and came back timeously with a new estimation of effort. It was not expected that he would realise the scope or magnitude of the work when prompted one week before the due date.

It was expected that as a team leader he would think wider than his immediate development deliverable and understand and appreciate his contribution to the overall delivery and the impact of development delays on the IT Operations team.
"I thought the handover document was the technical specification for the system as well as the technical design documents for the ESB. Those documents they already have."

"They are already supporting the system. If I give them the scripts, they should be able to do it. Besides, very little changed and they can get the background of the functionality change from the technical spec."

"My job is to make the system changes. I don't do documentation."

"I don't know. The IT Ops team can their own documentation if they need it. It is not my fault they don't know what they are doing."

The developer was physically tired

While he was generally a positive person and had good working relationships with his immediate team, he did not feel like he “belonged in this company” and was therefore disinclined to put in extra effort

He felt that the documentation was not his responsibility and would not have been necessary if competent people were to work with him on this project

He had no respect for the IT Ops team and believed they had no competencies. This view is not without merit. The IT Ops team was staffed with very junior people who would do better in a help desk environment. The most senior member of the IT Ops team was frequently absent.
Annexures

The IT Ops team should have been a full member of the SOA project team but never made the transition properly, hence the emphasis of having all design, development changes and solution insight properly documented.

Figure 29: Early theoretical coding

![Image of early theoretical coding]

Figure 30: Brown paper analysis

![Image of brown paper analysis]