Knowledge transfer and retention:
the case of a public water utility in South Africa

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Declaration

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Date: 1 March 2011

Summary

This thesis focuses on the problem of knowledge retention and transfer in the face of the imminent retirement of experts, who are hard to replace for demographic or skill shortage reasons.

Distinctions between technical, social and structural knowledge are made, and the theory on what makes knowledge "sticky" for transfer between generations of workers is reviewed. Thereafter, a case study of the knowledge retention situation at a public water utility is presented. In this regard, a large number of technical experts are due to retire within the next five years. Knowledge audit interviews were conducted with fifteen experts that have been with the organisation for most of their career and are due to retire soon. They were asked about what they considered to be their 'hard to replace' knowledge and professional networks, to what extent this could be captured or transferred, and what they considered to be the difficulties in terms of retaining this knowledge and these networks after their retirement.

It was found that the motivation of experts to contribute to knowledge transfer and retention was low. This had to do with the perception that more junior members of the organisation are in any case likely to leave and with an organisational culture that was not supportive of knowledge transfer and retention activities. Moreover, a lack of knowledge leadership and formal knowledge management systems hindered knowledge transfer and retention practices.

This study concludes that as far as the case in question is concerned, there is a need for a formal knowledge management system and strategy, and that top management commitment is critical for the success of knowledge transfer and retention. With regard to the theory of the stickiness of knowledge, the case study highlighted the importance of organisational culture and trust when it comes to the motivation of retiring experts to transfer their knowledge. It also emphasised that a silo-type organisational structure limits absorptive capacity, and that the social knowledge of professional networks, rather than technical knowledge, are the most difficult to retain.

Opsomming

Die tesis fokus op die problem van kennisbehoud en –oordrag teen die agtergrond van diensverlatende spesialiste wat moeilik vervangbaar is vanweë redes van demografie of vaardigheidtekort.

Onderskeidinge word getref tussen tegniese, sosiale en strukturele kennis en 'n oorsig word gegee van die teorie oor "klewende kennis" in die oordrag van kennis tussen generasies van werkers. Daarna word 'n gevallestudie van die kennisbehoudsituasie in 'n publieke waterverskaffer ondersoek. In hierdie geval sal 'n groot getal tegniese spesialiste binne die volgende vyf jaar die organisasie se diens verlaat. 'n Kennis-oudit is met behulp van onderhoude met vyftien sulke spesialiste, wat die grootste deel van hulle loopbane by die onderneming werksaam was, onderneem. Hulle is uitgevra oor wat hulle sien as die kennis wat met hulle diensverlating vir die organisasie verlore sou gaan en omtrent die professionele netwerke wat hulle onderhou. Hulle is gevra tot watter mate hierdie twee kategorieë van kennis oordraagbaar is om so vir die organisasie behou te kan word en wat hulle reken die probleme is wat in die pad van kennisbehoud na hulle aftrede staan.

Daar is bevind dat die spesialiste se motivering om by te dra tot kennisbehoud en –oordrag laag was. Dit het te make met die siening dat die jonger lede van die organisasie in elk geval die organisasie sou verlaat en met 'n organisasie-kultuur wat nie kennisbehoud en –oordrag ondersteun nie. Verder is dit toe te skryf aan 'n gebrek aan kennisleierskap en formele kennisbestuursisteme.

Die gevolgtrekking word gemaak dat sover dit die gevallestudie aangaan, 'n formele kennisbestuurstelsel en –strategie krities is vir die sukses van kennisbehoud en –oordrag. Met betrekking tot die teorie oor klewende kennis het die gevallestudie die belang van organisasie kultuur en vertroue wanneer dit kom by die motivering van spesialiste om hulle kennis te deel belig. Dit het ook beklemtoon dat 'n silo-gebaseerde organisasie kultuur die kennis absorpsie vermoë verlaag en dat die sosiale kennis van professionele netwerke moeiliker is as tegniese kennis om te behou.

Acknowledgements

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I would also like to give my thanks to the following people:

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Dedication

This thesis is dedicated to Hunadi wa Sefetse sa Gobetse

My granny, you are my guiding angel wherever you are.

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List of Acronyms

APQC	American Productivity Quality Center
AWWA	American Water Works Association
CIDB	Construction Industry Development Board
CoPs	Communities of Practice
CSIR	Council for Scientific and Industrial Research
DWA	Department of Water Affairs
ECSA	Engineering Council of South Africa
ERWAT	East Rand Water Care Company
IEC	International Electrotechnical Commission
I-Space	Information Space
ICT	Information and Communications Technology
IT	Information Technology
IWA	International Water Association
HR	Human Resources
KM	Knowledge Management
KMS	Knowledge Management System
SABS	South African Bureau of Standards
SAICE	South African Institute of Consulting Engineers
SALGA	South African Local Government Association
SAM	Strategic Asset Management
SWOT	Strengths, Weaknesses, Opportunities and Threats
TUT	Tshwane University of Technology
UJ	University of Johannesburg
WISA	Water Institute of South Africa
WRC	Water Research Commission

Chapter 1

Introduction and background

1.1. Introduction

Many companies around the world are rapidly approaching a crisis in their workforce, triggered by the convergence of two demographic trends: the growing number of aging workers in the population and the shrinking pool of skilled younger workers who can replace them. The aging population is a global trend, and many countries are currently facing even greater demographic challenges.[1] In the past few years, companies have been so focused on downsizing in order to contain costs that they have largely neglected a looming threat to their competitiveness, the likes of which they have never before experienced: a shortage of talented workers and the aging workforce.[2] Many employees born in the late 1940s up to 1964, the so-called 'baby boomers', are beginning to retire *en masse*. The fact that baby boomers are retiring is probably not news to anyone. The problem will not just be a lack of old bodies in organisations. Dychtwald,[3] DeLong,[4] Slagter[5] and many others attest to the fact that skills, knowledge, experience and relationships will be lost every time knowledge workers retire, and these things take time and money to replace. Given the inevitable time lag between the demand for skills, experience and knowledge, and the ability of the educational system to provide them, companies will continue to experience a skills shortage in the fast-growing technical fields. Poole and Sheehan[6] contend that in addition to the loss of expertise and on-job knowledge built up during employees' careers, the loss of client intelligence, established internal and external networks and social and networking skills may also reduce organisational performance.

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[1] Bridgeford, L.C. 2008. Talent war goes global: AARP puts global spotlight on companies with age-friendly policies. *Employee Benefits News*, 22(15): 14.
[2] Dychtwald, K.; Erickson, T. & Morison, B. 2004. It's time to retire retirement. *Harvard Business Review*, March: 49.
[3] Dychtwald, K. et al. 2004.
[4] DeLong, D.W. 2004. *Lost knowledge: Confronting the threat of an aging workforce*. United States: Oxford University Press.
[5] Slagter, F. 2007. Knowledge management among the older workforce. *Journal of Knowledge Management*, 11(4): 82-96.
[6] Poole, D. & Sheehan, T. 2006. Strategies for managing the global brain drain. *Knowledge Management Review*, May/June.

Strack, Baier and Fahlander[7] identify two categories of demographic risks facing organisations. The first is capacity risk, which involves the impending retirement of large numbers of workers and the loss of accumulated knowledge and expertise. The second is productivity risk, which Strack and his colleagues describe as the risk of the overall effect of having older workers on the payroll. While age often brings valuable expertise and knowledge, it can also mean a lack of fully up-to-date skills, health problems and lowered motivation due to job and career satisfaction or inertia. As the baby boom generation moves into retirement, organisations must plan for the replacement of this large and knowledgeable cohort of workers.[8] Closely related to retirement is knowledge loss risk. When older workers leave the organisation, there is also the risk that the knowledge they possess will leave with them.[9] It is the latter that calls for a strategic framework of action for knowledge transfer and retention within organisations. The loss of knowledge decreases an organisation's capacity for effective action or decision-making.[10] Knowledge about the organisation, the processes within a company and much more critical knowledge need to be transferred to the next generation of employees.

The aging workforce phenomenon is a global trend. The statistics are quite compelling, indicating the seriousness of this phenomenon on a global scale. The literature has devoted a lot of attention to this topic, and the loss of organisational memory affected by impending retirements is a cause for concern in many organisations. Even before older workers start retiring in large numbers, they can pose distinct management challenges.[11] Age brings experience and wisdom, which make employees extremely valuable in all kinds of ways. Davenport et al. [12]argue that departing employees leave with more than they know - they also take with them critical knowledge about who they know. This information needs to be a part of any knowledge-retention strategy. According to Streb et al., "this demographic change has

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[7] Strack, R., Baier, J. & Fahlander, A. 2008. Managing demographic risk. *Harvard Business Review*, February, 86(2): 119-128.
[8] Calo, T. J. 2008. Talent Management in the Era of the Aging Workforce: The Critical Role of Knowledge Transfer. *Public Personnel Management*, Winter 2008, 37(4): 403.
[9] Calo, T. J. 2008: 412.
[10] Delong, D. W. 2004.
[11] Strack, R.et al. 2008: 121.
[12] Davenport, T. H., Salvatore, P. & Cross, R. 2006. Strategies for Preventing a Knowledge-Loss Crisis. *MIT Sloan Mangement Review*, 47(4): 31-38.

a significant impact on various dimensions of the society". [13] The shift towards an older population is mirrored in many companies and their age structure. There are applicable issues and related costs that could cause companies across industries to engage in what is called aging workforce management.[14] Burke and Ng[15] state that the aging of the workforce means that organisations might lose workers and employees due to early retirements, which is still a common practice in some companies to decrease the average high age and to manage the overall surplus of personnel. This could lead to a loss of important skills, experience and knowledge. For the management of affected companies, this does not only mean that they have to safeguard their organisation against a loss of knowledge if large cohorts of experienced people retire, but that they also have to face new challenges due to increased age diversity within the workplace.

1.1.1. The aging workforce phenomenon in a global context

According to a United Nations survey, "the magnitude, tempo and consequences of the global ageing workforce are issues of considerable significance for both developed and developing countries". [16] An aging workforce will compel businesses to change how they operate and could even threaten some companies' viability.[17] When an employee retires, a firm not only loses someone to do the work, but also the accumulated knowledge and expertise of that person. Strack et al. argue that "if many people are retiring and they are difficult to replace, your organization faces what we call capacity risk, a potential diminished ability to carry out the company's business of making a product or offering a service". [18] With the aging world population, the impact of this phenomenon is being felt in both developed and developing countries. In many studies, such as those conducted by Tempest et al.,[19] Strack et al.,[20]

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[13] Streb, C. K.; Voelpel, S. C. & Leibold, M. 2008. Managing the aging workforce: status quo ad implications for the development of theory and practice. *European Management Journal*, 26: 1-10.

[14] Streb, C. K. et al. 2008: 2.

[15] Burke, R. J. & Ng, E. 2006. The changing nature of work and organizations: implications for human resource management. *Human Resource Management Review*, 16(2): 86-94.

[16] United Nations. 1999. *United Nations Population Ageing*. Available at: http://www.undp.org/wdtrends/a1999/ageing.htm

[17] Strack, R. et al. 2008: 119.

[18] Strack, R. et al. 2008: 120.

[19] Tempest, S., Barnatt, C. & Coupland, C. 2002. Grey advantage: New strategies for the old. *Long Range Planning*, 35: 475-492.

[20] Strack, R. et al. 2008.

Blankenship et al.,[21] Jorgensen[22] and DeLong[23] (among many others researching this phenomenon), the fact that in most developed countries, the workforce is steadily aging, has been highlighted. A recent study by Moon et al.[24] presents a frightening picture, indicating that 65 percent of senior engineers worldwide will be eligible for retirement within the next three years. From a knowledge management perspective, the loss of the workforce due to retirement translates into a loss of critical, accumulated organisational knowledge.

The percentage of the U.S. workforce between the ages of 54 and 64, for example, is growing faster than any other age group. Strack et al.[25] indicate that the situation is particularly acute in certain industries. According to these authors, the energy sector is being hit hard, as more than a third of the workforce is over 50 years old, and this age group is expected to grow by more than 25% by 2020. The coming mass exodus of experience held by technicians and engineers in the electric power industry is a well-founded phenomenon.[26] This loss has been the subject of workshops, conferences, media reports and symposia. Figure 1 below illustrates the distribution of ages in the power utility industry.

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[21] Blankenship, L. & Brueck, T. 2008. Planning for knowledge retention now saves valuable organizational resources later. *American Water Works Association Journal*, 100(8): 57-61.
[22] Jorgensen, B. 2005. The ageing population and knowledge work: a context for action. *Foresight*, 7(1): 61-76.
[23] Delong, D. W. 2004.
[24] Moon, B.; Hoffman, R. & Ziebell, D. 2009. How did you do that? *Electronic Perspectives*, , 34(1): 20-29.
[25] Strack, R. et al. 2008: 120.
[26] Ray, D. & Snyder, B. 2006. Strategies to Address the Problem of Exiting Expertise in the Electric Power Industry. *Proceedings of the 39th Annual Hawaii International Conference on System Sciences*, Volume 10, 04-08 January 2006.

Figure 1 The aging of the utility workforce
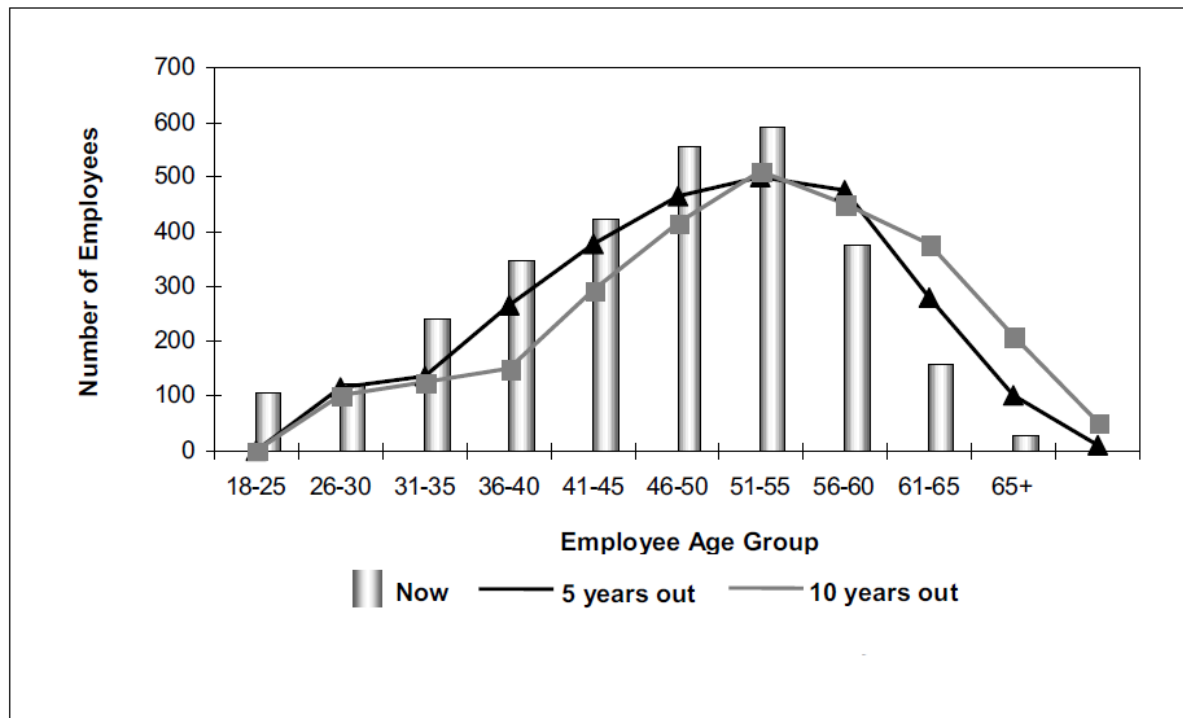
Source: KEMA Analysis (2005)

Davis[27] contends that the principal reason for the exodus of expertise is the aging workforce. According to predictions in the utility sector, the tipping point in accelerating retirements will come at the end of this decade.[28] Some utilities report that as much as 40 percent of their employees will be eligible for retirement in the next five years.[29] However, the average may be more to the order of 20 percent over the next five years and 50 percent over the next ten years.[30]

A major generational shift is also coming to the water and wastewater industry.[31] It is stated that this major change will present both problems and opportunities to water utility managers

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[27] Davis, R. 2005. *The Aging Utility Workforce: Increasing Pressures on Resources, Costs, and Productivity.* KEMA Inc., March 2005.

[28] Mueller, K. 2004. Envision the Utility of Tomorrow. *Public Utilities Fortnightly*, 62-66: 39-45.

[29] Bridgers, M. 2005. The Aging Workforce: The Facts, The Figures. *Presentation at the EEI Transmission, Distributions, & Metering Spring Conference 2005.* Tampa Bay, Florida, April 3-6, 2005.

[30] Ray, D. and Frank, W. 2005. Collaboration to Facilitate Research and Education in a Transitioning Electric Power Industry. *International Energy Journal*, 6(1), Part 4: 4-164.

[31] Olstein, M.A., Voeller, J., Marden, D.L., Jennings, J.D., Hannan, P.M. & Brinkman, D. 2005. *Succession Planning for a Vital Workforce in the Information Age.* Denver: AwwaRF.

worldwide. Blankenship et al.[32] state the fact that large numbers of water utility workers are retiring or leaving to seek opportunities elsewhere. The departure of these workers is well documented in the literature. An American Water Works Association Research Foundation (AwwaRF) study[33] published in 2005 found that half the water utility workers were older than 44 years, and the average retirement age was determined to be 56. The same report argued that many water utilities will lose 30-50 percent of their current workforce within the next 5-7 years, an unprecedented loss of knowledge for any organisation. Figure 2 below illustrates the global trend in the next 5 to 10 years in the water utility industry.

Figure 2: Most utilities have a window period of 3 to 5 years to transfer knowledge
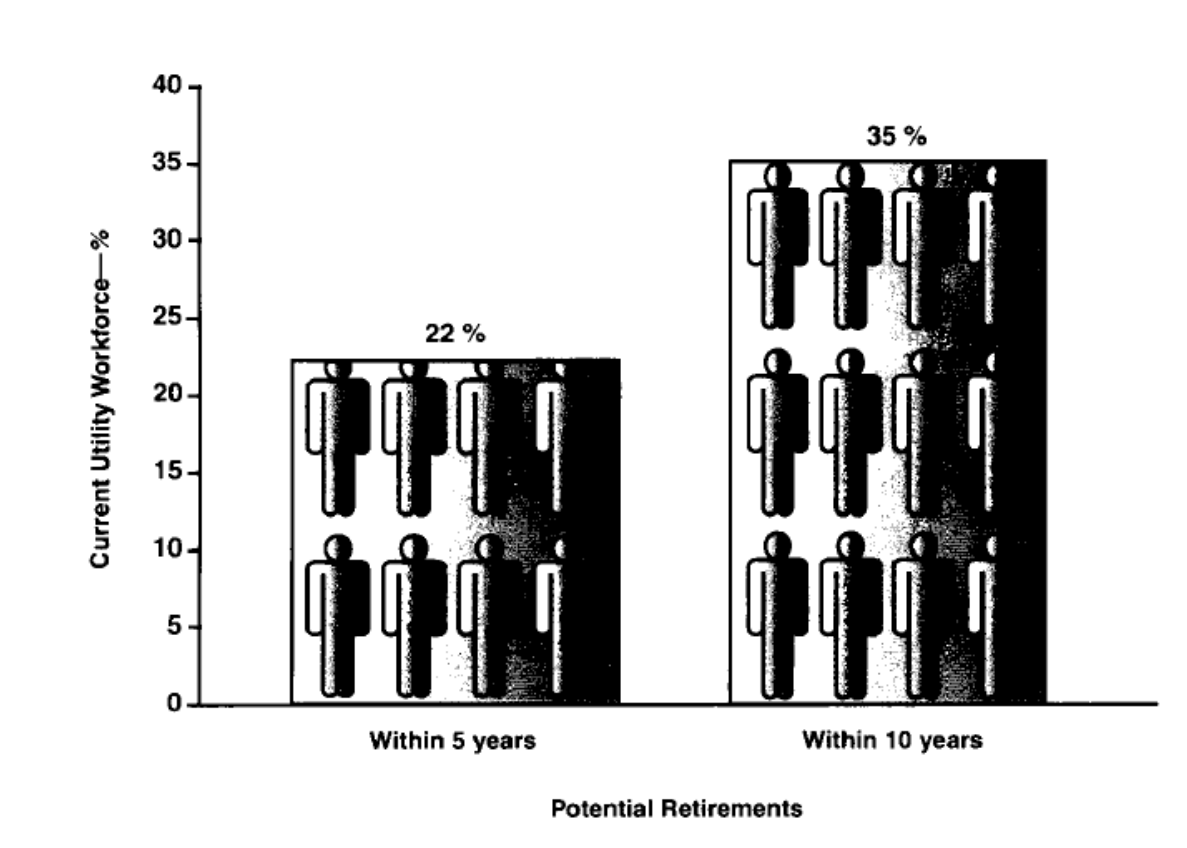
Source: Blankenship et al. (2008)

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[32] Blankenship, L. & Brueck, T. 2008: 57.
[33] Olstein, M. A. et al. 2005.

Experienced operations and maintenance workers have unique and critical knowledge that is used to ensure reliable and safe facility operations. Blankenship et al.[34] emphasise the fact that this critical knowledge often pertains to situations that may be infrequent, but with potential negative consequences, such as plugging or recovery of operations after an extreme weather event. Such a situation calls for a strategic framework to retain and transfer knowledge, in order to ensure long-term success.

This phenomenon is not only prevalent in the U.S.A. - elsewhere in the literature, it is also reported that Europe is experiencing a similar trend. IBM Consulting Services[35] reports that many European countries are wrestling with the common challenge of a greying population. The report points out that these countries built their economies using a labour force fuelled by the largest demographic booms in history. It is also argued[36] that both European governments and organisations are now faced with addressing the challenges of an aging workforce. In the United Kingdom (UK), the percentage of the population over 65 was anticipated to rise from 15 percent in 2001 to 20 percent in 2021, with 19 million people expected to be over the age of 60 in the UK by 2030.[37] Similarly, in other European countries, 20 percent of the population will be of a retirement age by 2016 in France, 2006 in Germany, and 2003 in Italy. In the same study, it is also reported that in Japan, the proportion of the population aged over 65 will also increase from 15.6 percent in 1997 to 27 percent in 2020. Figure 3 below indicates the employment rates of older workers in European Union countries . From the statistics mentioned above, it becomes apparent that the world population is indeed aging. Organisations need to do something to manage the impact of the demographic revolution. This revolution will mainly impact an organisation's ability to be knowledge productive and contribute to the landscape of lost knowledge in the workplace. Stam[38] points out that a related development of the aging population is that the proportion of older people within the working population is now accelerating, as the post-war baby boom generation approaches retirement. To illustrate this acceleration, between 2000 and 2006 the number of 55-65 year olds in the Dutch working population increased by more than 400.000, while the number of

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[34] Blankenship, L., & Brueck. T. 2008: 58.
[35] IBM Consulting Services. 2005. *Addressing the challenges of an aging workforce: A human capital perspective for companies operating in Europe*, 1-13.
[36] IBM Consulting Services. 2005: 1.
[37] Tempest, S et al . 2002: 476.
[38] Stam, C. D. 2009. *Knowledge and the ageing employee: a research agenda*. Available online http:www.scienceguide.nl/pdf/Stam200906.pdf, Accessed 07 July 2009.

25-35 year olds decreased by 370.000.[39] The aging and shrinking workforce will affect organisations over the next decade. As today's economy and the performance of firms is based mainly on knowledge and competing for knowledge (Drucker,[40] Nonaka & Takeuchi)[41], the aging workforce will affect the organisation's ability to be knowledge productive.[42]

Figure 3. Status of EU countries regarding aging workers

Source: IBM 2005

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[39] Stam, C. D. 2009.
[40] Drucker, P. F. 1993. *Post-capitalist society*. Schiedam: Scriptum.
[41] Nonaka, I. & Takeuchi, H. 1995. *The Knowledge creating company*. New York: Oxford University Press.
[42] Stam, C.D. 2009.

The aging workforce phenomenon and its impact on organisational competitiveness in Africa and South Africa in particular are not well-researched in the literature. However, this does not mean that South Africa can escape this global phenomenon. The aging population and its impact on both private and public sectors need to be thoroughly researched.

1.1.2. The South African context

South Africa is not an exception to this global phenomenon, even though, from a demographic perspective, South Africa looks different. What makes the South African case unique is that even though, demographically speaking, there are younger people available, there is still a shortage of skills for replacing those who are retiring. This has to do with educational challenges in the face of economic growth. Africa is experiencing a surge of growth in many sectors of the economy, and the skills shortage within the continent's most profitable industries is becoming an increasing cause for concern.[43] The establishment of a skilled workforce to match this development is and will continue to be a serious challenge. Africa does not have the same pool of professional people as the developed world, and those who are qualified leave their countries to look for greener pastures in developed economies.[44] Thus, Africa is faced with a 'brain drain' crisis. Many are discouraged from returning to their home countries by the economic and political crises that have bedevilled the continent over the last few decades. Failing economies, high unemployment rates, human rights abuses, crime, armed conflict, and lack of resources and infrastructure are some of the factors that force highly qualified African professionals to seek employment elsewhere in developed economies. It is estimated that since 1990, at least 20,000 highly qualified Africans leave the continent each year. This substantial brain drain arrests economic development on the continent.[45] Moreover, in order to fill the gaps created by the skills shortage, African countries spend an estimated $4 billion annually to employ about 100,000 expatriate non-Africans.[46] Africa is not only losing the bodies of these qualified professionals, but also a

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[43] Forsyth, R. 2010. The Threat of Skills Shortage: African Business Review examines high demand skills and ask whether Africa 's skills shortage could threaten the future growth and prosperity of the continent, *African Business Review*, July: 26-29.

[44] Mutume, G. 2003. Reversing Africa's brain drain: new intitiatives tap skills of Africa expatriates. *Africa Recovery*, 17(2): 1-8.

[45] Mutume, G. 2003:4.

[46] Mutume, G. 2003:2.

huge reservoir of knowledge, skills and expertise that could be used to improve the lives of Africans.

South Africa, as a mixed economy, is the most affected country on the continent. Skills shortages are a big problem in many sectors of South African business and industry.[47] Demographically speaking, South Africa has a lot of younger people, but from a skills perspective, it lacks the ability to replace the skills required to match economic growth. According to Forsyth[48], "job applicants at all levels in the industries will be needed including engineers, technicians, business development managers and scientists to meet the developmental goals of the country and the continent." It is stated that some of South Africa's best artisans, technicians, doctors and engineers are leaving the country for a variety of reasons.[49] The challenge is that it is the skills that South Africa needs most that are leaving with them. Combined with the general shortage of skills in key industry areas, this only serves to complicate the problem. This then poses a double problem in relation to economic growth and sustainability prospects for South African companies. Blankley et al.[50] indicate a concern that, since 1994, South Africa has experienced a loss of key human resources from the country through emigration. Over the same period, science and technology industries have been going through a major transformation, which includes increasing pressures on research institutions and universities to produce more graduates in science, engineering and technology areas. The problem of a serious shortage of engineers or a brain drain in the engineering fraternity has received a lot of media attention and publication. The output of engineering graduates at universities has declined significantly since the mid-1990s. Figure 4 below illustrates this decline.

[47] Erasmus, J. & Breier, M. 2008. *Skills and Shortages in South Africa*. Pretoria: HSRC Press.
[48] Forsyth, R. 2010:1.
[49] Kraak, A. & Press, K. 2008. *Human Resources Development Review 2008: Education, Employment and Skills in South Africa*. Cape Town: HSRC Press.
[50] Blankley, K.M., Maharajh, W., Pogue, R., Reddy, T.E., Cele, V. & Du Toit, M. 2004. *Flight of the Flamingos: a study on the mobility of R&D workers*. Cape Town: HSRC Publishers.

Figure 4 University Graduates: Engineering Bachelors Degrees 1991 – 2000
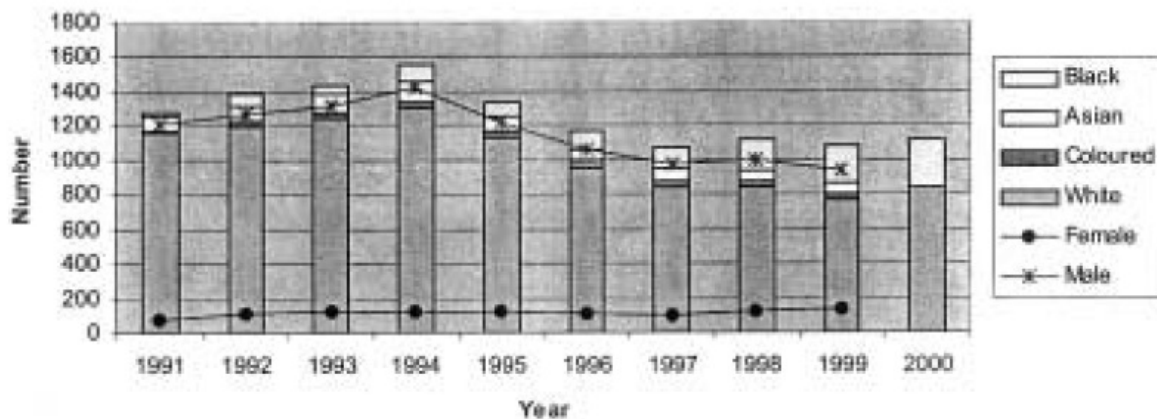
Source: Steyn & Daniels (2003)

It is also interesting to note that the enrolments for the National Diploma, Higher Diploma and BTech in engineering and technical disciplines are declining. The universities of technology (formerly known as technikons) were established to consolidate supply-side provision of technical capacity at the technician level. Kraak reports that the actual enrolments and graduate throughputs in engineering fields are declining.[51] It is ironic that these institutions were designed to provide technological education, but are currently witnessing a decline in the engineering fields. Figure 5 below illustrates these graduate declines at universities of technology. At the same time, there are increases in graduates and enrolments in softer, non-technical subjects such as business studies, which are not in serious demand in terms of economic and infrastructural development in the country.

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[51] Kraak, A. 2005. Human resource development and the skills crisis in South Africa: the need for a multi-pronged strategy, *Journal of Education and Work*, 18(1): 57-83.

Figure 5 Technikon Graduates: Engineering Higher Diplomas and BTech degrees
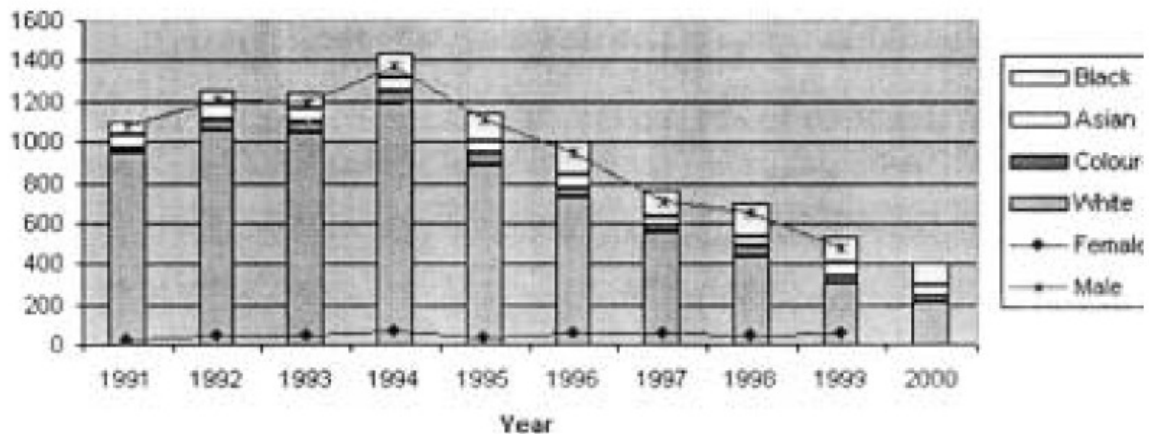
Source: Steyn & Daniels (2003)

It is widely reported that there is a serious shortage of engineering skills in South Africa. Du Toit and Roodt[52] state that the country is embarking on a massive and very expensive expansion in infrastructure, while at the same time facing a shortage of engineering capacity, particularly in the public sector. This has been described as one of the worst capacity and scarce skills shortage in years. The engineering skills shortage is the biggest issue facing the public and private sectors today, and is leading to a crisis that threatens the country's engineering capacity and ability to develop, refurbish and maintain the infrastructure.[53] It is proving extremely difficult to recruit professionals in the fields of engineering and technical knowledge. Figure 6 below illustrates the difficulties encountered in recruiting engineers and technicians.

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[52] Du Toit, R. & Roodt, J. 2009. Engineering Professionals, In: Erasmus, J., Breier, M (Eds). 2009. *Skills Shortage in South Africa*. Cape Town: HSRC Press, 75-112.
[53] Inggs, M. 2007. Global shortage, *Engineering News*, November 2007.

Figure 6 Occupational areas in which difficulties are experienced in recruiting qualified professionals
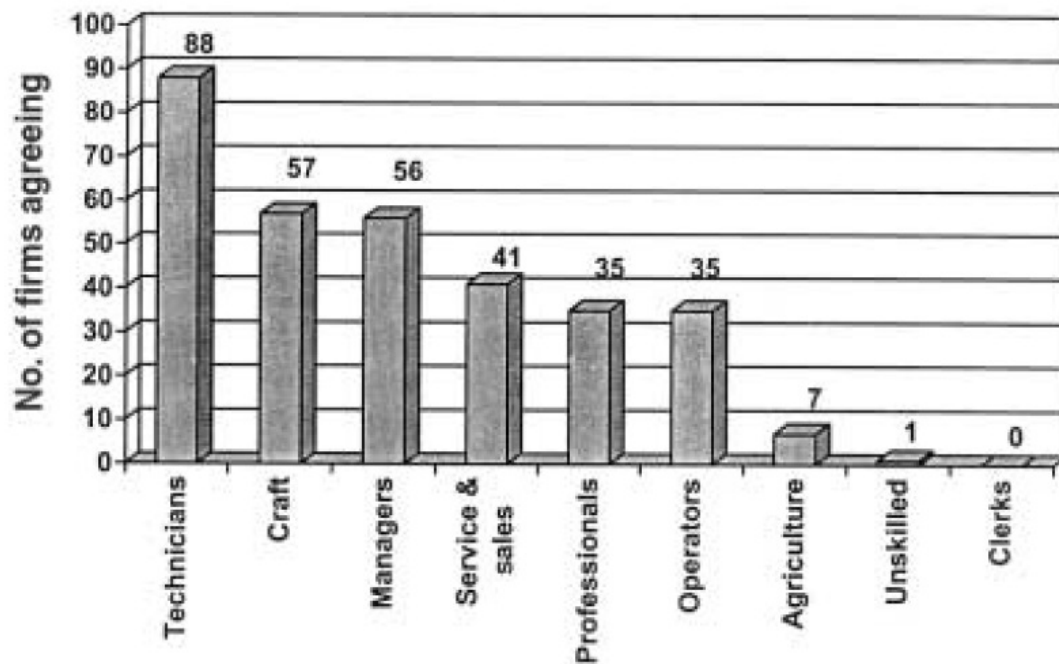
Source: Kraak et al. (2000)

There are many factors contributing to the situation. These include the status and image of the engineering professions in relation to other more lucrative careers, the shortage of matriculants who meet the criteria to gain entrance to engineering degree programmes, and the high quality of engineering education in the country, which causes graduates to be in great demand internationally.[54] Inggs[55] argues that some of the factors contributing towards the current situation include de-professionalisation of technical positions, which makes it hard to convince students to adopt engineering as a profession. In South Africa, this has resulted in the loss of professional expertise and knowledge, and an ageing professional group, which is further complicated by globalisation and the worldwide phenomenon of outsourcing.

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[54]Du Toit, R. & Roodt, J. 2008:75.
[55] Inggs, M. 2007.

As we can see, in South Africa one is faced with a special version of the aging workforce problem in the developed world.

1.1.3. The aging workforce phenomenon at a public water utility

The aging workforce in the public utilities industry is a well-known and documented phenomenon in the literature.[56, 57, 58 and 59] . Rand Water, the public water utility in South Africa, like many water utilities around the world, is faced with a major generational change in its workforce. Established in 1903 and currently 107 years old, the utility is confronted with the problem of an aging infrastructure and workforce in the core competence areas. Many of its scientists, technicians, artisans or engineers, who were born between 1946 and 1964, are occupying mission-critical specialist and managerial positions in the organisational structure, and are retiring within the next 5 to 10 years. This large wave of retirements will threaten long-term organisational survival. The trend with the baby boom generation is that they tend to stay long at an organisation. Certain skills that this public water utility will need when replacing the retiring knowledge workers, such as engineers, scientists and managers, are already in short supply and forecasted to become even more scarce. In an article published in the Mail & Guardian newspaper,[60] South Africa is cautioned to replace the aging workforce. It is also argued that South Africa should not only be equipping people with technical skills for current needs, but also for replacing its aging workforce in the future. The article reports that the current artisan population is aging, with an average age of 50 to 55 years. Rand Water is facing a significant threat to its survival, as well as a threat to its commitment to continue to provide reliable, sustainable and safe portable water to its customers, due to the imminent wave of retirements.

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[56] Olstein, M. A et al. 2005.
[57] Blankenship, L. & Brueck, T. 2008.
[58] Ray, D. & Snyder, B. 2006.
[59] Davis, R. 2005.
[60] Roberts, J. 2008. SA cautioned to replace aging workforce. *Mail & Guardian Online* . Available at: http://www.mg.co.za/printformat/single/2008-07-22-sa-cautioned-to-replace-aging-workforce, (Accessed 16 July 2009).

1.2.   Research Problem

As aging engineering and scientific experts begin to retire in large numbers, this disappearance of intellectual capital will make it difficult for public utilities to sustain their past competitive performance levels. Rand Water, a public water utility, is no exception to this global trend. Many of the top performing knowledge experts in the core competence areas are in their 50s and 60s. The retirement age at Rand Water is set at 63. Many of the workers in question have spent their entire career or most of it at the utility, and have acquired a tremendous amount of the knowledge, which is not formally transferred and retained when they leave the public utility. Currently, there are no systems or strategies in place to deal with the potential knowledge loss and to ensure the knowledge retention of retiring experts. Rand Water is therefore a good example of the knowledge management problem of knowledge transfer and retention. This is the problem that this study focuses on, and it does so by considering the magnitude of the problem in the very specific context of a public water utility, namely Rand Water. Whenever scientists or engineers retire or resign, their knowledge, skills, experience, judgement and professional networks walk out the door with them. Apart from the risk of losing expert knowledge about technical issues, there is also the risk of losing personal social networks which are needed for gathering information or networking with colleagues.[61] In addition, this generation of knowledge experts, engineers and scientists, in their own technical and specialised fields, will be harder to replace. As they retire, tacit knowledge will gradually disappear from the public water utility.

In his book review of 'Lost Knowledge: Confronting the Threat of an Aging Workforce' by DeLong,[62] Johnston[63] contends that losing human knowledge can seriously affect organisational performance. Some organisations are embarking on knowledge management initiatives and strategies without an understanding of why their knowledge assets are important. Rather than being in a position to make informed decisions about what knowledge they need to manage and retain when the experts retire, they attempt to manage everything,

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[61] Haarmann, J.; Kahlert, T.; Langenburg, L. and Muller-Prothmann, T. 2008. *K.exchange - A Systematic Approach to Knowledge Transfer of the Aging Workforce*. Available online at SSRN: http://www.ssrn.com/abstract=1203402. (Accessed on 06 July 2009).
[62] David, W. D. 2004.
[63] Johnston, L. 2005. Lost Knowledge: Confronting the Threat of an Aging Workforce. *Business Book Review*, 22(25): 1-11.

whether it is significant or not.[64] It is for this reason that a knowledge audit is to be conducted with these retiring knowledge experts, in order to determine what knowledge they have and how this knowledge can be transferred throughout the organisation prior to their retirement. The findings of such knowledge issues from Rand Water will be used to provide some focus and clarity on knowledge retention and transfer theory. In addition, the aim of this study is to contribute to the knowledge transfer and retention literature, using Rand Water's case as a knowledge management problem.

1.3.   Research Questions

The objective of the study was to establish the following research questions:

1. What knowledge is most at risk when organisational experts retire?
2. How critical is this knowledge to the survival of the organisation?
3. What knowledge management (KM) retention strategies can be put in place to address the potential lost knowledge?
4. How can the public utility mitigate the risk of knowledge, skills, experience and networks walking out the door when an expert retires?
5. Does the corporate culture support and value experience and expertise?
6. How can this public water utility institutionalise knowledge transfer and retention practices in order to manage workforce crises?
7. How critical is a knowledge audit of retiring experts to the development of knowledge retention strategies?

The ultimate goal of conducting these audit interviews with retiring experts was to use the findings as a launching pad for the development of knowledge transfer and retention strategies. Furthermore, and more importantly, the results and findings of such knowledge audits could be used to enhance understanding with regard to knowledge transfer and retention theory. This study contributes to the theory of knowledge transfer and retention, as well as using Rand Water as a case in point to add to and clarify the theory of knowledge stickiness outlined by Szulanski in the literature.

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[64] Henczel, S. 2000. The information audit a first step towards effective knowledge management: An opportunity for the special librarian. *Inspel*, 34(3/4): 210-226.

1.4.   Motivation for the study

In the literature, the aging workforce phenomenon and knowledge retention problems have been researched independently of each other in the empirical and theoretical literature. The aim of this study is to focus on knowledge transfer and retention at a public water utility company. As the so-called 'baby boomers' will retire in large numbers in the next five to ten years, well-planned and effective knowledge transfer and retention strategy within the organisation is of critical importance. What is not known is to what extent these engineers, scientists, technicians and managers are leaving without transferring their knowledge and expertise. According to Slagter, "knowledge about the organization, the processes within the company and much more critical organizational knowledge need to be transferred to other generation of employees". [65] If this does not happen, then this knowledge will disappear and the knowledge level of the organisation will become diminished and unbalanced.

The purpose of this study was to develop an ideal model of knowledge retention strategy for the public water utility faced with the threat of losing the knowledge of the aging workforce. For the purpose of researching this phenomenon, knowledge audit interviews were conducted with a focus group of retiring experts within Rand Water (those experts retiring in the next five years), with the aim to identify and address the potential loss of company knowledge and expertise as experienced and specialised employees retire.

1.5.   Research Methodology

In this study, the literature was used extensively to cover the theoretical foundations and empirical research conducted on retiring knowledge experts, knowledge audits, knowledge transfer and retention. In addition to the literature review and in order to enhance the understanding of the aging workforce in management practice, especially from a knowledge management perspective, knowledge audit interviews were conducted with an elite group of employees, most of whom were retiring from the public water utility within the next five years. Triangulation, a combination of both qualitative and quantitative approaches, was

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[65] Slagter, F. 2007: 82.

adopted as part of the knowledge audit interview instrument, in order to elicit information from engineers, scientists and technicians retiring within the next five years. Triangulation is viewed as a method of combining quantitative and qualitative approaches in one study.[66] Structured and semi-structured interviewing comprising mainly closed and open-ended questions were used. The qualitative component was used to elicit information on the potential loss of company knowledge and expertise as key knowledge experts retire, whereas the quantitative approach was used to cover numerical data in order to determine the numbers of years spent in the organisation, so as to build a business case for knowledge transfer and retention. These retiring knowledge experts can be regarded as people who are in a privileged position as far as knowledge is concerned, people in authority, or people who are particularly expert or authoritative.[67] Elite individuals, such as the retiring experts in this study, can be defined as those who have more knowledge and status, and who therefore assume a higher position than others in the organisation.[68]

In an elite interview, the interviewee has more knowledge of the subject area and a better grasp of the broader context than the interviewer. This approach is recognised as a useful tool because researchers have some control over the construction of data and because interviewing is flexible enough to allow issues to emerge during dialogue and discussions to be pursued.[69] McQuade et al.[70] concur that the rich data in interview transcripts means that the relative importance of issues, as viewed by the interviewee, can become clearer. The emphasis is on the viewpoints of the interviewee, not only on the predetermined ideas of the researcher.

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[66] De Vos, A.S. 2002. *Research at grass roots: for the social sciences and human service professions*. 2nd edition. Pretoria: Van Schaik Publishers.

[67] Gillham, B. 2000. *The Research Interview*. London: Continuum.

[68] Odendahl, T. 2002. "Interviewing elites", in Gubrium, J. F. and Holstein, J. A. *Handbook of Interview Research: Context and Method*. London: Sage Press, 299-301.

[69] Charmaz., K. 2002. "Qualitative interviewing and grounded theory analysis" in Gubrium, J.F. and Holstein, J.A. *Handbook of Interview Research: Context and Method*. London: Sage Press, 675-676.

[70] McQuade, E.; Sjoer, E.; Fabian, P.; Nascimento, J.C. & Schroeder, S. 2007. Will you miss me when I'm gone? A study of the potential loss of company knowledge and expertise as employees retire. *Journal of European Industrial Training*, 31(9): 758-768.

1.6. Scope, delimitations and exclusions

The landscape of lost knowledge within organisations is broad and caused by many different variables, i.e. middle career turnover, retirements, early retirements, deaths, resignations and staff movements, among other factors. Delong[71] maintains that the effects of lost knowledge in organisations is both tangible and intangible. However the scope of this study was limited to knowledge workers (engineers, scientists, technicians and specialists) who were retiring within the next five years. These retiring workers were located within the core competence areas of the public water utility. This study is only limited to the threats of looming retirements, lost knowledge, knowledge transfer and retention in the public water utility industry of South Africa. This study did not include knowledge workers in other areas of the business, other than those in the core competence areas and support processes, as illustrated in Figure 7 below.

Figure 7 Public water utility core competence areas
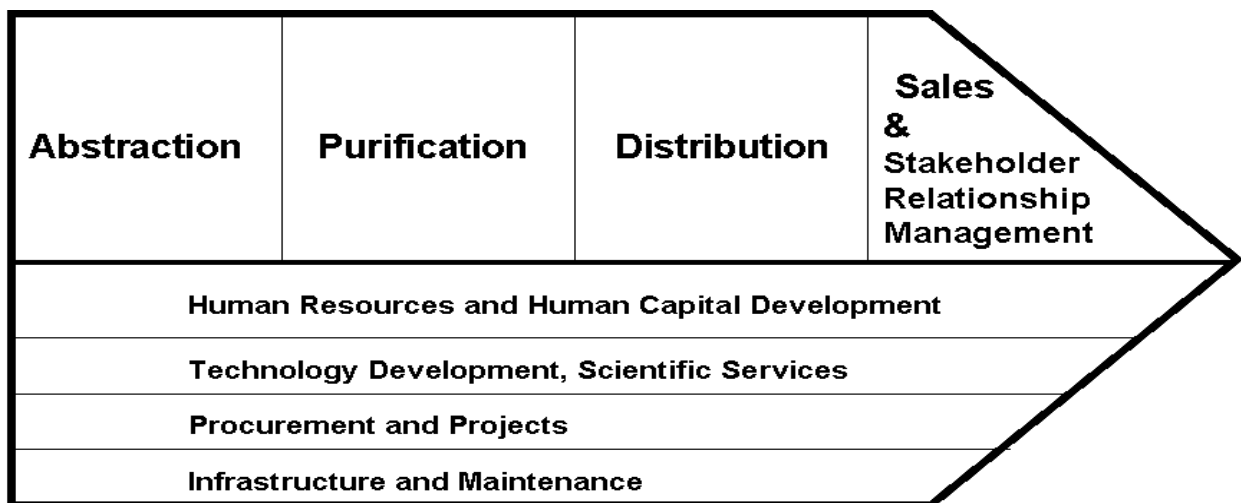
Figure 4. Model of Rand Water core competence areas adopted from Michael Porter
Competitive Advantage: Creating and Sustaining Superior Performance (1985)

Rand Water's core competences are abstraction, purification, distribution, sales and stakeholder relationship management. The support processes and competencies support the core competencies in their roles in the value chain. In order for this public water utility to

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[71] DeLong, W.D. 2004: 26.

survive the impact of an older generation mirrored in its company age structure in the core competence areas, it has to devise strategies to mitigate the consequences of this phenomenon.[72]

1.7.   Structure of the Study

This study proceeds as follows: Chapter 1 provides an introduction, background and overview of the aging workforce phenomenon on a global scale, as well as its impact on knowledge loss in organisations, particularly in the public utility company under study. Chapter 2 focuses on knowledge transfer and retention theory in relation to the aging workforce phenomenon. This chapter is theoretically grounded in the work of Boisot, McElroy, Szulanski and Becerra-Fernandez, and empirically grounded in the work of Delong. Chapter 3 provides a brief background to and current knowledge status of the public water utility used in this study. In addition, it also presents a literature review on knowledge audit theory and a discussion of the context in which the knowledge audit is to be conducted. Chapter 4 presents the findings of the knowledge audit interviews conducted in the public water utility and the implications for a knowledge transfer retention strategy. Chapter 5 provides an overall interpretation of the findings and reflects on the implications for practice and future strategic direction at Rand Water, as well as what one can learn from the case study in terms of the theory on knowledge retention and transfer.

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[72]"To summarize, the threat of losing important knowledge through retiring experts as well as the increasing number of older employees within the organization lead to financial and organizational challenges that management has to be prepared to face and cope with. To avoid the possible negative implications of an aging workforce, organizations are compelled to implement appropriate human resource measures to manage, for example, knowledge transfer between generations, or to arrange for new retirement and retraining policies, flexible work arrangements, suitable training and development, and appropriate organizational design" (Streb et al., 2008: 2).

Chapter 2

Knowledge transfer and retention

2.1.   Introduction

When a key employee leaves the organisation, expert knowledge leaves as well. Accordingly, this challenge becomes even thornier for organisations facing a surge in retirements. It can take years to transfer critical knowledge developed through many years of experience and job performance from experienced workers to their potential replacements. "It can take up to 10 years to develop the kind of deep smarts that these highly experienced workers will take with them".[73] In the meantime, losing critical knowledge can damage the competitive advantage of many organisations. This chapter explores the key concepts that need to be understood as part of the holistic effort to understand, retain and transfer the knowledge of the aging workforce. In order to achieve this, theoretical arguments and theories seen as influential in the field of knowledge transfer and retention are examined.

While the aging workforce phenomenon as a global trend has been thoroughly explored in the previous chapter, this chapter also attempts to look at knowledge transfer and retention efforts to address the knowledge that is at risk with impending retirements. In a nutshell, this chapter endeavours to focus knowledge management strategies (knowledge transfer and retention efforts) on organisations faced with similar changes, whereby skills, knowledge, experience and relationships will walk out the door every time a knowledge worker retires. Knowledge transfer and retention can be a corporate-wide, operating unit, functional or group level initiative, depending upon where lost knowledge is seen to be a threat.[74] Organisations need to think strategically in order to contain such risks within their businesses. They will also need to focus on reducing the uncertainty that is created by the threat of lost knowledge with impending retirements. Before looking in more detail at knowledge management efforts, this

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[73] Leonard, D. and Swaps, W.C. 2005. *Deep Smarts: How to Cultivate and Transfer Enduring Business Wisdom.* Harvard Business School Press.

[74] DeLong, D. 2004. *Lost Knowledge: Confronting the Threat of an Aging Workforce.* Oxford: Oxford University Press.

chapter attempts to unpack what is meant by the knowledge that needs to be retained and transferred within organisations.

2.2.   Theory of knowledge

In order to study organisational knowledge transfer and retention, the concept of knowledge first needs to be explored. Many authors in the field of knowledge management, such as Nonaka & Takeuchi, Polanyi, Boisot and others, have made considerable contributions to the theory of knowledge. According to Nonaka, "knowledge is defined as the set of justified beliefs that enhance a firm's capability for effective action". [75] This definition recognises the importance of individual perceptions, by viewing knowledge as a personal belief and including the need to justify it. The definition of knowledge can be both objective and subjective. The subjective and context-sensitive nature of knowledge implies that its categories and meanings depend on individual perceptions[76]. From the objective stance, knowledge is regarded as an object, which is representative of the world, independent of human perception, and exists in a variety of forms and locations[77]. This is in agreement with the early organisational transfer models that viewed knowledge as an object that could be passed on mechanistically from the creator to a translator, who would adapt it in order to transmit the information to users, as illustrated by Figure 8 below. According to Dissanayake[78], within this process, the user was generally viewed as a passive actor or receptacle of knowledge, and the context within which the transfer occurred was usually ignored. Accordingly, these classical models, as depicted in the figure below, imply a hierarchical, top-down relationship between the generator of knowledge, who holds the resource (knowledge), and the user (receptacle), who is locked into a dependency stance.

Figure 8 Traditional model of knowledge transfer
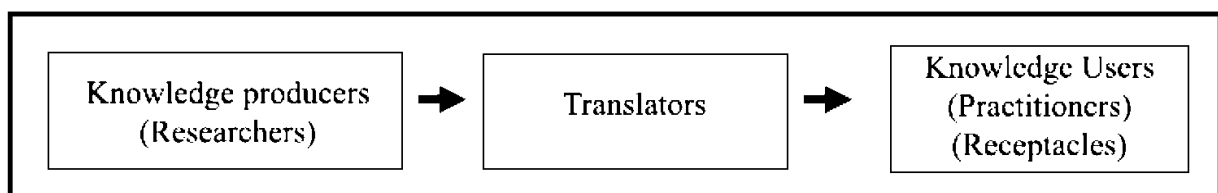
[75] Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1): 14-37.
[76] Davenport, T. & Prusak, L. 1998. *Working knowledge*. Cambridge: Harvard Business School Press.
[77] Beccera-Fernandez, I. & Sabherwal, R. 2003. *Decision Sciences*, 34(2): 225-260.
[78]Dissanayake, W. 1986. "Communication models and knowledge generation, dissemination and utilization activities: a historical survey", in Beal, G.M., Dissanayake, W. and Konoshima, S. (Eds). *Knowledge Generation, Exchange and Utilization.* Philadelphia, PA: Westview Press.

Source: Parent et al. (2007)

Many authors have criticised this linear model of knowledge for ignoring the reality of both the context in which the new knowledge is generated and the one within which it is used. For the purpose of this study, knowledge is therefore viewed as subjective, in that it is dependent on human perception. This perspective contends that knowledge does not exist independent of human experience - instead, it develops through the social creation of meanings and concepts, and therefore loses a universal objective character[79]. The subjective nature of knowledge is apparent in Polanyi's[80] view that knowledge resides in the individual, and in Nonaka and Takeuchi's[81] view of knowledge as a dynamic human process of justifying personal beliefs. Many similar studies, such as those conducted by McElroy[82], share the view that organisational knowledge is embodied in individuals and groups. Becerra-Fernandez[83] concurs that because different individuals have different experiences and backgrounds, their beliefs, and hence knowledge, could also differ from one another. Consequently, the focus of organisations should be on enabling individual employees to enhance their personal areas of knowledge, so that they can apply them effectively to the pursuit of organisational goals[84]. The subjective stance is in agreement with the social construction view of reality, which was introduced to sociology by Berger and Luckmann[85], in that it suggests that reality is reproduced by people acting on their interpretation and knowledge of it. According to this social construction theory, knowledge is developed, transmitted and maintained in social situations. As such, knowledge is a dynamic construct that evolves as it gets interpreted, used and reused. It is a product of the constant, everyday life interactions between humans and the social systems within which they are operating[86]. It must be emphasised that this distinction between the classical view of knowledge as an object and the subjective view of knowledge

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[79] Venzin, M.; Von Krogh, G. & Roos, J. 1998. Future research into knowledge management. In Von Krogh, G.; Roos, J. & Kleine, D. (year*). Knowing in firms: Understanding, managing and measuring knowledge*. Thousand Oaks, CA: Sage, 26-66.

[80] Polanyi, M. 1958. *Personal Knowledge: Towards a Post-Critical Philosophy*. London: Routledge & Kegan Paul.

[81] Nonaka, I.& Takeuchi, H. 1995. *The knowledge creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.

[82] McElroy, M. W. 2002. *The New Knowledge Management*: *Complexity, Learning and Innovation*. New York: Butterworth-Heinemann.

[83] Becerra-Fernandez et al. 2004:17.

[84] Alvi, M. & Leidner, D. 2001. Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quartely*, 25(1): 107-136.

[85] Berger, J.M. & Luckmann, T. 1966. *The Social Construction of Reality: A Treatise on the Sociology of Knowledge*. New York: Anchor Books.

[86] Parent, R.; Roy, M. and St-Jacques, D. 2007. A systems-based dynamic knowledge transfer capacity model. *Journal of Knowledge Management*, 11(6):81-93.

as the result of everyday interactions is crucial to our understanding of how knowledge is generated, distributed and used within social systems.

In our understanding of how this knowledge is generated and shared within the organisation, the distinction between the three terms, namely data, information and knowledge, is relevant for explaining knowledge. Knowledge builds upon information that is extracted from data[87]. In contrast to data, which can be characterised as a property of things, knowledge is a property of agents, predisposing them to act in a particular situation. Information is the subset of the data residing in things, which activates an agent through the perceptual filters. In contrast to information, knowledge cannot be directly observed. Its existence can only be inferred from actions of agents. It is argued that knowledge assets cannot be directly observed in nature, as they need to be apprehended indirectly. To draw an inference out of Boisot's argument, it can therefore be inferred that knowledge is at the highest level in a hierarchy, with information at the middle level and data at the lowest level.

Boisot's definition of knowledge is conceived in line with the argument advanced by Nonaka and Polanyi. Knowledge is the set of expectations held by an individual and modified by the arrival of the information. In other words, it is the agent's disposition to act on the basis of an internally held, tentative sets of beliefs. Therefore, knowledge, as discussed throughout this study, is defined in relation to the subjective nature of knowledge. The source or sender of knowledge may choose what part of his or her knowledge can be transferred to recipients. Similarly, the recipients of such knowledge can make a choice regarding what knowledge is of use in his or her particular circumstances.

To sum up the theory of knowledge, as discussed above, it is noted that none of the above specifically addresses knowledge from the organisational perspective. Instead, it is defined from a philosophical perspective. Organisations are pragmatic entities and a definition of knowledge therefore needs to reflect this emphasis. Nonaka and Takeuchi[88] come close to defining knowledge in useful and organisational terms. According to Thompson et al., in their

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[87] Boisot, M.H. 1999. *Knowledge Assets: Securing Competitive Advantage in the Information Economy*. Oxford: Oxford University Press.
[88] Nonaka & Takeuchi. 1995.

definition of knowledge, "knowledge is essentially related to human action". [89]However, this definition is silent in terms of the context in which this human action takes place. Thompson et al.[90] attempt to focus on the organisation. They define knowledge as "situated, re-usable human awareness leading to effective action". In virtually every situation, knowledge in the organisation is applied to the human actions of responding to specific needs, problems or opportunities. In other words, the nature of organisational knowledge is such that its effectiveness is the critical part of the definition. Knowledge experts are considered to be knowledgeable because they know how to take effective action in the situation for which the knowledge they have accumulated over a period of time is relevant. This also applies to the retiring knowledge experts at the public water utility.

2.3. Classification of knowledge

Human knowledge, in the mainstream literature on knowledge management, is generally divided into two types: tacit and explicit knowledge. Explicit knowledge can be expressed in words and numbers and shared in the form of data, scientific formulae, specifications, manuals and the like. According to Nonaka & Konno[91], this kind of knowledge can be readily transmitted between individuals, both formally and systematically. Knowledge that can be expressed in words and numbers only represents the tip of the iceberg of the entire body of knowledge: "We can know more than we can tell".[92] Polanyi alludes to the complex nature of tacit knowledge in this statement. This type of knowledge has a personal quality, which means that it is hard to formalise and communicate - it is knowledge that resides in an intuitive realm.[93] Tacit knowledge is derived from personal experiences, is subjective and difficult to formalise.[94] Therefore, tacit knowledge is often learned through shared and collaborative experiences. Acquiring knowledge that is tacit in nature requires participation and doing, and is therefore more of a 'hands-on' approach.

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[89] Thompson, M.P., Jensen, R.J. & DeTienne, K. 2009. Engaging embedded information: Towards a holistic theory of knowledge transfer in organizations. *Competitiveness Review: An International Business Journal*, 19(4): 323-341.
[90] Thompson et al. 2009:325.
[91] Nonaka, I. & Konno, N. 1998: 43.
[92] Polanyi, M. 1958. *Personal Knowledge: Towards a Post-Critical Philosophy*. London: Routledge & Kegan Paul.
[93] Nonaka, I. 1994:16.
[94] Nonaka, I.; Totama, R. and Nagata, A. 2000:2.

Nonaka and Takeuchi, in their 1995 study, examine knowledge according to two dimensions: ontological and epistemological. The ontological dimension relates to the nature of knowledge-related phenomena. In this regard, Nonaka and Takeuchi differentiate between the different types of knowledge, which can be found at individual, group, organisational and inter-organisational levels. Knowledge can be lost at the individual, group, functional and organisational levels. It is mentioned that knowledge lost at the individual, group or functional level can have implications for the organisation as a whole.[95] Similarly, knowledge is lost when individual experts retire or leave the organisation, and this affects the organisation at all these levels. A fundamental aspect of knowledge retention is determining what critical knowledge is most at risk of being lost. Knowledge is different from information: information is data or facts, whereas knowledge is the ability to make effective decisions. Frigo[96] identifies the following three types of knowledge which are essential in a public water utility:

2.3.1. Technical Knowledge

This encompasses individual capacities. It is what individuals know or know how to do. Technical knowledge is typically demonstrated as skill (i.e. the ability to operate a particular pump, the ability to use spreadsheet software, and an understanding of chemical reactions, etc). Technically specific knowledge is deep knowledge about a specific area. This includes knowledge about the tools and techniques that may be used to address problems in this area.[97] This kind of knowledge is often acquired as part of some formal training, and is then augmented through experience in the field.

2.3.2. Social Knowledge

Social knowledge is found in the relationships within an organisation. This includes working cultures. Individuals and groups develop networks of relationships that are crucial to the organisation. Cultural knowledge is the collective understanding of "how we do things" in a particular organisation.[98] An individual who wants to be accepted as a member of a group or the organisation learns and adheres to cultural norms. In simplistic terms, social knowledge is

[95] Delong, D.W. 2004: 27.
[96] Frigo, M. 2006: 83.
[97] Becerra-Fernandez, I. et al. 2004: 20.
[98] Aiman-Smith, L., Bergey, P., Cantwell, A.R. and Doran, M. 2006. The Coming Knowledge and Capability Shortage : Knowledge, skills and experience walk out industry's door opened by the growing wave of retirees. *Research Technology Management*, July-August:15-23.

an individual's ability to interact with other people or employees within and outside the borders of the organisation, and to adapt to the social networks of the organisation.

2.3.3. Structural knowledge

Social knowledge is embedded in an organisation's systems, processes, policies and procedures. Structural knowledge, on the other hand, tends to be explicit or rules-based. According to Becerra-Fernandez et al.[99], structural capital is everything that remains when the employees go home: databases, customer files, software, manuals, trademarks and organisational structures - in other words, organisational capability. Examples of such knowledge include knowledge of how to follow the utility's procurement processes, purchase a piece of equipment and navigate a permit process.

The public water utility under study has a high percentage of seasoned scientists and engineers over the age of 50, and is vulnerable to the loss of technical, structural and social knowledge. Indeed, utility leaders will need to focus knowledge retention strategies on these types of knowledge if they want to sustain current performance levels. A key aspect of a knowledge retention strategy is to not only identify the particular units within an organisation that could be vulnerable to the loss of technical and social knowledge, but also identify personnel who, if they leave the utility, could severely impact utility operations. Chapters 3 and 4 of this study attempt to identify these critical employees and their knowledge, which is at risk of being lost if not shared before these employees leave the organisation.

2.4. Knowledge transfer

From the literature reviewed,[100] it seems as though researchers within the area of knowledge transfer have different views regarding what knowledge transfer means. Knowledge transfer, normally discussed in relation to the concept of "best practice transfer", is defined by Szulanski[101] as "replication of an internal practice that is performed in a superior way in some part of the organization and is deemed superior to internal alternate practices and known alternatives outside the company", and where "practice" is taken to be the routine use of

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[99] Becerra-Fernandez, I. et al. 2004:3.
[100] Nonaka, 1991, Boisot, 1999, McElroy, 2004, Argote & Ingram, 1999, Szulanski, 1996.
[101] Szulanski, G. 1996.29.

knowledge. According to Carlie et al., "knowledge transfer is an area of knowledge management concerned with the movement of knowledge across the boundaries created by specialized knowledge domains". [102] In other words, it is the convergence of knowledge from one place, person or ownership to another. The literature reveals that many authors and researchers in the field of knowledge management have failed to provide a clear-cut definition of knowledge transfer - hence, at times knowledge transfer is often discussed together with the term "knowledge sharing". However, a closer scrutiny would suggest that the two terms are different in some respects. Knowledge sharing is a people-to-people process[103]. It is a process whereby individuals mutually exchange knowledge,[104] and is therefore a two-way process. In a nutshell, it consists of both the supply of new knowledge and the demand for new knowledge. Knowledge transfer, unlike knowledge sharing, is a one-way process, in that the source or sender transfers knowledge to the recipient.

Nonaka and Takeuchi[105] point out that knowledge sharing is a critical stage in the process of knowledge transfer. Nevertheless, this study has more to do with the process of knowledge transfer and retention, rather than knowledge sharing. Knowledge sharing in organisations involves exchange of knowledge at the individual level, whereas knowledge transfer goes beyond this level. For the purpose of this study, knowledge transfer is defined as a process of identifying and retaining knowledge that already exists in the organisation, and acquiring as well as applying it to enhance organisational performance and sustainability in both short-term and long-term planning. It includes the transfer of knowledge at higher levels such as the group, product line, department or division. Knowledge transfer in organisations is the process whereby one unit (e.g. group, department or division) is affected by the experience of another.[106] Knowledge transfer is defined at the individual level as how knowledge acquired in one situation applies or fails to apply to another. It is argued that although knowledge transfer in organisations involves transfer at the individual level, the problem of knowledge transfer transcends the individual level to include transfer at higher levels of analysis, such as

[102] Carlie, P. & Rebentisch, E. 2003. Into the black box: the knowledge transformation cycle. *Management Science*, 49: 1180-1195.
[103] Ryu, S., Ho, S.H. & Han, I. 2003. Knowledge sharing behaviour of physicians in hospitals, *Expert Systems with Applications*, 25: 113-122.
[104] Truch, A., Higgs, M., Bartram, D. & Brown, A. 2002. *Knowledge sharing and personality*. Paper presented at Henley Knowledge Management Forum.
[105] Nonaka, I. & Takeuchi, H. 1991. *The knowledge Creating Company*. Oxford University Press: Oxford.
[106] Argote & Ingram. 2000:151.

the group, product line, department or division. This difficulty of knowledge transfer is what is referred to as 'knowledge stickiness' by Szulanski.[107] Knowledge stickiness simply implies that knowledge is not such an easy thing to transfer from one person to another. Stickiness connotes difficulties experienced in the transfer process. Knowledge transfer in organisations manifests itself through changes in the knowledge or performance of the recipient units.[108] Therefore, knowledge can be measured by measuring changes in knowledge or performance. However, it is argued that organisations do not necessarily know all that they know. Szulanski and Von Hippel[109] suggest that this is because internal transfers of knowledge, rather than being fluid, are often "sticky" or difficult to achieve.

2.5. Knowledge transfer theory

In the existing body of literature on knowledge transfer, different models or paradigms of organisational knowledge transfer advance various theories. This illustrates why knowledge often remains a difficult phenomenon to study. Early organisational knowledge transfer models viewed knowledge as an object that could be passed on mechanistically from the creator to a translator, who would adapt it in order to transmit the information to the user.[110] It should be noted that within this process, the user was generally viewed as a passive actor or receptacle of knowledge, and the context within which the transfer occurred was typically ignored. Many authors have criticised this traditional model of knowledge transfer for ignoring the reality of both the context in which the new knowledge is generated and the one within which it will be used.[111] However, the most recent models, such as the communities of practice model and the knowledge network model seem to capture the imagination of the research and practice communities. The community of practice model has been described as groups of people informally bound together by shared expertise and passion for a joint enterprise.[112] Communities of practice are generally motivated by people realising that they can benefit by sharing knowledge, insights and experiences with others who have similar goals.

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[107] Szulanski, G. 2000. The Process of Knowledge Transfer: A Diachronic Analysis of Stickiness. *Organizationa*l *Behaviour and Human Decision Processes*, 82(1): 9-27.
[108] Argote & Ingram. 2000:151.
[109] Szulanski, G. 1994 and von Hippel, E. 1994.
[110] Dissanayake, W. 1986:67.
[111] Inkpen & Dinur. 1998; Frambach, 1993; Johnston & Leenders, 1990.
[112] Wenger & Snyder. 2000.

2.6. The impact of loss of knowledge through retirements

Most of the concerns that have been raised regarding the aging workforce involve the loss of knowledge as a result of the retirement of baby boomers, and the potential shortage of workers to fill the gaps that exist in the workforce. Many of these retiring employees have amassed great knowledge, skills and wisdom, which have either not been captured by the organisation's collective memory system or which have not been personally transferred to other individuals within the organisation.[113]: "The departing employees take many kinds of knowledge with them; subject-matter expertise, organizational memory of why certain key decisions were made and awareness of past company projects".[114] In a nutshell, when employees leave, they depart with more than they know - they also leave with critical knowledge about who they know. Studies have repeatedly demonstrated that such relationships are crucial sources of information and performance in organisations.[115] The fact remains that an employee who has been with a company for 15 years or more cannot simply be replaced by another individual, even someone with very similar skills, without resulting in disruptions in the web of formal and informal relationships that get the job done.[116] Co-workers require time to understand a new person's true expertise and determine when to seek out that individual. Building up such experience and networks is not an overnight process, but rather a continuous and lengthy one.

In the current knowledge economy, managers and knowledge workers work in a rapidly evolving technical and scientific environment. They gain experiential knowledge, only some of which is formally captured and shared. Inevitably, many are leaving without passing on valuable knowledge, experience and expertise. In many instances, successors only discover that they are missing key information through mistakes, unexpected quality defects or major costly disruptions. In a public water utility, such costly, unexpected disruptions or mistakes cannot be tolerated, as this would be gambling with millions of lives. These knowledge gaps can be difficult to pinpoint and diagnose because the work processes of today are very

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[113] Thomas, J. C. 2008. Talent Management in the Era of the Aging Workforce: The critical Role of Knowledge Transfer. *Public Personnel Management*, 37(4):403-416.
[114] Parise S, Cross R and Davenport. 2006. Strategies for Preventing a Knowledge-Loss Crisis. MIT Sloan Management Review. 31-38
[115] An overview of the importance of social networks in Cross R and Parker A. 2004. "*The Hidden Power of Social Networks: Understanding How Work Really Gets Done in Organizations*". Boston: Harvard Business School Press
[116] Parise et al. 2006.32.

complex. DeLong[117] points out that managers cannot afford to lose knowledge if they expect not only to sustain their current performance levels, but to also improve performance levels through innovation and growth. Business strategists, managers and leaders must therefore urgently address the issue of knowledge retention, which threatens to undermine the evolution of the knowledge economy. According to Johnston, "the challenges of knowledge retention are being driven by two forces that are shaping today's workforce,"[118] namely an aging population and the increasing complexity of knowledge needed in technologically advanced societies. These two forces together cause an acute skills shortage.

The challenge facing many organisations, both private and public, is not only the loss of some of their most experienced employees, but also the fact that many of these knowledge workers and managers are taking with them new types of critical expertise and experiential knowledge that did not exist a generation ago. In the new economy, organisations are facing not only a labour shortage, but also a knowledge shortage. DeLong and Johnston emphasise the fact that the problem for management is not only one of a headcount - it is a question of retaining sophisticated, context-dependent knowledge that resides with an employee who is leaving.[119]

Recognising that lost knowledge can be a threat to organisational performance is the first important step. The design and implementation of effective knowledge transfer and retention strategies will require managers to understand the forms and types of lost knowledge and how they affect the organisation. Focusing on the threat of lost knowledge, instead of staffing shortages, will provide managers with a more accurate perspective on the impact of turnover on the knowledge economy. Knowledge is power and the economic engine of any business. Lost knowledge, broadly defined, means the decreased capacity for effective action or decision making in a specific organisational context.[120] The hidden or unanticipated costs of lost knowledge through retirements or any attrition are becoming a huge drain on organisational productivity and, in some cases, a threat to sustaining competitive advantage. In the long-term, organisations cannot compete effectively in the knowledge economy unless they are serious about knowledge retention. The best approach is to look at the impact of lost

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[117] DeLong D.W. 2004.
[118] Johnston, L. 2005. Review of "Lost Knowledge: Confronting the Threat of an Aging Workforce. *Business Book Review*. 22(25), 1-11.
[119] DeLong, 2004; Johnston, 2005.
[120] Johnston, 2005:3.

knowledge when employees retire, in order to develop strategies to effectively manage knowledge.

Delong[121] indicates that the problem of lost knowledge has four dimensions that business leaders need to understand, namely:

1. It can occur at the individual , group or organisational level;
2. It can have either anticipated or unanticipated effects;
3. It can have tangible or intangible effects; and
4. It can create immediate or delayed costs.

Different lost knowledge scenarios call for different solutions. Accordingly, recognising that lost knowledge through impending retirements may be a threat to business performance is a critical first step in addressing this phenomenon. According to Delong, lost knowledge can have an impact on organisational strategy and performance in five main ways, namely:

1. Reduced capacity to innovate;
2. Ability to pursue growth strategies is threatened;
3. Reduced efficiency undermines low-cost strategies;
4. Losing knowledge can give competitors an advantage;
5. Losing certain knowledge at the wrong time increases vulnerability.

Organisations need to identify these situations ahead of time, as this will assist them in focusing and aligning their knowledge retention initiatives, which will have the greatest impact on long-term business performance and sustainability. Senior management in organisations need to start thinking strategically about the threats and opportunities posed by retiring employees, and formulate strategies to respond to this phenomenon.

2.7. Knowledge Stickiness

Knowledge stickiness, which is also referred to as knowledge ambiguity in the knowledge transfer literature, is central to this study. Knowledge stickiness is one of the best predictors

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[121] DeLong, 2004:31.

of organisational knowledge transfer. According to Szulanski[122], one of the main reasons why knowledge does not flow within organisations is that people "stick" to their knowledge. Tacit knowledge is difficult, sometimes impossible, to capture, transfer and retain. Brown & Duguid[123] offer contradictory views on knowledge, which they describe openly or implicitly as something that is "sticky" or "leaky". They contend that the divergence is best resolved from the perspective of practice, which can embrace a single framework for the sticky and leaky manifestations of knowledge. It is important for the knowledge practitioners out there to realise that there are conflicting views and alternative approaches. Sticky arguments focus primarily on the challenge of moving knowledge inside the organisation. This is advocated by Szulanski[124] and von Hippel[125]. For example, von Hippel discusses the well-known path of resistance between a firm's research labs and engineering, while Szulanski examines the stickiness which is evident in attempts to move the knowledge inherent in "best practice" from one part of the organisation to another. In a nutshell, such discussions generally focus on the movement of knowledge within the borders of the organisation. Leakiness and the like, in contrast, generally focus on the external and undesirable spiral flow of knowledge outside organisations. Such a loss of knowledge beyond the boundaries of the firm to competitors has the potential to weaken the competitiveness of the firm. Liebeskind[126] argues that a firm's competitive advantage lies in its ability to prevent knowledge from leaking beyond the boundaries of the firm to its competitors.

The problem of stickiness has to do with the tacitness of knowledge. The difficulties involved in the transfer of tacit knowledge are seen as the cause of the stickiness of knowledge itself. It is argued that when knowledge is sticky and transfer is difficult, the implications are more strategic and may threaten a firm's long-term competitiveness, including new enterprise formation, exploitation of technological know-how, and the successful development and commercialisation of new products and services.[127] Some authors have shown an increasing interest in the phenomenon of organisational learning, which looks at how organisations

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[122] Szulanski, G. 2003. *Sticky knowledge: Barriers to knowing in the firm.* Thousand Oaks: Sage Publications.
[123] Brown, J.S. and Duguid, P. 1998. Organizing Knowledge. *California Management Review*, 40(3): 28-44.
[124] Szulanski, 1995, 1996.
[125] Von Hippel, E. 1994. Sticky information and the locus of problem solving: Implications for innovative. *Management Science*, 40(4): 429-439.
[126] Liebeskind, J.P. 1996. Knowledge, strategy, and theory of the firm. *Strategic Management Journal*, 17(Winter Special Issue): 92-107.
[127] Teece, D.J. 1998. Capturing value from knowledge assets: the new economy, markets for know-how, and intangible assets. *California Management Review*, 40(3): 55-79.

create, retain and transfer knowledge. [128] However, one of the findings of this focus on knowledge and learning is that the mere possession of potentially valuable knowledge somewhere in the firm does not necessarily mean that other parts of the firm benefit from this knowledge.[129] This is largely because internal transfer of knowledge is also a "sticky" or cumbersome process to achieve. Knowledge transfers are often laborious, time consuming and difficult. In a difficult transfer situation, problems are more likely to be escalated. Whereas some of the transfer-related problems will be diagnosed easily and resolved routinely by those directly involved with the transfer, other problems may transcend the resourcefulness of the organisational actors who are normally affected by and routinely resolve transfer-related problems.[130] Innovation depends on knowledge. Firms that create and use knowledge rapidly and effectively are able to innovate faster and more successfully than those that do not. It is also argued that tacit knowledge transfer boosts innovation in the organisation.[131] The greater the extent of tacit knowledge transfer, the more likely the firm is to be able to innovate effectively. This is largely because tacit knowledge is more difficult to transfer and deploy across the borders of the firm than leaky explicit knowledge. Such knowledge is more likely to be rare and difficult for the rival firms to replicate. Therefore, it is essential to examine the predictors of knowledge transfer, as discussed in the literature.

2.7.1. Factors affecting knowledge transfer and stickiness

Knowledge factors play a significant role in the success or failure of knowledge transfer. The higher the degree of tacitness of a firm's knowledge, the harder it is to be transferred from one firm to another. Zander and Kogut[132] posit that attributes of the knowledge being transferred are primary determinants of the effectiveness of knowledge transfer. As such, they may also moderate when and how trustworthiness affects the success of knowledge transfer. Trust is a critical element in the transfer process, especially in terms of tacit knowledge. Because of the personal nature of tacit knowledge transfer, trust and motivation to share are important factors in the transfer process. It is suggested that the levels of risk and uncertainty

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[128] Argote, L. 1999; Huber, G.P. 1991.
[129] Szulanski, G. 2000:10.
[130] Szulanski, G. 2000:10.
[131] Cavusgil, S.T., Calantone, R.J. and Zhao, Y. 2003. Tacit knowledge transfer and firm innovation capability. *The Journal of Business & Industrial Marketing*, 18(1): 6-21.
[132] Zander, U. and Kogut, B. 1995. Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization Science*, 6(1): 76-92.

that are associated with tacit knowledge transfer are reduced by trusting relationships.[133] While the integration of external technical knowledge into organisations can be governed and defined by licensed, legal contracts, the very nature of tacit knowledge places it beyond the influence of contractual agreements. Therefore, the transfer of tacit knowledge cannot be enforced by some contractual agreements. The transfer of such knowledge is not amenable to enforcement by contract - hence, the importance of trustworthiness in the transfer of knowledge. It is easy to infer, from the literature reviewed, that without trust there cannot be genuine tacit knowledge transfer amongst employees in the organisation. This is further supported by Foos et al.[134] in their study, which showed that tacit knowledge transfer is more likely to be successful when there is a higher level of trust among internal and external project team members. Szulanski asserts that the eventfulness of the knowledge transfer is likely to depend on the dispositions and abilities of the source and recipient.[135] The motivation of the source may be affected by an incentive to compete or collaborate with the recipient, and by the effort required to support the transfer.

The reliability of the source may also play a negative or positive role in the transfer process. According to Zander and Kogut[136], a capable and trustworthy source is more likely to influence the behaviour of the recipient. Similarly, the recipient may be more or less motivated to seek or accept knowledge from the source. It is argued that lack of motivation to transfer knowledge may result in procrastination, passivity, feigned acceptance, sabotage or even outright rejection in terms of the implementation and use of new knowledge.[137] Casual ambiguity in the use of knowledge is positively correlated with stickiness. When the claim that knowledge will be effective in solving the recipient's problem is partly speculative, it will be harder to induce a potential recipient to engage in the transfer of that knowledge.[138] Casual ambiguity exists when precise reasons for the success or failure of knowledge transfer are unknown. The exact conditions of the best practice cannot be reproduced, and the impact of the idiosyncrasies of the new environment cannot be fully understood. This is a problem

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[133] Roberts, J. 2000. From know-how to show-how? Questioning the role of information and communication technologies in knowledge transfer. *Technology Analysis and Strategic Management*, 12(4): 430.
[134] Foos, T., Schum, G. and Rothenberg, S. 2006. Tacit knowledge transfer and the knowledge disconnect. *Journal of Knowledge Management*, 10(1): 6-18.
[135] Szulanski, G. 2000.
[136] Zander, U. and Kogut, B. 1995. Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization Science*, 6(1): 76-92.
[137] Szulanski, G. 2000: 12.
[138] Szulanski, G. 1995:438.

related to the gap between what should be done and what is actually done.[139] It is also argued that difficulty in the replication of a capability is most likely to emanate from ambiguity regarding what the factors of production are and how they interact during production.[140] Unproven knowledge is another factor in the stickiness of tacit knowledge transfer. When the knowledge has a short, unproven track record or lack of evidence base, Szulanski argues that it will arouse suspicion and therefore increase stickiness. Status and trustworthiness of the source may positively influence the ease of transfer. However, trustworthiness may also be detrimental to the transfer process if the knowledge from a trustworthy source is flawed and the recipients assume that they do not have to critically appraise the transferred knowledge. On the other hand, however, trustworthiness and credibility are likely to facilitate transfer. Szulanski believes that lack of credibility of the source will be positively correlated with stickiness.

The arduous relationship between the source and recipient is another critical factor in the transfer process, and this does affect the stickiness of knowledge transfer. The transfer of knowledge, especially when such knowledge has tacit components, may require numerous individual exchanges.[141] The success of such exchanges depends on the ease of communication and intimacy of the overall relationship between the source and recipient. An arduous (i.e. laborious and distant) relationship might create some serious problems in the transfer, whereas intimacy eases communication between the source and the recipient. The fact that it is hard to identify and transfer tacit knowledge is the reason why the formal processes for its integration are often lacking and ignored, or even difficult to implement. It has been found that most difficulties in transferring largely tacit knowledge are a result of recipients lacking the experience to make effective use of new ideas, and the presence of arduous relationships.[142] There are also problems associated with identifying the precise tacit knowledge that needs to be transferred.[143] However, it is evident that explicit management

[139] Elwyn, G., Taubert, M. and Kowalczuk, J. 2007. Sticky knowledge: A possible model for investigating implementation in healthcare contexts. *Implementation Science*, 2: 1-8. Available at: http://www.implementationscience.com/content/2/1/44

[140] Szulanski, G. 1996. Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management Journal*, 17(Winter Special Issue): 27-43.

[141] Nonaka, I. 1994.

[142] Szulanski, G. 2003.*Sticky Knowledge: Barriers to Knowing in the Firm*. Thousand Oaks, CA: Sage Publications.

[143] Dayasindhu, N. 2002. Embeddedness, knowledge transfer, industry clusters and global competitiveness: a case study of the Indian software industry. *Technovation*, 22(9): 551-560.

models for tacit knowledge transfer are needed, and that they will differ from those for more explicit types of knowledge.

Knowledge transfer does not only take place within a social context, but the context itself is part of the content of the knowledge. The organisational context in which knowledge is transferred can negatively or positively influence the degree of stickiness in the transfer process. According to Szulanski[144], context consists of factors that influence the stickiness of knowledge or the difficulty in transferring it. Context, according to Inkpen and Dinur, shapes "a firm's ability to recognize, to utilize knowledge, and to derive competitive advantage from it". [145] The authors argue that five contextual dimensions shape the spectrum of the transfer process, namely environmental, cultural, strategic, decision-making and technological dimensions. An organisational context that facilitates the development of transfers is said to be fertile. In contrast, an organisational context that does not nurture knowledge transfers within the firm could be said to be barren. Formal structures and systems, sources of coordination, and cultures of the organisational context can influence the number of attempts needed to recreate knowledge and the fate of these attempts.

The factors that are crucial for knowledge transfer, according to the above authors, are mainly associated with the recipient's situation, such as lack of motivation, and lack of absorptive and retentive capacity. Table 1 below depicts all the predictors of stickiness. Recipients of knowledge might be unable to exploit outside sources of knowledge - that is, they may lack absorptive capacity. The premise of the notion of absorptive capacity is that the organisation needs prior related knowledge to assimilate and use new knowledge.[146] Accumulated prior knowledge increases the ability to internalise and remember new knowledge. The ageing experts have a rich prior knowledge in their various fields of expertise, and this will assist in reducing stickiness levels in the transfer process. Such capacity is largely a function of their pre-existing stock of knowledge, and is manifested in their ability to value, assimilate and apply new knowledge successfully for commercial ends. On the other hand, a recipient who lacks absorptive capacity will be less likely to recognise the value of knowledge and apply it

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[144] Szulanski, G. 1996.

[145] Inkpen, A. and Dinur, A. 1998: 9.

[146] Cohen, W.M. and Levinthal, D.A. 1990. Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35: 128-152.

successfully. Szulanski[147] argues that this may increase the cost, retard the completion, and even compromise the success of a recreation effort. A knowledge transfer process is only effective when the knowledge being transferred is retained. The ability of a recipient to institutionalise the utilisation of new knowledge reflects his/her retentive capacity. However, the absence of such ability will increase the number of difficulties in the process and create an excuse for discontinuing its use and reverting back to the previous status quo.

Table 1: Predictors of stickiness at different points of knowledge transfer

Communication elements	Predictors of stickiness
Knowledge	1. Causal ambiguity 2. Unproven knowledge
Source	3. Motivation of source 4. Credibility of source
Recipient	5. Recipient motivation 6. Recipient absorptive capacity 7. Recipient retentive capacity
Context	8. Barren organisational context 9. Arduous relationship between source and recipient

Source: Szulanski (1996)

2.7.2. Stages in the transfer process

The intra-firm transfer of internal knowledge is seen as an unfolding process consisting of stages in which characteristic factors not only appear to a greater or lesser extent, but also in a certain order of occurrence. Szulanski[148] identifies initiation, implementation, ramp-up and integration as the four critical stages in the transfer process. Each of these four stages can be problematic in its own way. Figure 9 below illustrates the unfolding transfer process.

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[147] Szulanski, G. and Jensen, R.J. 2004. Overcoming Stickiness: An Empirical Investigation of the Role of the Template in Replication of Organizational Routines. *Managerial and Decision Economics*, 25: 347-363.
[148] Szulanski, G. 1996. Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management Journal*, 17(Winter Special Issue): 27-43.

Figure 9: The process of knowledge transfer

Formation of the transfer seed | Decision to transfer | First day of use | Achievement of satisfactory performance

Initiation | Implementation | Ramp up | Integration
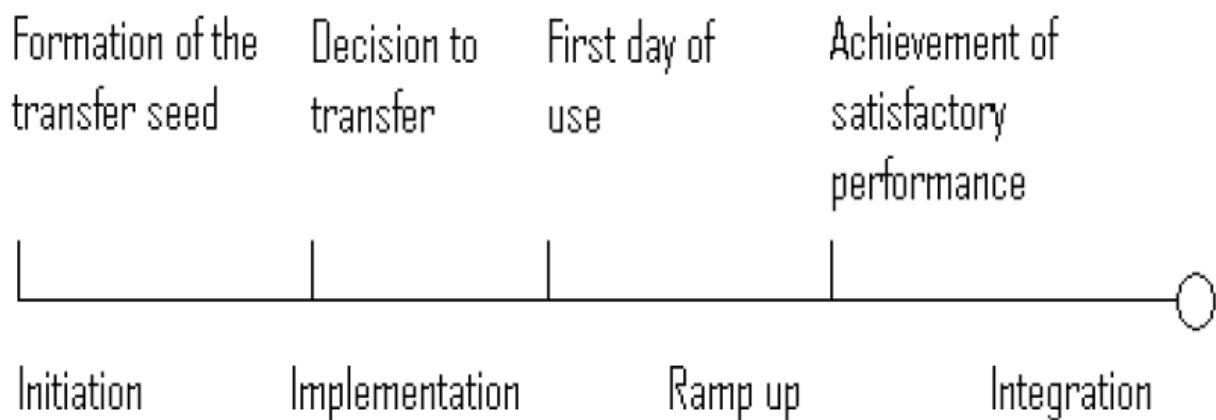
Source: Szulanski (1996)

1. Initiation stickiness

Initiation stickiness is the difficulty in recognising opportunities to transfer and acting upon them. An opportunity to transfer exists as soon as the seed for that transfer is formed, i.e. as soon as a gap and knowledge to address the gap is found within the organisation. The first milestone is known as the transfer seed. This is early recognition that either a gap in knowledge or the use of knowledge exists, or that someone has discovered better knowledge or an improved way of doing things. In short, a transfer begins when both a need and the knowledge to meet that need co-exist within the organisation. The recognition of such a need may trigger a search for potential solutions, a search that leads to the discovery of superior knowledge. The eventfulness of the initiation stage depends on how difficult it is to find an opportunity to transfer and to decide whether or not to pursue it.

2. Implementation stickiness

This second milestone is characterised by a decision process. Following the decision to transfer knowledge, attention shifts to the exchange of information and resources between the source and the recipient. Transfer-specific ties are established between members of the source and recipients, and information and resource flows will typically increase and possibly peak at this stage. The eventfulness of the implementation stage depends on how challenging it is

to bridge the communication gap between the source and the recipient, and to fill the recipient's technical gap. Bridging the communication gap may require solving problems caused by incompatibilities of language, coding schemes and cultural norms. Closing the technical gap may disrupt the normal activities of both the source and recipient. It may distract the source from its main mission (unless its mission is to support the transfer), especially when supporting the transfer means generating additional documents, constructing dedicated equipment, lending its own skilled personnel, or training the recipient's personnel.

3. Ramp-up stickiness

Once the recipient begins using acquired knowledge, i.e. starts up a new production facility, rolls over a new process, or moves over to a new system, the main concern becomes identifying and resolving unexpected problems that keep the recipient from matching or exceeding a priori expectations of post-transfer performance. The ramp-up stage offers a relatively brief window of opportunity to rectify unexpected problems. When precise reasons for success are not really understood, it is again manifested in stickiness during this stage. The greater the casual ambiguity of the best practice, the more likely it is that problems will be encountered during this phase when the newly transferred knowledge is implemented and the performance is expected to exceed that of the previous practice. The eventfulness of the ramp-up phase depends on the number and seriousness of unexpected problems and the efforts required solving them. Unexpected problems may surface because a new environment, where the transferred knowledge is put to use, reacts differently than expected, or when the training of personnel turns out to be insufficient or incomplete, or when trained personnel leave the organisation or prove to be unfit for new roles.

4. Integration stickiness

Once satisfactory results are initially obtained, the use of new knowledge becomes gradually routinised. This progressive routinisation is inherent to every recurring social pattern. Unless difficulties are encountered in the process, the new practices will blend in with the objective, taken-for-granted reality of the organisation. However, when difficulties are encountered, the new practices may be abandoned and, where feasible, reversal to the former status quo may occur. If the new knowledge presents too many problems, it is unlikely to become part of everyday routine, and will therefore be difficult to sustain in practice. Thus, the new knowledge or practice will not be integrated into organisational life. The eventfulness of the integration phase depends on the effort required to remove obstacles and to deal with

challenges to the routinisation of the new practice. Organisational sub-units may differ in their ability to maintain routine operations. The commitment of the recipient to specific practices will become evident during the institutionalisation stage, because each time the truce is disturbed, the appropriateness of the new practice may be explicitly questioned and re-evaluated, thus requiring an affirmative decision to continue.

Achieving effective performance is the fourth milestone, and normally takes much more time, as processes are ramped up to speed. The milestones of knowledge transfer are therefore the following: formation of a transfer seed, decision to transfer, first day of use, and achievement of satisfactory performance. Szulanski divided these further, as is evident from the diagram above, into four chronological stages: initiation and implementation, two stages that are characterised by learning before doing (planning and experimenting), followed by ramp-up and integration, two stages that are characterised by learning by doing (resolving problems, follow through and adaptation).

2.8.   Knowledge transfer and retention approaches

Tacit knowledge refers to knowledge that resides in an individual's mind or in those of a collective group within the organisation. It is very difficult to transfer, but provides the context for information, which makes it more meaningful and applicable. The tricky part of transferring knowledge is to determine what and where this knowledge is and by what means it can be captured and transferred. The approaches for explicit knowledge may be more mechanical, whereas those for tacit knowledge are more complex.[149] The retention and transfer of knowledge held by expert workers about to retire is a major concern and challenge for utility companies. Today, managers and professional experts work in a rapidly changing technical and scientific environment - they gain experiential knowledge, only some of which is formally documented and shared.[150] Many of these workers are leaving without passing on valuable experience and knowledge. It is imperative that companies acknowledge this phenomenon and develop a strategy to manage the lost knowledge as a result of impending retirements. Different lost knowledge scenarios call for different solutions. The

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[149] Nonaka, 1994; Brown and Duguid, 1998 and Szulanski (1995, 1996, 2000, 2003 and 2004).
[150] Johnston, L. 2005:2

strategy may involve both social and technological means of transferring and retaining knowledge. Frigo, McElroy and DeLong emphasise the fact that a knowledge retention strategy must include both technical and human solutions.[151]

2.8.1. Socio-centric approach to knowledge transfer

Intangible assets have the potential to create more value than tangible or physical assets.[152] It is stated that three factors related to intangibles, which consist of human capital, external capital and structural capital, are expected to generate future benefits and create sustained organisational values. Tacit knowledge, which is defined as implicit and non-codifiable knowledge, is difficult to transfer and retain, and is learnt through experience, learning by doing and apprenticeship.[153] In order to succeed in transferring and retaining tacit knowledge, it is necessary to share it through know-how, which is the process of demonstration, and through show-how, which involves face-to-face contact between the source and receiver. [154]In other words, the transfer of know-how requires a process of show-how. For example, the concept of Community of Practice (CoP) is seen as an effective social activity for sharing and retaining organisational knowledge. The CoP has the effect of promoting human networks and motivating people to share, create and retain knowledge. Building informal networks of employees who share similar interests and problems can be an important way of transferring, and thus retaining knowledge within organisations. Communities of practice create an atmosphere for socialisation, in which knowledge can be created and shared.

Interviews, knowledge maps, storytelling, videotaping, training, after action reviews, training and mentoring are ideally suited for enabling individual employees to convert their tacit knowledge into applied knowledge.[155] Although all these efforts can form the holistic approach of any knowledge transfer and retention strategy, this study does not scrutinise the pros and the cons of their use in an organisation. A focused investigation of their effectiveness will be sufficient for developing the theoretical and empirical grounding in that

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[151] Frigo, M. 2008; McElroy, M.W. 2002 and DeLong, D. 2004.
[152] Boisot, M.H. 1999.
[153] Szulanski, 1995, 1996 & 2000; Von Hippel, 1994; Brown & Duguid, 1998.
[154] Roberts, J. 2000. From know-how to show-how? Questioning the role of information and communication technologies in knowledge transfer. *Technology Analysis & Strategic Management*, 12(4): 429-443.
[155] APQC. 2002.

regard. Mentoring and coaching are probably the most effective ways of directly transferring critical implicit and tacit knowledge from one individual employee to another. Mentoring programmes provide a means to facilitate the transfer of knowledge from experienced employees (i.e. subject matter experts) to new employees.[156] Traditionally, mentoring programmes have been used to develop targeted junior employees within an organisation. For the purposes of knowledge transfer and retention, mentoring and coaching programmes are excellent for transferring knowledge from a departing employee to a successor. Both tacit and explicit knowledge can be shared. For example, tacit knowledge might include orientation towards the organisational culture. The participants in the APQC study reported that they used mentoring as a means for transferring knowledge and that they focused on mentoring as an approach to transfer soft skills, as well as social and cultural norms.[157] Mentoring supports the sharing of the broadest range of knowledge, from detailed technical skills and tacit cultural values to career development advice, in a relationship that ideally allows the expert to monitor the degree to which knowledge is actually being absorbed and used by the protégé.[158] It can be a very valuable practice for retaining the loss of knowledge, because it is very effective in transferring the complex types of knowledge that cause knowledge stickiness.

Organisational culture is a critical factor in the success of knowledge transfer and retention endeavours. According to Becerra-Fernandez, "organizational culture reflects the norms and beliefs that guide the behaviours of the organization's members".[159] Values such as trust, individual development and integration cannot be developed and sustained unless the organisation's systems, processes and practices are aligned in order to support them.[160] Organisational culture can make or break the knowledge transfer process in organisations. A knowledge culture is one of the factors which results in long-term competitive advantage. In the knowledge transfer and management process, a knowledge culture is an organisational lifestyle enabling and motivating employees to create, share and use knowledge on behalf of the organisation and in order to ensure continued success.[161] It not only leads to a proper environment for effective knowledge transfer and encourages people to share knowledge, but

[156] APQC. 2002:50.
[157] APQC. 2002.
[158] DeLong. 2004:107.
[159] Becerra-Fernandez et al. 2004:40.
[160] Delong. 2004:72.
[161] Bock, F. 1999. The intelligent approach to knowledge management: viewing KM in terms of content, culture, process, and infrastructure. *Knowledge Management Review*, 7(March-April): 22-25.

also determines which knowledge is worth managing, and which is not - it defines the relationship between individual and organisational knowledge.[162] This is achieved by identifying who is likely to possess transferable knowledge, and to whom it should be transferred - this creates a context of social interaction, which defines how knowledge will be applied in specific situations, and establishes the processes resulting in the development and distribution of new knowledge within the organisation.

Supporting organisational culture helps motivate employees to share knowledge and understand the benefits of a knowledge retention strategy. Compensation systems that encourage knowledge hoarding, promotion practices that penalise the development of deep technical expertise over rapid promotions to management ranks, and cost-cutting activities that discourage investments in learning, are all practices that contradict top management's espoused commitment to learning and innovation. When employees see a discrepancy between the values touted by top leadership and those actually reflected in management practices, they will conclude that the espoused values of knowledge sharing and learning are not taken seriously by the organisation, and this will undermine management's credibility.[163] This does not create a fertile environment for knowledge sharing and retention in the organisation. The attributes of an enabling organisational culture, such as incentives that reward knowledge sharing and transfer, as well as leadership and management support, assist in creating an environment that is conducive to knowledge transfer and retention. Organisations that establish a knowledge culture, which encourages s co-operation, collaboration, experimentation and risk assumption, focusing on essential values and work models, will create a good working environment and achieve better results in terms of organisational learning, as well as establishing specific routines that develop and maintain knowledge transfer in their business process.

Shared identity is also a critical element of the organisational knowledge culture. Like absorptive capacity, shared identity is considered to be a positive antecedent of knowledge transfer - where a shared identity is present, knowledge is more likely to be transferred. Trust

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[162] Girduaskiene, L. and Savaneviciene, A. 2007. Influence of Knowledge Culture on Effective Knowledge Transfer. *Engineering Economics*, 4(54): 36-43.
[163] Rose, H. 2001. Exit Strategies at the World Bank. *Knowledge Management*, 4 (11).

is a functional prerequisite for knowledge transfer. It is argued that trust, relative to price and authority, is the most effective mechanism for facilitating the transfer of knowledge resources within and between organisations, in part because the presence of trust decreases situational uncertainty.[164] Kogut and Zander posit that the concept of shared identity is critical to the identity of a firm, and explain the implications of identity as follows: firstly, it defines the conventions and rules by which individuals coordinate their behaviour and decision-making. Secondly, identification establishes the process by which learning is developed through the formation of values and convergent expectations.[165] In a nutshell, shared identity within a network or CoP means that the individual members have a sense of belonging and purpose in relation to the collective. And, when there is a sense of a shared purpose, individual employees are more likely to share and transfer knowledge.

2.8.2. Techno-centric approach to knowledge transfer

Information and communication technologies play a central role in the emerging knowledge-based economy, in which the generation and exploitation of knowledge are seen to play a dominant role in the creation of wealth. It is posited that the ICT revolution should not be viewed as synonymous with the rise of the knowledge-based economy, although both phenomena are closely related.[166] ICTs facilitate the rapid collection, collation, storage and dissemination of data, thereby assisting in the knowledge creation, transfer and retention process. In other words, ICTs facilitate knowledge transfer through the exchange of data and information. They are best suited to the explicit type of knowledge. However, the transfer of tacit knowledge cannot be executed in such a simple manner, because the transformation from knowledge to information and data is a totally different process. The focus of the ICT in the knowledge transfer process has more to do with what McElroy calls first generation knowledge management or supply-side KM.[167] Supply-side KM is designed to enhance the supply of existing knowledge to workers in an organisation. It is usually associated with two-well-known phrases that have become the mantras for advocates of the knowledge-sharing and transfer side of KM: (1) It's all about capturing, codifying and sharing valuable explicit

[164] Adler, P. 2001. Market, hierarchy and trust: The knowledge economy and the future of capitalism. *Organization Science*, 12(2): 215-234.
[165] Kogut, B. and Zander, U. 1996. What firms do? Coordination, identity and learning. *Organizational Science*, 7(5): 502-519.
[166] Roberts, J. 2000:429.
[167] McElroy, M.W. 2002.

knowledge, and (2) It is all about getting the right information to the right people at the right place. Boisot[168], like McElroy, is of the firm belief that once tacit knowledge is abstracted and codified, it can be more easily distributed throughout the organisation. This perspective emphasises the power of information technologies and focuses on one side of the coin.

Managing and enhancing the organisational processes of knowledge creation, storage, transfer and application in many organisations have relied on the widespread use of knowledge management systems (KMS). This suggests that technology is an essential ingredient for sustaining knowledge transfer and retention, although this approach facilitates the leaking of knowledge from the organisation. The application of IT to organisational knowledge transfer has focused on three common applications: [169]

1. The coding and sharing of best practices
2. The creation of corporate knowledge directories
3. The creation of knowledge networks.

While KMS initiatives rely on IT as an important enabler, they tend to overlook the socio-cultural factors that underpin knowledge transfer and retention processes.

There is a tendency for organisations to emphasise the role of information technology (IT) in knowledge transfer and retention efforts. However, in the last few years, there has been an increase in powerful arguments in favour of a more holistic view which recognises the link between social and technical factors.[170] Figure 10 below illustrate such a holistic knowledge transfer and retention strategy within an organisation. Retaining critical knowledge in the workplace requires human solutions, such as mentoring, succession planning and career development processes, as well as technological solutions such as databases, expert locators, intranets, groupware and automation. Human resource processes and practices are a critical component of the tacit knowledge transfer process in an organisation. These include staffing profiles, career development processes, succession planning, phased retirement programmes and work-culture developments that promote staff retention, thereby also retaining key

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[168] Boisot, M.H. 1999.
[169] Alavi, M. And Leidner, D. 2001. Review: knowledge management and knowledge management systems: conceptual foundations and research issues. *MIS Quarterly*, 25(10): 107-136.
[170] DeLong ,2004 and Frigo, 2006.

knowledge. It is a common practice in large urban areas for utilities to recruit and poach employees from surrounding utilities. Isabell et al.[171] posit that to avoid the loss of critical employees, organisations need to ensure that people will want to remain there, and create an environment that is attractive to younger workers and promotes innovative and creative thinking. In this regard, utilities will need to continue offering ongoing training opportunities to employees and provide challenging and varied work assignments. Taking these steps will keep employees engaged and committed to the organisation's success, and make it more resistant to poaching.

Figure 10 Knowledge Retention Strategy Framework
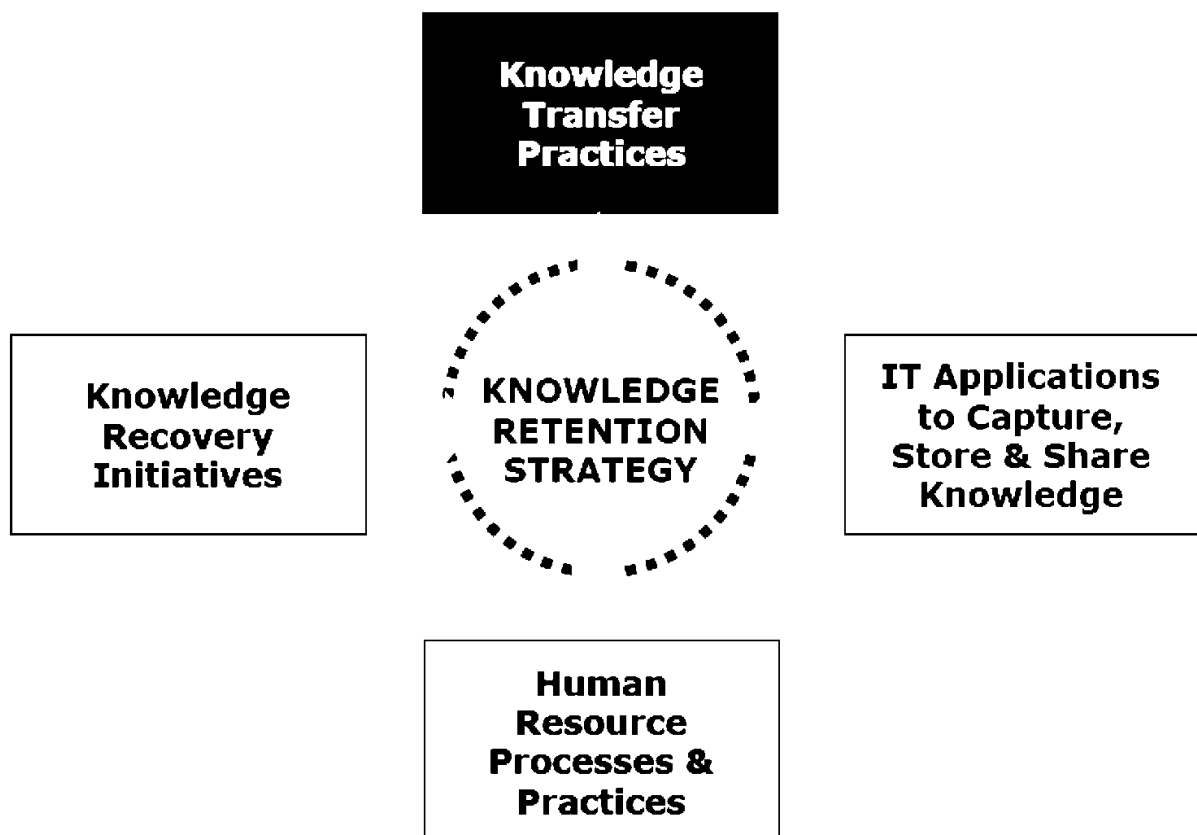
Source: Delong (2004)

The policies and practices that are necessary for knowledge transfer to occur reside within the human resource (HR) function, and the involvement and leadership of HR management is central to the success of the knowledge transfer and retention process. Traditionally, HR executives and professionals have been responsible for an organisation's staffing procedures,

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[171] Isabell, M., McCain, K., Meadors, D., Post, A. and Schneider, S. 2008. Recruit and retain great employees: Proven approaches you can implement now. *American Water Works Association Journal*, 100(8): 52-58.

in order to ensure that employees and job candidates with the right talents are in the right place at the right time. However, they are cautioned that they should have great incentives to develop and implement the necessary policies and practices to encourage and facilitate the transfer of critical knowledge within the organisation, before knowledge is lost and becomes unrecoverable.[172] In addition to being exposed to and offered the right culture, environment and support systems, baby boomers who are eligible for retirement must be motivated to keep working and to transfer their knowledge to their younger colleagues.

2.10. Conclusion

The transfer of knowledge from one context to another must entail the transformation of both the content and context of knowledge. Neither the content nor the context of knowledge is taken for granted - rather, both are emergent features of social interactions. Transfer is normally sticky. Sticky knowledge may play a role in helping to overcome the barriers to transfer. The cost of acquiring knowledge is related to how tacit or implicit it is - the more tacit the knowledge, the greater the degree of stickiness, and the more explicit it is, the more able it is to leak out to other people's spaces, groups and practices, especially competitors. By focusing attention on how we move and transfer knowledge in all its subtleties, we may find some of the answers we are looking for, and the challenge of how to spread good ideas and practices may be won with an armoury based on knowledge tools with an empirically tested evidence base. Organisational culture is important for an effective knowledge transfer process. With regard to the knowledge culture, the attitude of organisational members towards knowledge and the significance of its transfer to the organisation are of critical importance in the transfer process. Cultures of organisations differ, and certain cultural features, beliefs and values are unique to each business enterprise. Thus, it is very important to determine what features of the knowledge culture create appropriate conditions for knowledge transfer and retention processes.

Strong ties are more likely to promote in-depth communication and facilitate the exchange of detailed information or knowledge between the source and recipient of the knowledge. Close relationships enhance opportunities for people within organisations to share feelings,

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[172] Calo, T. J. 2008:411.

emotions, collaborative experiences and mental models through physical, as well as face-to-face, contact. In order for firms to maintain their competitive advantage, it is necessary for them to have a higher degree of tacit knowledge transfer. Improving knowledge retention and transfer does not end with the development of a strategy. Implementing such a strategy successfully will require a carefully thought out implementation plan. No one can predict exactly how the changing workforce will affect utility companies around the globe. However, some things are certain - the development of an integrated knowledge retention strategy will be key to reducing the effect of the changing workforce, thereby assisting utilities in retaining knowledge that is pertinent to its operations and expertise, and, ultimately, to ensuring a successful future.

Chapter 3

A knowledge audit at the public water utility

3.1   Introduction

The purpose of this chapter is twofold, namely: to provide a brief overview of the knowledge status of the public water utility, and secondly, to present a review of the literature on knowledge audits. It also intends to provide a brief background to the public water utility being studied. In today's knowledge economy, many organisations are realizing that they must explicitly manage their knowledge resources in order to acquire and maintain a competitive advantage. For this reason, managers need to understand how they can identify and evaluate the existing knowledge resources within an organisation and how to manage them, in order to achieve a competitive advantage. Knowing what one knows or does not know is an important building block of any knowledge transfer and retention initiative. The baby boom generation is now approaching retirement age in large numbers. As these baby boomers begin retiring from the workforce, this disappearance of intellectual capital will make it extremely difficult for public water utilities to sustain their performance levels. According to Frigo, "utilities depend on the ability to identify and retain critical operations knowledge". [173] As workers retire or leave, their critical job and utility operations knowledge leave with them. Globally, all utilities are facing this challenge, but differ in terms of how they address it.[174] Rand Water, a public water utility in South Africa, is no exception to this global trend. The imminent mass exodus of expertise and knowledge of technicians, scientists and engineers is a well-known phenomenon.

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[173] Frigo, 2006:81.
[174] Frigo, 2006; Ray, 2006; and Delong, 2004.

DeLong[175] contends that losing human knowledge in a technology-intensive era can seriously affect organisational performance. Estimates show that 40 percentage of the water and wastewater utility workforce will be eligible to retire in the next five years. In addition, utility leadership has experienced difficulty in attracting and retaining younger workers. Frigo[176] argues that this combination has the potential to be problematic for the next 10 to 15 years. In order for utilities to manage the loss of knowledge, they need to first establish what knowledge they have and what knowledge is at risk of leaving the organisation. A knowledge audit is the commonly accepted method for identifying such knowledge. Hylton[177] attests to the fact that about 80% of knowledge management has failed. Frappaolo[178] points out that organisations need to know what they know before they can attempt to introduce a knowledge management initiative. A knowledge audit can provide a way for organisations to determine what they do and do not know- it can thus provide the necessary baseline.

3.2. The public water utility mandate

Rand Water, the largest public water utility in South Africa, is tasked with the mandate to purify and distribute portable water. Water is the most basic need for sustaining life. People can go without many commodities that they deem necessary, but without water, a person can only survive for a very short time. Rand Water was established 107 years ago in 1903, and was charged with providing this vital commodity to the municipalities and gold mines of the Witwatersrand.[179] This study has more to do with knowledge retention efforts and a focused knowledge audit, rather than exploringit's the history or services of this utility. Therefore, only a limited or brief overview of the utility and its activities is provided as background information. In the early days, Rand Water main consumer was mining.[180] This has evolved over decades, reflecting the changing face of the Gauteng province of South Africa, and it is believed that at least 70% of its water is supplied to urban domestic consumers, who now dominate the market. The area serviced by Rand Water has extended to include mines, power stations, industries and towns in Gauteng, Free State, North West and Mpumalanga

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[175] Delong, 2004.

[176] Frigo, 2006.

[177] Hylton, 2002a:2.

[178] Frappapolo, C. and Koulopoulos, T. 2000. Why Do a Knowledge Audit? In Cortada, J. and Woods, J.A. (Eds). *The Knowledge Management Yearbook 2000-2001*. Woburn, MA: Butterworth-Heinemann, 418-424.

[179] Rand Water. 2004a. *100 Years of Excellence: 1903 – 2003*. Johannesburg: Creda Communications.

[180] Tempelhoff, J.W. *The substance of ubiquity Rand Water*. Vanderbijlpark: Kleio Publishers.

provinces, thus embracing most of the economic activity in South Africa and a third of its population. Figure 11 below depicts the utility's area of supply.

Figure 11 Rand Water: MAP OF AREA OF SUPPLY
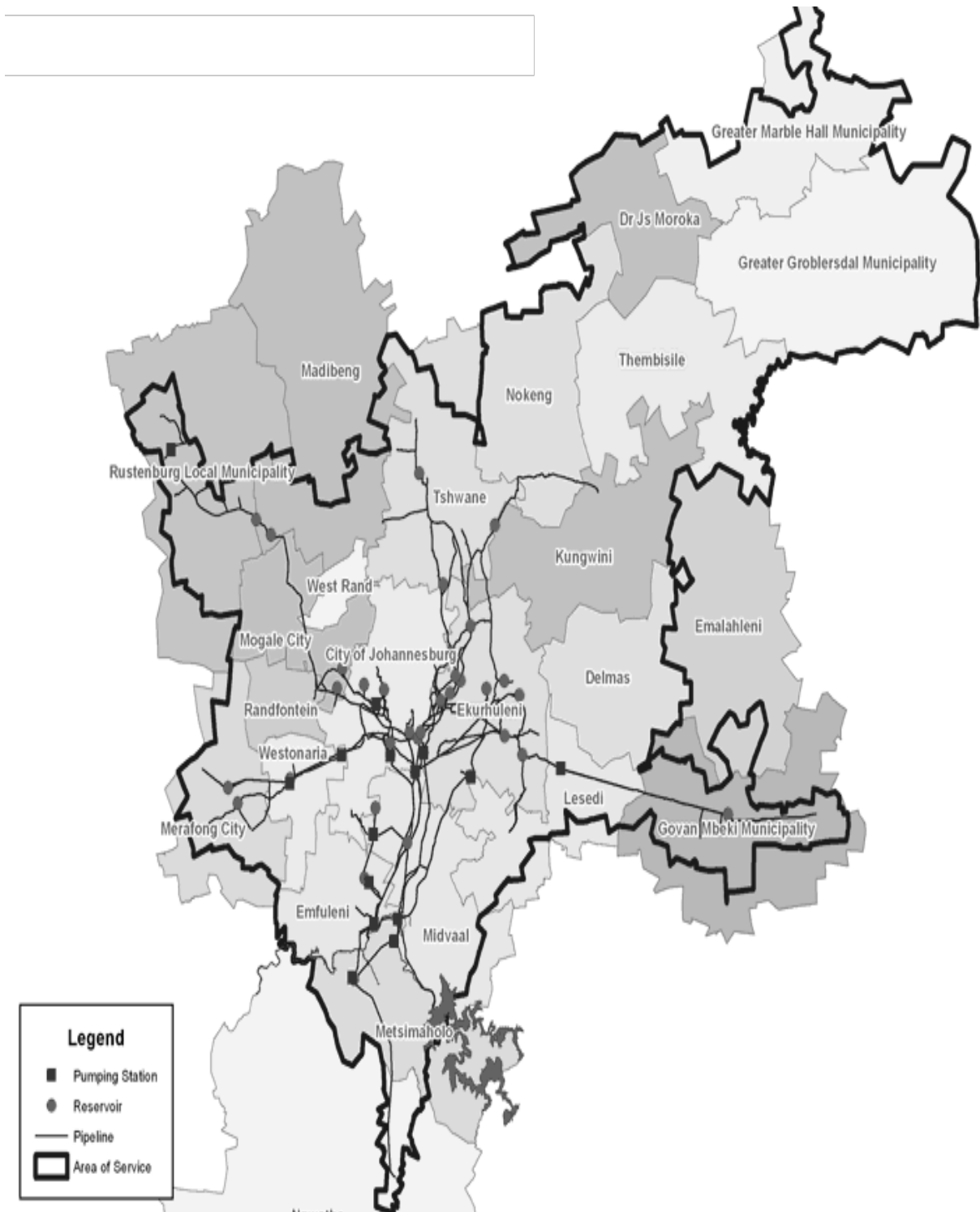
This public water utility has the responsibility to supply sufficient clean, fresh, portable water to all these people, as well as to mining and industries. Since the Industrial Revolution, which began around 1850, engineering has developed rapidly. This is mainly due to a rapid population increase, which created the need for more water in towns and cities, especially where minerals had been discovered. Such discoveries always draw fortune seekers and attract industries, which in turn draw people seeking employment. This was the case with the establishment of the public utility. Development cannot occur without sufficient water, which community engineers must therefore be able to supply. This is why large industrial developments usually occur close to an adequate source of water or close enough, so that water can somehow be brought to the area. In the case of the Witwatersrand, water had to be brought in from somewhere in order to sustain development.[181]

The discovery of gold in the conglomerates (sedimentary rock consisting of pebbles and sand grains cemented together) of the Witwatersrand during the 1880's was the catalyst for later large-scale development.[182] Eventually, the need arose to bring in water from the Vaal River, because the meagre water supply from small streams, rivulets and boreholes was inadequate to support the multitudes of people who gathered there.

The core business processes of Rand Water are infrastructure management (including pipeline infrastructure, renovation and storage system management), water purification and treatment, water distribution through its pipeline network, water quality, and bulk water sanitation.

Three parties are involved in water supply: the Department of Water Affairs, Rand Water and local authorities. The Department of Water Affairs builds and maintains all the dams in South Africa. Figure 12 below illustrates the structured water supply chain of Rand Water. The raw water is then sold to bulk water suppliers such as Rand Water, among others.[183] It purifies the raw water, treats it and then sells it to local authorities. The local authorities store the clean water in nearby reservoirs, and then sell it to the residents and businesses within its area of supply.

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[181] Rand Water. 2004a.
[182] Rand Water. 2004b. *Rand Water: A Century of Excellence*. Johannesburg: Creda Communications.
[183] Rand Water website: http://www.randwater.co.za

Figure 12 Utility water supply chain
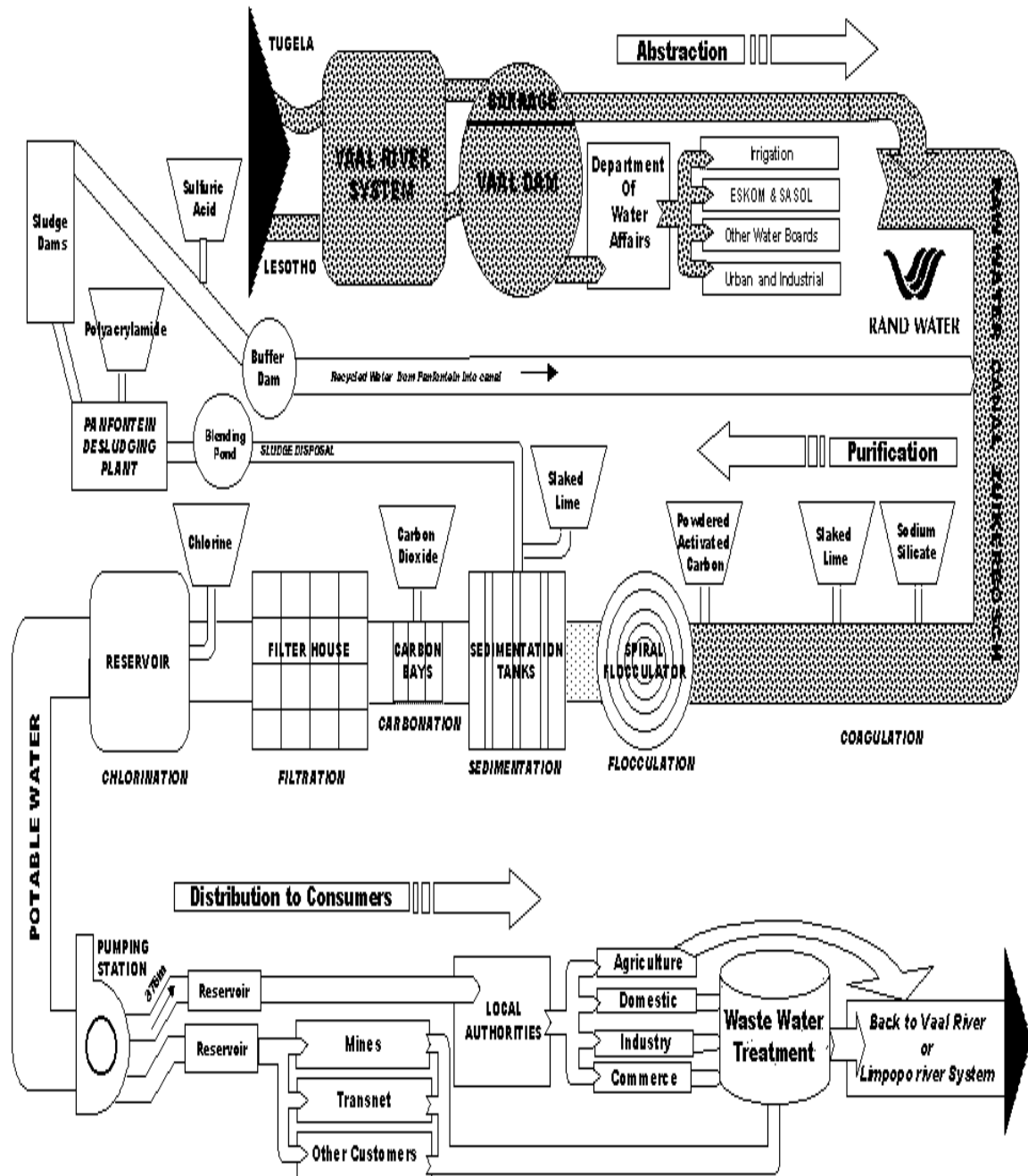
3.3. Knowledge at the public water utility

Rand Water is currently faced with the serious problem of intellectual capital leaving the organisation. The key business processes are operating in silo-oriented groups. As such, the existing organisational knowledge embedded in human capital is being largely managed within these silo-oriented groups. Thus, business-critical knowledge that is straddled across functional business units is being neglected. Knowledge sharing, transfer and retention are very limited between and across divisions and departments.

Currently, there is no clear business strategy on how to manage, integrate, transfer and retain knowledge embedded in the organisational business processes, procedures, systems, routines, employees, experiences and so forth. The current organisational culture relating to knowledge transfer and retention processes is causing a great deal of loss for the utility in terms of money being invested in staff development and knowledge then walking out of the organisation when employees leave. It is common knowledge that the utility invests millions of rands in human resource development and training on an annual basis. However, the organisation does not seem to be too concerned about retaining knowledge. In an internal business case document on knowledge management, the authors identified the following knowledge problems that pose a serious threat to long-term organisational performance:[184]

1. An aging workforce (knowledge experts) that is about to retire in key business process areas;
2. Business-critical tacit knowledge sharing in silo-orientated groups;
3. Tacit knowledge leaving the organisation before it is captured and shared;
4. A young workforce with a short career life within the organisation as a result of frustration caused by the above;
5. The general exodus of staff leaving the organisation;
6. Knowledge gaps and bottlenecks as a result of the above;
7. An inability to retain and sustain organisational intellectual capital;
8. Emerging water boards tapping the company's intellectual capacity, especially in key business process areas;

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[184]Phaladi, M.P. 2006. *Business Case: Creating a Knowledge Management Environment within Rand Water*. Unpublished.

9. A very limited market for Rand Water to tap intellectual capacity in key strategic areas (technical know-how in the water utility industry).

What can be learnt from the above is that the public water utility is faced with the challenges of knowledge disintegration and loss between the generational mixes. The high turnover of young professionals and mid-career workers, coupled with aging experts, serves to perpetuate the growing knowledge deficits.

3.4 Retiring knowledge experts

A major generational shift is in store for the water and wastewater industry. Olstein et al.[185] predict a large wave of retirements in the next 10 years. As a result of these retirements, utilities will lose a great deal of tacit knowledge. It is estimated that more than 80% of useful operational knowledge in utility companies is tacit.[186] The knowledge management techniques which might capture this knowledge before it leaves the utility have not been used in the industry. A commonly held view is that when experts retire, the knowledge, skills and judgments that they possess leave with them. Lave et al.[187] point out that in many public water utility companies, there is a high concentration of workers in their late forties and fifties, half of whom will be eligible to retire within the next five years. Rand Water is no exception to this rule. Many of its experts in the core competence areas are in their fifties and sixties, and they will be retiring within the next five years. Certain skills that the utility will need when replacing retired workers, such as engineers, scientists and managers, are in short supply, and the situation is predicted to get worse. The phenomenon is further complicated by young workers who do not stay for long in the organisation. Losing promising young workers is a problem when retirements are high, thus putting pressure on the organisation to address the problem of turnover among generation X and generation Y employees.

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[185] Olstein et al. 2005.
[186] Hylton, A. 2002a
[187] Lave et al. 2007.

3.5 A knowledge audit

One of the first steps in knowledge transfer and retention initiatives is to conduct a knowledge audit. By conducting a knowledge audit, an organisation can assess its stores of knowledge and the flows of this knowledge throughout the organisation. A knowledge audit is a systematic examination and evaluation of organisational knowledge assets, and is usually recommended in industries as an important first step prior to the launching of any knowledge management initiative.[188] Wang[189] refers to a knowledge audit as the process of identifying and naming the existing, as well as missing, organisational knowledge. A large proportion of organisational knowledge resides in the collective memory of individual employees. Hylton[190] defines a knowledge audit as a systematic and scientific examination of the explicit and tacit knowledge resources in a company. A knowledge audit investigates and analyses the current knowledge environment and culminates in a diagnostic and prognostic report on the organisation's current knowledge health. This report must be able to provide evidence regarding whether or not corporate knowledge value potential is being maximised. The knowledge audit measures the risks and opportunities of the organisation with respect to corporate knowledge.

One of the most important tasks in a knowledge audit is to build a knowledge map of the knowledge stock. The knowledge audit process involves the following:[191]

1. Determining existing and potential knowledge sources, flows and constraints
2. Identifying and locating explicit and tacit knowledge
3. Building a knowledge map of the knowledge stocks and flows
4. Identifying missing knowledge and who needs it
5. Providing recommendations to management, including suggested areas of improvements.

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[188] Choy, S.Y., Lee, W.B. and Cheung, C.F. 2004. A systematic approach for knowledge audit analysis: integration of knowledge inventory, mapping and knowledge flow analysis. *Journal of Universal Computer Science*, 10(6): 674-682.
[189] Wang, J. & Xiao, J. 2009. Knowledge management audit framework and methodology based on processes. *Journal of Technology Management*, 4(3): 239-249.
[190] Hylton, 2002a:1.
[191] Liebowitz et al., 2000 & Nissen, 2006.

A thorough knowledge audit provides answers to questions regarding what knowledge is required for a certain job, what knowledge is currently available, how the knowledge is being used, who else uses this knowledge, and who has expert knowledge on a particular subject in the organisation.[192] Questionnaires, interviews and focus groups are often employed in conducting knowledge audits.[193] The results of a knowledge audit provide an organisation with valuable information, including: (1) the knowledge needs of the organisation, (2) what assets are available and where they are located, (3) if knowledge gaps or bottlenecks exist, and (4) the knowledge flow within the organisation.[194]

The knowledge audit is one of the key elements of knowledge management, and examines and systematically analyses the specific fields inside the organisation and customer needs outside the organisation.[195] A knowledge audit assesses potential stores of knowledge within the organisation. It is asserted that by discovering what knowledge is possessed, it is then possible to find the most effective method of transfer and retention. This can then be used as the basis for evaluating the extent to which change needs to be introduced within the organisation. In other words, it can also be used to evaluate the competitiveness of the business enterprise by identifying strengths, weaknesses, opportunities and threats - the so-called knowledge SWOT analysis.[196] Therefore, it provides the foundation on which a knowledge strategy can be developed to address knowledge problems identified during the knowledge audit process. It is apparent from these analyses that a knowledge management initiative is unlikely to succeed without a knowledge audit, a point that is emphasised by many researchers.[197] As the first step towards an effective knowledge management strategy, if carried out correctly, the organisation's knowledge needs, strengths, weaknesses, opportunities, threats and risks are revealed for the implementation of a knowledge transfer and retention strategy. Therefore, a knowledge audit will provide us with a good picture of the knowledge retention problems existing at Rand Water.

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[192] Dattero et al., 2006; Liebowitz et al., 2000 and Nissen, 2006.

[193] Liebowitz et al., 2000.

[194] Burnett, S., Illingworth, L. and Webster, L. 2004. Knowledge auditing and mapping: a pragmatic approach. *Knowledge and Process Management*, 14(4): 275-286.

[195] Liebowitz, J., Rubenstein,-Montano, B., McCaw, D., Buchwalter, J. and Browning, C. 2000. The knowledge audit. *Knowledge and Process Management*, 5: 498-506.

[196] Wiig, K. 1995. *KM Methods: Practical Approaches to Managing Knowledge*. Arlington, Texas: Schema Press Ltd.

[197] Hylton, 2002a, 2002b, 2004 & 2005; Liebowitz, 2000; Henczel, 2000 and Burnett et al, 2004.

3.5.1.   Objectives of the knowledge audit

Many of the mistakes of both earlier and more recent adopters of KM can be traced back to the serious oversight of not including a knowledge audit in their overall KM strategies and initiatives.[198] A knowledge audit is the indisputable first stage in a KM initiative, but it has not yet been sufficiently recognised as being of supreme importance to every KM initiative. The purpose of a knowledge audit is to provide an organisational assessment of knowledge and the flows of this knowledge throughout the organisation. Only by determining what knowledge an organisation has can plans be made to facilitate the effective sharing, distribution, creation and utilisation of company knowledge by knowledge workers.[199] This study seems to be the first of its kind to attempt to focus on and conduct a knowledge audit of retiring knowledge experts. According to Burnett et al.[200], the main objectives of a knowledge audit are to do the following:

1. To determine where knowledge exists within the organisation.
2. To identify the types of knowledge which exist within the organisation.
3. To identify the preferred methods of knowledge transfer.
4. To investigate how knowledge is then applied by employees within the organisational unit or department.
5. To establish a benchmark of best practice within the organisation and its departments or subsidiaries.
6. To develop a knowledge management strategy for the organisation.
7. To develop an implementation plan in order to achieve this strategy.

It is argued that organisations that audit and map their knowledge know what they know, and can achieve many benefits. The benefits of conducting such knowledge auditing activities include, but are not limited to, the following: identifying what is needed to support overall organisational goals and individual and team activities; and obtaining tangible evidence of the extent to which knowledge is being effectively managed and where improvements are

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[198] Perez-Soltero, A., Barcelo-Varenzuela, M., Sanchez-Schmitz, G., Martin-Rubio, F. and Palma-Mendez, J.T. 2006. Knowledge audit methodologies with emphasis on core process. *Proceedings: Engaging International Information Systems and Management Perspectives – No Barriers No Divides.* Costa Blanca, Spain: EMCIS.
[199] Dattero, R., Galup, S.D. and Quan, J.J. 2007. The knowledge audit: Meta-Matrix analysis. *Knowledge Management Research & Practice*, 5: 213-221.
[200] Burnett et al., 2004:27.

needed. Moreover, a knowledge audit provides an evidence-based account of the knowledge that exists within the organisation and how this knowledge moves around and is used by the organisation. It also reveals pockets of knowledge that are not currently being used to good advantage and are therefore untapped potential. Burnett et al.[201] indicate that it provides a map of knowledge and communication flows and networks, by providing examples of good practice, as well as barriers to good practice. A knowledge audit provides an inventory of knowledge assets, allowing them to become more visible and therefore more measurable and accountable, and enhancing the understanding of the contribution of knowledge towards organisational performance.[202]

The following are typical benefits that arise from carrying out a knowledge audit, as indicated in the literature:[203]

1. It helps in the identification of core knowledge assets and flows, and who creates and uses what knowledge. In the process, it also provides an inventory of knowledge assets, allowing them to become more visible and therefore more measurable and accountable, and giving a clearer understanding of the contribution of knowledge towards organisational performance.

2. It helps the organisation to clearly identify what knowledge is needed to support overall organisational goals, as well as individual and team activities.

3. It identifies key areas of knowledge that need to be managed effectively, and provides an assessment of information quality.

4. It highlights gaps in knowledge provision and reveals duplications in accessing or maintaining information.

5. It reveals pockets of knowledge that are not currently being used to good advantage, and therefore offer untapped potential.

6. It helps to prioritise actions in a KM initiative, and also generates a high level map of knowledge which can be used as a basis for intranet navigation or taxonomy.

7. It identifies blockages in knowledge flows throughout the organisation.

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[201] Burnett et al. 2004:26.
[202] National Electronic Library for Health. 2005. Available at:
http://.www.nelh.nhs.uk./knowledge_management/kms/audit_toolkit.asp
[203] Hooff et al. 2003; Skyrme, 2007 and Paramasivan, 2003.

8. Key knowledge holders are identified - it can be particularly useful to highlight 1-deep knowledge areas i.e. knowledge held by only one individual and therefore at high risk of leaving the organisation.

9. It starts the process of engagement with potential beneficiaries of a KM programme.

10. It provides vital information for the development of effective knowledge retention and transfer programmes and initiatives that are directly relevant to the organisation's specific knowledge needs and current situation.

11. It provides a benchmark against which KM progress can be evaluated.

Overall, a knowledge audit provides a snapshot of the health of an organisation's key asset, its knowledge, and shows how it can enhance an organisation's performance. It provides vital information for the development of an effective knowledge retention strategy and initiatives that are directly relevant to the organisation's specific knowledge needs and current situation. Now that the benefits and objectives of a knowledge audit have been thoroughly explained, the most important question is: When is it the right time to conduct such an audit?

3.5.2. When to conduct a knowledge audit

As discussed earlier in the chapter, an audit is a good first step in developing a KM programme and activities. The data collected enables a strategy and action plan to be more rigorous and evidence-based. However, any time that a major KM project is planned, some kind of audit, even if it is not a comprehensive one, will give a measure of the state of knowledge before the proposed changes.[204] It has also been established that other times at which a knowledge audit can prove useful is, firstly, when a KM strategy has been stalled - for example, it may have received top management approval, but little seems to have happened. In this case, however, it might be useful to run a KM assessment first to find out if lack of awareness of the management of knowledge assets is the main reason for the setback. Secondly, a knowledge audit may be useful when a major organisational restructuring, merger or acquisition is planned - the audit will assist in identifying what knowledge must not be lost as a result of any downsizing or retirements. Thirdly, a knowledge audit is useful

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[204] Skyrme, D. 2007. *Knowing What You Know and Need to Know: How to Conduct A Knowledge Audit*. David Skyrme Associates.

when a major new information or content initiative is planned, such as a new enterprise content management system or portal. And lastly, it is useful when there is a sense of growing frustration throughout the organisation with regard to information, e.g. people cannot find the information they need even when they suspect that it exists in the organisation or they stumble across unknown information resources or duplicates.

However, for the purpose of this study, the knowledge audit can be used to identify what knowledge is at risk of walking out the door without being captured and shared when older employees retire. Organisations need to establish what knowledge, skills and experience this older generation have, and how critical they are to the survival of the organisation. The knowledge of older employees is not of equal value. Evaluating the impact of individual retirements on organisational performance is not a feel-good exercise - it is about the business impact.

According to DeLong[205], there are at least three types of employees that management should be evaluating: firstly, relatively easy-to-replace (low-skill) workers who are truly coasting towards retirement. It is argued that these people are unlikely to have unique knowledge that is important to the future of the business, and they should be encouraged to retire as soon as they become eligible. However, companies are cautioned to ensure that their assumptions are correct regarding the availability of even minimally qualified replacements; secondly, higher-skilled employees and managers who are not particularly motivated to improve their skills or to work hard to ensure late career success. The cost of this so-called deadwood is becoming more serious for organisations facing strict headcount restrictions. Today, most of these employees are simply encouraged to retire as soon as they are eligible. However, the skilled labour market is tightening due to increased baby boomer retirements, and the pressure to find ways to re-energise this marginal workforce will therefore increase. The difficulty in replacing them will make investing in late career training and development more worthwhile; and lastly, highly-skilled workers and managers, where leadership may be underestimating the true cost of their departure. These are employees who should be proactively retained. Unfortunately, executives often do not have a clue about these employees' real value to the organisation, or the difficulty involved in replacing them. A knowledge audit, if carried out

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[205] DeLong, D. 2008. Knowledge Loss Prevention: Five keys to decisions vis-à-vis an ageing workforce. *Inside Knowledge*, 11(5) Senior Knowledge Special Edition: 15-19.

correctly with this focus group of employees, will undoubtedly be able to identify the real value of these knowledge assets and their contribution towards organisational performance.

A knowledge audit is of great importance in identifying critical knowledge within organisations. APQC states that "one of the critical success factors in addressing the issue of knowledge retention is in taking time to evaluate what knowledge to capture". [206] It is worthwhile mentioning here that not all knowledge is worth capturing, storing and sharing. It is important, therefore, for an organisation to ask the following questions: What knowledge do we have that is valuable? If we were to use it in a different way, how would it add value to the organisation? And can the value proposition for this knowledge be articulated?

An analysis of these questions highlights the need to align a knowledge retention strategy and activities with the business strategy of the organisation. In a nutshell, it confirms the earlier view that a knowledge audit is the first critical step in the development of a knowledge retention strategy. Without a knowledge audit, a knowledge retention initiative will not succeed. It is argued that the greatest benefit of a knowledge audit is the resulting inventory of knowledge sources and flows.[207] A side-effect of conducting a knowledge audit is that people within the organisation are stimulated to think more about the knowledge that is important to them. A major disadvantage of conducting such an audit is the amount of time required to interview and observes knowledge workers.

3.5.3.   The elements of a knowledge audit

Developing a knowledge retention and transfer strategy is a process of change towards improving organisational performance. In order to achieve this change, an organisation needs a strategic vision of where it wants to be, what knowledge, skills and experience it has to sustain the competitive advantage, and an accurate picture of where it is now - its current reality. A knowledge audit is one of the strategic management tools that can be used in this regard. Knowledge audits, unlike traditional financial audits, are qualitative checks of an

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[206] APQC.2002:33.
[207] Nissen, M.E. 2006. *Harnessing Knoweledge Dynamics: Principled Organizational Knowing and Learning.* IRM Press.

organisational knowledge health. The defining feature of a knowledge audit is that it places people at the centre of its concerns - it purports to find out what people know, and what they do with the knowledge they have.[208] The common tools used for knowledge audits are face-to-face interviews, questionnaires, workshops, focus group discussions and online consultations.[209] There are a wide variety of approaches for conducting a knowledge audit, with varying levels of coverage and detail. However, as a general rule, most knowledge audits will involve some or all of the following: (1) knowledge needs analysis, (2) knowledge inventory analysis, (3) knowledge flow analysis, and (4) knowledge mapping. There is no set standard for auditing knowledge status within organisations - it is a combination of methods that will unearth the core information in order to assist in the analysis and development of insights. Figure 13 below provides a generic outline of the steps involved in the knowledge auditing process.

Figure 13 Steps for carrying out a knowledge audit

```
                        2  Fact Finding
 Size / variety
 of organization       Face-to-face:
       ↓               - interviews
                       - workshops               4  Develop
                       - focus groups               deliverables
  1  Scope
     and plan                              3  Analysis
                                              & interpretation
                       Information-based:
                       - documentation                5  Stimulate
  Resources            - questionnaires                   action
                       - intranet analysis
                       - statistics
                                 6  Review and revisit
```
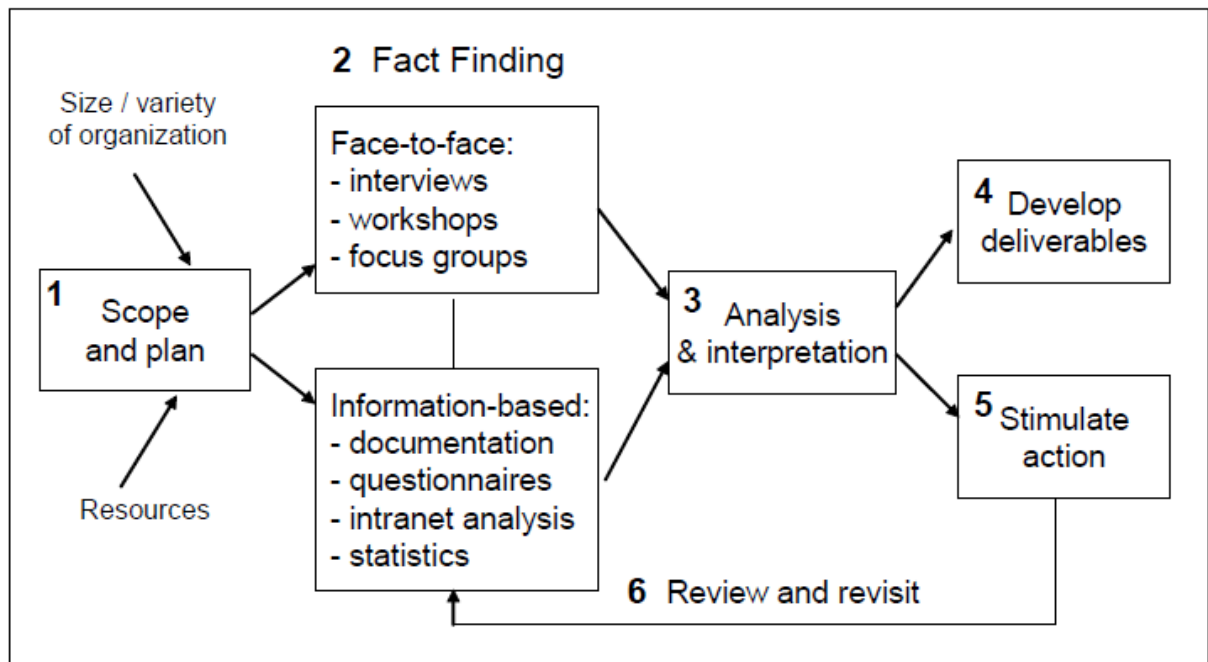
Source: Skyrme (2007)

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[208] Serrat, O. 2008. *Learning Lessons with Knowledge Audits*. Malaysian Evaluation Society's Third International Conference, Kuala Lumpur, Malaysia, 1-17.
[209] Dattero, 2007; Perez-Soltero et al,2006; Hylton, 2002a; Paramasivan, 2003; Skyrme, 2007 and Cheung et al., 2007.

The six steps involved are:

1. Scoping and planning – how wide and deep the audit should be, what areas to cover, how much effort to invest.

2. Fact-finding – the core activity that involves collecting data on knowledge needs accessibility and quality of knowledge, knowledge flows and blockages. It also reviews contextual factors that impact on effective knowledge management.

3. Analysis and interpretation – identifying critical knowledge areas needing more attention, for example, based on their overall importance versus their current usefulness, and uncovering knowledge gaps and duplication.

4. Developing deliverables – as well as a report, these may include lists and characteristics of knowledge resources and sources - the output of an audit typically feeds into a KM strategy and action plan.

5. Stimulating action – simply reporting on the state of knowledge resources will not change them for the better. This stage is about follow-ups and putting any recommendations into practice.

6. Review and revisit – an audit should not simply be a once-off exercise, but a process that is repeated in order to review progress.

The deliverables in a knowledge audit are tailored to a client organisation's requirements, but typically include the following: a core process or knowledge chart, supplier or user matrix, a knowledge map, an initial set of information standards, a sample set of inventory records and a detailed report including, but not limited to, charts, diagrams and tables of knowledge assets.

3.5.4. A framework for the knowledge audit

Some organisations are embarking on knowledge transfer and retention programmes without an understanding of why their knowledge assets are important. Rather than being in a position to make informed decisions about what knowledge needs to be managed, they attempt to manage everything, whether it is significant or not. A wide variety of approaches have been proposed for conducting a knowledge audit, with varying levels of coverage and

details.[210] However, there seems to be a lack of a systematic and standardised knowledge audit approach, and the practice differs in different industries and organisations. Moreover, it has been found that these approaches do not establish a clear strategy explaining relevant areas within the organisations where such audits should be initiated. They seem to audit everything, whether it is significant or not. Perez-Soltero et al.[211] point out that another deficiency found in the great majority of knowledge methodologies is that they do not establish measurement criteria to verify the impact related to KM processes. This study focuses its knowledge audit on the aging knowledge experts in core competence areas or processes at Rand Water. It is believed that focusing on knowledge that exists in core processes ensures not only that these assets exist, but that the knowledge audit identifies those assets that are critical to organisational survival.[212]

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[210] Burnett et al., 2004; Cheung et al., 2005; Debenham & Clark, 1994 ; Dattero et al., 2007; Lauer et al., 2001; Levy et al, 2010; Liebowitz et al, 2000; Hylton, 2002a, 2002b & 2002c; Perez-Soltero et al., 2006 & 2009; Wiig, 1995.
[211] Perez-Soltero et al., 2006.
[212] Perez-Soltero et al., 2006:5

Figure 14 A knowledge audit with an emphasis on core processes
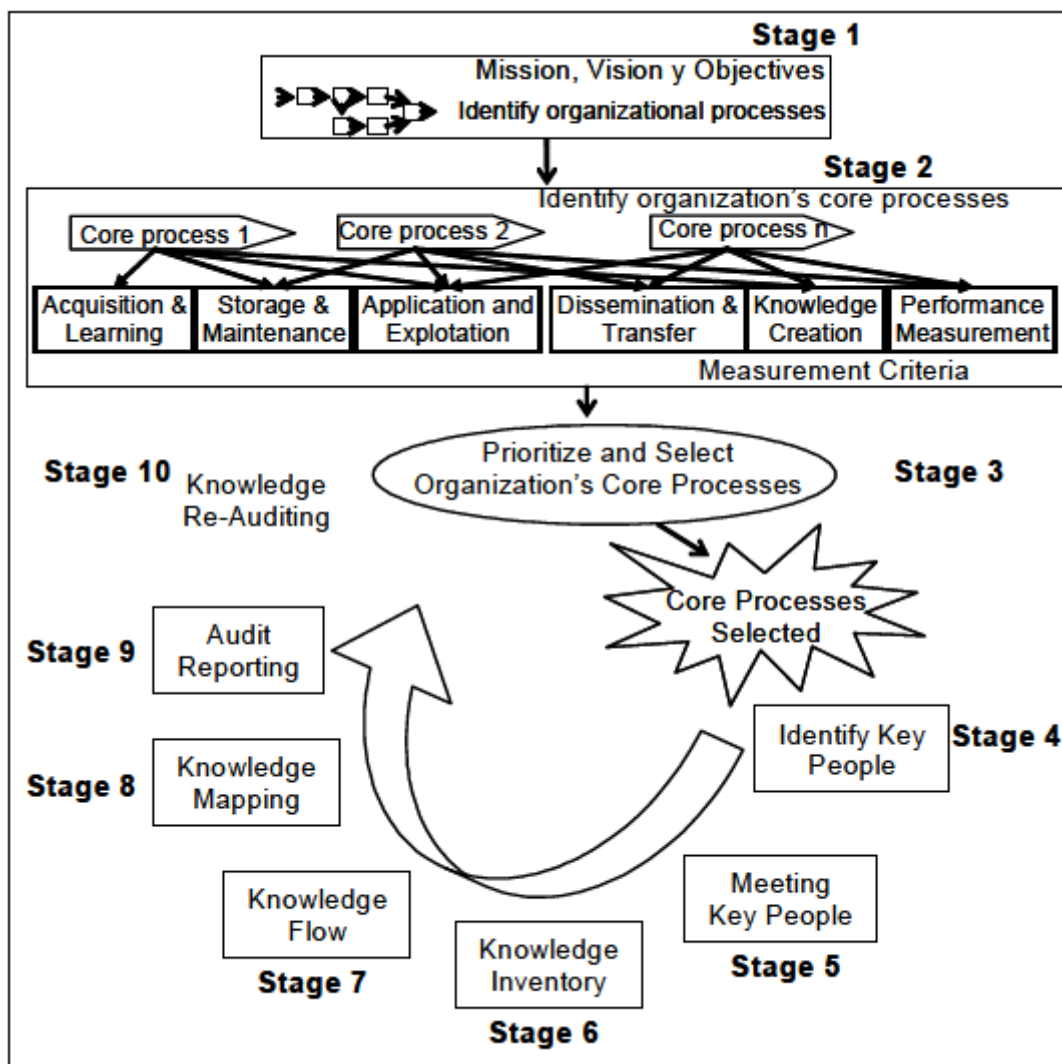
The ten-stage knowledge audit methodology proposed by Perez-Soltero, as shown in Figure 14 above, describes the knowledge audit process stage by stage, highlighting those aspects of the process that are critical to its success, and the issues that the knowledge auditor may face that can influence the value of the outcomes. Knowledge transfer and retention initiatives cannot be everything to everybody. Some knowledge is more important than others, and it has to start somewhere in the organisation. The core business processes are relevant and appropriate areas on which to focus the knowledge audit. This study will use the knowledge audit framework and focus the audit on the core competence areas of the public water utility, as illustrated by Figure 7 in Chapter one. The researcher is of the firm view that this audit methodology will be effective in auditing the key knowledge and knowledge experts within the public utility, and will indeed be able to identify opportunities to make improvements in the organisational knowledge transfer and retention system.

3.6. Conclusion

In concluding this chapter, knowing what you know or do not know is an important building block of any knowledge transfer and retention initiative. Carrying out a knowledge audit is the most critical step of the whole process in any organisation, regardless of whether it is in the private or public sector. Therefore, a comprehensive knowledge audit should be well-designed in order to accomplish its objectives. From the literature reviewed, it is clear that without a knowledge audit, any knowledge retention intervention will fail, because a knowledge audit is the basis for developing a knowledge transfer and retention strategy. It is an effective instrument for diagnosing organisational knowledge health - in general, the results provide sufficient insight into the organisation's knowledge status and processes. By discovering what knowledge is present and missing within the enterprise, it is then possible to find the most effective strategy for transferring and retaining that knowledge. The next chapter presents the results of the knowledge audit and focuses the instrument on the context of knowledge transfer and retention, as discussed in Chapter 2. Furthermore, it also focuses on the retiring workforce in the core competence areas within the public water utility.

Chapter 4

Presentation and discussion of results

4.1. Introduction

In this chapter, the data collected through knowledge audit interview questions are presented This is followed by a discussion of the results of the study. Graphs and tables are also used to simplify the analysis and interpretation of the data collected from the respondents. Fifteen knowledge experts in various disciplines at the public water utility were selected as a sample for this study. The main target of the sample was those individual employees who had been with the utility for many years and were well-established experts in their own field. The targeted experts were those who were retiring in the next five to eight years. Triangulation, a combination of both qualitative and quantitative approaches, was used to obtain information from the engineers, scientists and technicians retiring from the organisation within the specified period. These retiring knowledge experts can be regarded "as some people, who are in a privileged position in so far as knowledge is concerned, person in authority, or persons who are particularly experts or authoritative in their disciplines".[213] The Knowledge Management Core Team at Rand Water identified some of the individuals as experts in their own right. The worrying fact was that most of those who were identified were retiring very soon, and thus exposed the public utility to the risk of organisational knowledge walking out the door without being captured and shared. Elite interview was therefore regarded as being the best data collection instrument for collecting data from elite individuals such as these retiring experts. Elite individuals can be described "as those individuals who have more knowledge and status; and assume a higher position than others in the organization".[214]

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[213] Gillham, B. 2000. *The Research Interview*. London: Continuum.
[214] Odendahl, T. 2002:300

4.2. Presentation of results

The findings to be presented and discussed here have been categorised for the sake of simplicity. Similar questions have been grouped together to enhance their analysis and interpretation. The findings are based on the data collected through the use of closed and open-ended questions during interviews. Eleven out of the total of fifteen knowledge experts were interviewed in person at the headquarters of the public water utility, whereas the remaining four were interviewed telephonically at a later stage. The researcher could not interview all of them due to the nature of their work, time constraints and workload. However, for all the interviews, schedules were drawn up and agreed on well in advance. This in a way assisted in eliminating the potential problem of the unavailability of respondents. The experts who were interviewed were drawn from the departments indicated in Table 2 below.

Table 2 Departments from which experts were drawn

| Department	Number of experts interviewed
Civil Engineering	3
Pipeline Management and Research	1
Bulk Infrastructure Planning	1
Operations	1
Electrical Engineering	2
Information and Communications Technology	1
Scientific Services	5
Process Engineering	1
Total	**15**

The problem encountered at the time of the study was that three out of the fifteen experts identified had already retired. However, through referrals from those interviewed, three other people were recommended for the study based on their expertise and knowledge within their own disciplines. These employees had already established themselves within the organisation

as experts in their respective fields. They had also been working for the public utility for many years. Furthermore, they were in the position to take over from their predecessors, who had retired during the last few months. The time factor, to a certain extent, was a problem in terms of locating one of the key experts who had been with the utility for forty years. This was largely due to workloads, both inside and outside the organisation, hence the telephone interview. It is noted that almost every expert interviewed recommended that this individual be interviewed, as he was considered to be holding a lot of corporate memory in his head. The knowledge audit findings are presented below.

4.2.1. Tenure of Service

There seemed to be an element of loyalty and career stability among the targeted research population. Many of the respondents interviewed had been with the organisation for most of their careers. Forty percent indicated that they had been with the organisation for 10 to 20 years, twenty seven percent for 20 to 30 years, another twenty seven percent for more than 30 years, and only six percent for less than 10 years. Figure 15 below indicates the tenure of service of the experts who were interviewed. Twenty-seven percent of the experts who had been with the organisation for more than 30 years had had a stable career there. All of them had risen through the ranks to where they are today in terms of positions within the organisation. The small percentage of them who had been with the organisation for a shorter time had spent their careers elsewhere before becoming part of the utility.

Figure 15: Tenure of Service
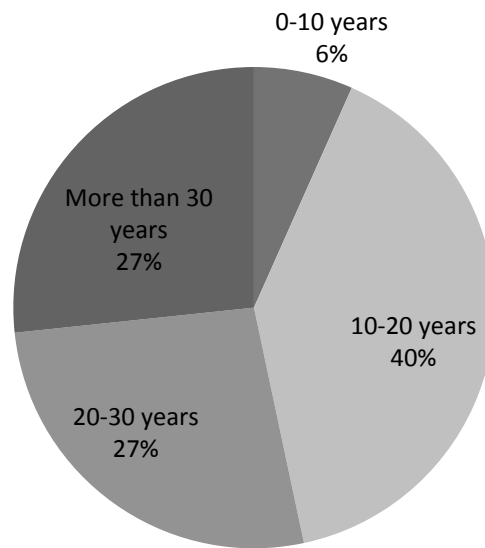
It is interesting to note that those who had been with the utility for more than 30 years had combined experience, expertise and knowledge of 145 years in total, compared to those in the categories of 10 to 20 and 20 to 30 years. Table 3 below depicts the tenure of service categories.

Table 3: Tenure of Service within the public water utility

Period of service in years	Number of experts	Total number of years
0 – 10	1	9
10 – 20	6	93
20 – 30	4	101
+ 30	4	145

The knowledge experts interviewed had held prior positions before their current one within the organisation. Ninety-three percent had risen through the ranks within the organisation to the senior technical positions they were in at the time of this study, whereas fewer than seven percent had never held other positions. This is illustrated in Figure 16 below.

Figure 16: Positions prior to current one
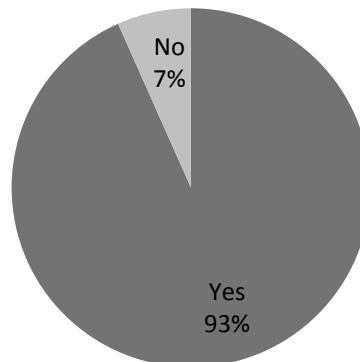
4.2.2. Core competencies and knowledge areas

Hamel and Prahalad[215] posit that a core competency is an area of specialised expertise that is the result of harmonising complex streams of technology and work activity. Core competencies provide a distinct advantage to Rand Water - they combine the complexities of people's knowledge, processes and the leverage of technology. Arguably, they drive the business and are the engine of growth. These core competencies are difficult for competitors to imitate. There seems to be a common understanding among the experts in terms of core competencies within the utility. Operations, Scientific Services (Water Quality Services), infrastructure and asset management and engineering, including all its facets, such as civil, mechanical, planning, process, electrical and automation engineering, were identified as core competencies of the public utility. In a water supply chain, these core competencies manifest themselves in abstraction, purification, distribution, infrastructure and maintenance, and technology development, as illustrated by Figure 7 in Chapter one and Figure 12 in Chapter three. There is a fair distribution of expertise in the knowledge areas of the business, namely: abstraction, purification, distribution, infrastructure and maintenance, and technology development. Figure 17 below provides a representation of the percentage of experts in the different areas of expertise.

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[215] Prahalad, C.K. and Hamel, G. 1990. The Core Competence of the Corporation. *Harvard Business Review*, May-June: 1-15.

Figure 17: Fields of expertise
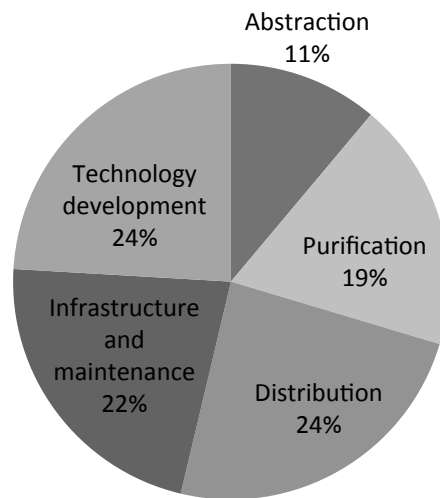
4.2.3. Fields of expertise for further development

The older employees have a wealth of knowledge and experience, which has been developed over many years of service. This knowledge and experience is predominantly experimental, accumulated through new ideas during a lifetime of on-the-job observations and trial and errors. Many of those interviewed indicated that they had accumulated a wealth of knowledge and experience, and therefore felt that they had reached a saturation point in terms of learning. Some of them did not identify any area for further development. For those who did identify areas for further development and learning, these areas are listed in Table 4 below.

Table 4: Areas for further expertise development
Asset management
Training consultancy
Infrastructure management
Distribution networks
Energy management

Conflict management
General management
Operational management
Mechanical engineering
Project management
Strategic management
Supply chain management
Electrical fields
Finance, micro-finance environment of the organisation
Pipeline design
Material design
Solar energy
Sanitation

4.2.4.   Coaching and mentoring

Coaching and mentoring programmes provide a means to facilitate the transfer of knowledge from experienced experts to new and more junior employees. There seems to be a lack of a formalised coaching and mentoring system. Where coaching and mentoring exist in the organisation, it happens in a non-formalised and ad hoc basis, driven by individual experts' passion for developing people. This is not dictated by the organisation's human resource policies. Out of the 15 knowledge experts interviewed, 53 percent indicated that they were involved in coaching and mentoring. In contrast, 43 percent indicated that they were not involved in any coaching and mentoring activities. Furthermore, those who were involved in coaching and mentoring activities emphasised that they were doing it out of a desire to develop young professionals, and that such interventions were not formalised. Some experts in the engineering departments were involved in coaching and mentoring young engineers on a long-term basis. The intention here was to take them through the process until they were registered as engineers. Senior experts in the scientific services division were also involved in

similar endeavours, whereby they were informally involved in coaching and mentoring young, aspiring scientists recruited from universities.

□

Figure 18: Coaching and mentoring
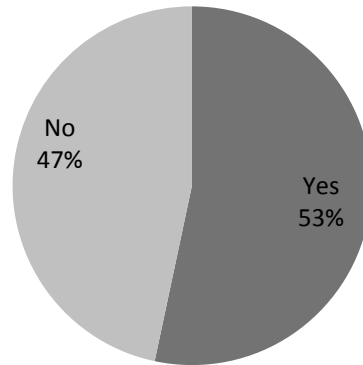
4.2.5.   Knowledge transfer activities

Fifty-three percent of the respondents indicated that they were not involved in knowledge transfer activities. Only forty-seven percent alluded to the fact that they were involved in transferring knowledge, whereas fifty-three percent were not involved in transfer activities, as illustrated in Figure 19 below. Those involved in knowledge transfer activities mostly indicated that such activities included the following: workshops, seminars, conferences, informal coaching and mentorship, workplace meetings, interaction with colleagues, communication, documentation, reports, institutional forums, interviews and meetings with consultants. On the other hand, those who were not involved in knowledge transfer activities posited that there was no formal system for transferring and retaining knowledge.

Figure 19: Knowledge transfer activities
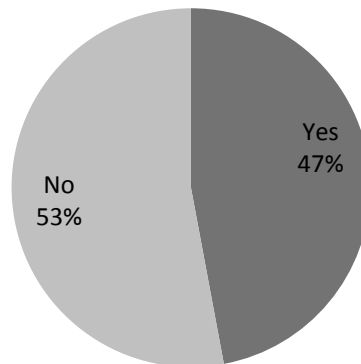
4.2.6. Information needs of experts

Access to information has changed tremendously - as such, information needs of experts are also changing. The respondents indicated a need to get access to more technical electronic information resource packages, including, but not limited to, technical information, standards and industry codes of practice, and scientific, water-related information. It was mentioned that they were currently struggling to access technical sites on the Internet because of restricted access to such sites. All of the experts indicated that they used the corporate library, interaction with colleagues, consultants and the Internet in order to meet their information needs. A need to augment the current library subscriptions to include more technical and scientific research and industry information was expressed by the majority of the respondents. Their information needs are listed in the table below.

Table 5 Information needs of experts
Access to larger subscription packages
Subscription to technical databases
Publications on water quality
Water quality-related standards and specifications

Water treatment-related standards and specifications

Industry-related standards and codes of practice

Water quality guidelines

Water-related legislation and regulations

Global warming

Information subscription

Textbooks on energy management

IEC standards and specifications

General management

Technical standards for different engineering disciplines

Strategic management

Board reports

Civil and structural engineering publications

Pipeline and design publications

Technical books

Rand Water reports

Scientific and water-related publications

Infrastructure management

Asset management

Local and international codes for material design

International standards and codes for pipeline design

4.2.7. Organisational networks: internal and external

The following internal and external networks and contacts were identified by the experts as being critical in terms of performing their work activities at the public water utility. The majority of the experts had a well-established social network outside the organisation, both local and international, which was essential to the survival of Rand Water. Those with a

limited external network indicated that the nature of their job was to service and support other internal departments. Experts with extensive external networks and contacts were mostly those in the divisions of engineering, pipeline design and research, and water quality.

Table 6: Internal and external knowledge transfer networks

Internal networks	Analytical services
	Automation
	Procurement
	Project management teams
	Creditors
	Process technology
	Pipeline design
	Pipeline construction
	Bulk water distribution / Operations
	Sales and customer services
	Managers in the immediate environments
	Managers in other environments
	General managers
	Site executive management
	Top management
	Strategic Asset Management (SAM division)
	Engineering, all facets of the engineering division
	Project Consultants
	Consulting engineering companies
	Consulting planning engineers
	Local municipal authorities
	Department of Water Affairs

External networks	Other government departments
	Mining industry
	Food and beverage industry
	Media
	SALGA
	SABS
	Manufacturers of steel
	Pipeline manufacturers
	Manufacturers of pipe equipment
	Manufacturers and suppliers of electrical equipment
	Chemical Engineers
	Other critical service providers
	Research Institutes: WRC, WISA, IWA, AWWA, CSIR
	Rand Water Chairs at TUT and UJ
	Universities: University of Pretoria, Johannesburg and TUT
	ECSA
	CIDB
	ERWAT
	Contractors, Other Water Boards / Utilities
	SAICE

4.2.8. Organisational culture and motivation

Organisational culture can be thought of as a relatively rigid, tacit infrastructure of ideas that shape not only our thinking but also our behaviour and perception of the business environment.[216] It effectively establishes a set of guidelines by which members of an organisation work and how these organisations are structured. The experts interviewed expressed the view that organisational culture was not futile for knowledge transfer and retention. This view is clearly depicted in Figure 20 below. Organisational culture reflects the norms and beliefs that guide the behaviour of an organisation's employees.[217] It is a critical enabler of knowledge transfer and retention in any organisation. It can make or break any organisational knowledge transfer and retention endeavour. There seems, however, to be a lack of motivation on the part of the source of knowledge. It has been indicated that the reluctance to transfer knowledge is largely due to individuals being afraid that once their knowledge has been transferred, it will threaten or lessen their ability to do their jobs. For whatever reason, some people feel that power comes from accumulating and hoarding knowledge for themselves.

□

Figure 20: Organisational culture
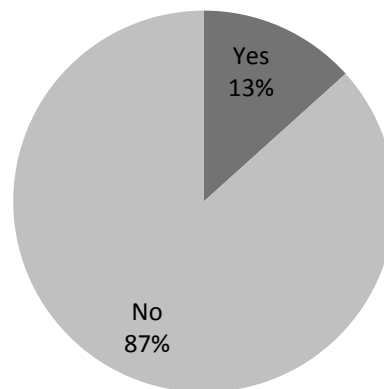
Many knowledge experts also feel that employees are not motivated by the management and leadership of the organisation to share knowledge. Based on the information collected from respondents, there seems to be a serious lack of management support and commitment at the highest level of the organisation. There is a strong indication of a correlation between

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[216] Gurteen, D. 1999. Creating a Knowledge Sharing Culture. *Knowledge Management Magazine*, 2(5).
[217] Becerra-Fernandez et al. 2004:40.

organisational culture and management support as factors influencing the transfer and retention of knowledge. The trend and consistency in terms of the answers provided to questions 21 and 22 of the interviews paint a gloomy picture for the utility as far as knowledge transfer and retention are concerned. These factors seem to be threatening knowledge transfer activities in the public water utility. Figure 21 below indicates that 87 percent of the respondents felt that the management did not motivate employees to share knowledge, whereas only 13 percent noted that the management was beginning to take knowledge sharing seriously, but there had not been any action yet. There seems to be no clear communication and understanding of the benefits of knowledge transfer and retention activities.

Figure 21: Motivation by management
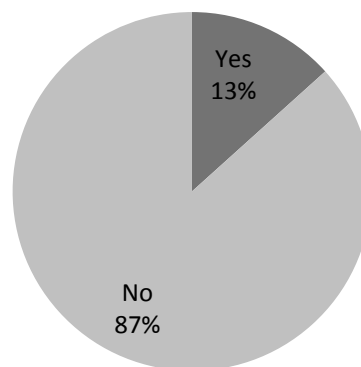
4.2.9.   The issue of trust

Trust is an important factor in the transfer and retention of knowledge. There seemed to be a high level of trust between the experts interviewed and their colleagues in their respective divisions and departments. All of the 15 experts interviewed indicated that they trusted their colleagues enough to share expertise and knowledge with them. However, this level of trust was limited to their immediate environments, and this means that knowledge transfer and retention activities were performed in a silo-oriented manner. Trust is thought to be a functional prerequisite for knowledge transfer and retention. Knowledge sharers must know

that they will get credit and that others will reciprocate.[218] Trust was only visible within silos - not throughout and across business units within the public water utility.

4.2.10. Knowledge transfer incentives and rewards

Incentives and rewards are critical pillars for successful knowledge transfer and retention efforts. Flowing from the discussions on organisational culture and management support issues, all of the respondents interviewed mentioned that there were no incentives and rewards for sharing knowledge within the organisation. It was pointed out that people are not rewarded for sharing knowledge, either financially, through promotion, or through recognition. The performance management system seemed to be a factor influencing the transfer and retention of knowledge within the utility. Upon probing further through discussions with the respondents, it was mentioned that the current performance management system of the public water utility stressed individual performance, thus inhibiting knowledge transfer and retention.

4.2.11. Barriers to knowledge transfer and retention initiatives

Almost every expert interviewed indicated that culture and a high turnover rate were the biggest enemies of knowledge transfer and retention initiatives in the public water utility. The performance management system was also seen as a threat to knowledge transfer. The public water utility bred a culture of competition between employees, and offered incentive bonuses based on performance targets, which was seen as stifling knowledge sharing and integration. The factors identified as barriers to knowledge transfer and retention are highlighted in the table below.

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[218] Jacobson C, M. 2006. Knowledge Sharing Between Individuals, in: Schwartz, D.G.(ed). 2006. *Encyclopaedia of Knowledge Management*. Hershey: Idea Group Reference, 507-513.

Table 7 List of identified barriers to knowledge transfer and retention

Barriers to knowledge transfer and retention	Lack of management motivation
	Lack of a talent retention strategy
	High turnover rate
	Lack of top management buy-in and leadership support
	Critical skill allowance
	Lack of incentives and rewards
	Size of the utility
	Lack of critical skill recognition
	Lack of knowledge transfer systems and policies
	Culture
	Fear of taking accountability
	Too much change
	Turf protection
	Poor communication
	Organisational structure that is too hierarchical
	Organisation is not attractive to young professionals
	Workload
	Time constraints
	Short period of employment of staff
	Loss of corporate memory
	Decreasing number of experts
	Risk-intolerant culture
	Lack of succession planning and job shadowing
	Insecurity
	Race factor
	Affirmative action
	Lack of awareness and existence of knowledge
	Lack of a directory of knowledge experts
	Silos

	Trust
	Lack of recognition
	Retirements

4.2.12.   Business critical knowledge

There seemed to be a common and holistic understanding amongst the experts interviewed in terms of identifying knowledge that is critical to the business. Knowledge of the business is considered to be critical for the public water utility. The experts argued that knowledge of the whole water supply value chain is critical for the survival of the utility. The knowledge of the portable water business, from abstraction and purification to pumping to tap water (consumers), including the legal implications, was considered to be critical, and it was therefore not surprising that it was identified as being the most critical knowledge to be retained. Figure 12 in Chapter three provides a holistic picture of the whole water supply value chain of the public utility. Knowledge of the integrated water management system is the economic engine of Rand Water, and knowledge of infrastructure management and maintenance runs through the entire value chain. This knowledge is also considered to be critical for transfer and retention by experts. In addition to knowledge of the water treatment process, the technical knowledge to build and operate equipment, plants, reservoirs and other facilities on the distribution network is also critical for transfer and retention.

4.2.13.   Means of knowledge transfer to the next generation

The knowledge experts interviewed identified several means for effective transfer of knowledge to the younger generation of workers. These means are listed in the table below.

Table 8: Identified means for transferring knowledge to the younger generation

Identified means for transferring knowledge
On-the-job training knowledge and observation
Hands-on approach
Job shadowing

Basic training

Designs of systems in place

Succession planning / clear career path

Capturing of tacit knowledge

Publications

Forums

Formal coaching and mentoring

Training

Specialised courses

Technical guidance

Close working relationships on projects

Experimentation

Conferences, workshops and seminars

Space to be independent

Allow trial and errors

Communication

Project design office

Proper project documentation and filing system

Personal discussions

Risk-tolerant culture

Video-taping

Video- conferencing

Capturing project lessons

Ensuring attractiveness to young scientists, engineers and technicians

Retention policies

Information and communications technology systems

4.3. Conclusion

Focused knowledge audit interviews with experts were successful, in that they revealed knowledge transfer and retention issues in the public water utility. The key to any future retention efforts is the identification of critical knowledge areas in the organisation. This provides a foundation for the development of knowledge transfer and retention strategies based on the issues raised by the knowledge audit. Some business processes are more important than others - similarly, some knowledge is more important than other knowledge in the organisation. Knowledge transfer and retention has to start somewhere. It was for this reason that the knowledge audit interviews focused on the core competence areas of the public water utility. The choice of elite interviewing was in order to advance this line of thinking. Hence, the experts interviewed were chosen solely on the basis of their knowledge status within their respective fields. The next chapter will provide an overall interpretation of the results and explore strategies to address the issues highlighted during the knowledge audit interviews.

Chapter 5

Interpretation and Conclusion

5.1.   The situation at Rand Water

As we have seen, many of the experts interviewed had spent their entire career or a large proportion of it with the company. We have assumed that in the process, lots of them have built up a tremendous amount of knowledge about how things work, how to get things done, and who to go to when problems arise.[219] When these experts retire, the company loses people to do the job, as well as their accumulated knowledge and expertise. If many people are retiring in core competence areas and they are difficult to replace, the organisation is likely to face what is called 'capacity risk'. According to Strack et al.[220], capacity risk is the potential diminished ability to carry out the company's business. The knowledge audit conducted at Rand Water established that many of these experts had been with the organisation for a long time. Almost all of them had risen through the ranks within the organisation to the key managerial or technical positions in which they are today. With their impending retirement, the public water utility will lose 348 years of experience. This vulnerability is further exacerbated by a high turnover from early and mid-career resignations. This phenomenon will certainly affect the public water utility's capacity to provide clean portable water to millions of people and the business industry within its areas of supply. The challenges with which the organisation is faced are discussed below.

5.1.1 Dangers of losing accumulated expertise and knowledge

In the scientific services division, all five experts, who are senior managers in their respective disciplines, namely process technology, water treatment management, water quality management, water quality specialised services and water quality assessment, are retiring within the next five to eight years, with two of them retiring within a few months after the time at which this study was undertaken. It is interesting to note that the senior manager of the scientific services division had been with the public utility for forty years and was retiring

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[219] Delong, 2004:3.
[220] Strack et al., 2008:120.

at the end of August 2010. This trend was also prevalent in other core business areas from which experts were drawn for the study, such as civil engineering, electrical engineering, pipeline management and research. In the pipeline management and research field, there was the problem of a lone expert with in-depth knowledge of the complex process of pipeline design and research. This poses a serious risk in so far as knowledge transfer and retention is concerned, since the expert is retiring within the next few years, and no one has been identified and developed to be his successor. It is also evident from the data collected that this expert is more likely to retire with a wealth of expertise and knowledge in the field of pipeline management and research, gained over a period of thirty-five years with the utility, and which has not been captured, shared or even transferred to the successor, since there is no succession plan in place. Succession planning seems to be a serious problem throughout the public water utility. All experts interviewed attested to the fact that they did not have successors to take over once they had retired from or left the organisation.

5.1.2 Staff turnover

High staff turnover was a serious concern for many of the experts. Experts are not motivated to transfer knowledge to the younger generations within the organisation if the latter will themselves leave the organisation soon. There is a level of reluctance to engage in such knowledge transfer activities. This is attributed to the fact that they feared that once the young engineers, scientists and technicians had gained sufficient knowledge and expertise, they would leave the utility. There are many factors that complicate the general attrition rate within the utility. Apart from the young engineers, scientists and technicians, who have short-lived careers within the utility, the retirement of experienced experts is also not helping the process. It is noted that those employees in their mid-career, namely those from 35 to 45 years of age, tended to have a stable career within the utility. Therefore, the retiring knowledge experts may be comfortable transferring their expertise and knowledge to this generation, as such knowledge is likely to be retained and used within the organisation for a longer period of time.

5.1.3 Culture

An organisational culture and structure that supports learning, as well as the sharing, storage and use of knowledge, goes a long way towards cultivating a culture of knowledge and retention. There is a feeling amongst the experts that the current organisational culture is not supportive of knowledge transfer and retention activities. The culture of the public water utility rewards individual performance and targets over team performance. As a result, employees compete with each other, and in so doing, they are keeping information and knowledge from their colleagues. To some extent, this can be blamed for the hindering culture of knowledge sharing and transfer. Where there is a chance of knowledge sharing, it is limited to workplace meetings and is done in a silo-oriented manner. According to Skyrme[221], culture stands out as the key factor that determines success or failure in terms of knowledge transfer and management. Factors such as fear, lack of incentives, motivation, turf protection, culture of resistance, too much change, and lack of leadership and management support are considered to be negative factors in the knowledge transfer culture within the public water utility. Such a culture is not considered to be attractive to the younger generation of engineers, scientists and technicians. Therefore, as such, this culture only serves as a barrier to potential knowledge sharing behaviours and attitudes within the organisation.

5.1.4 Leadership and management

The fact that 87 percent of the experts felt that the management and leadership of the organisation did not do enough to motivate employees to share knowledge is a cause for concern. The lack of formal knowledge transfer and management systems, as mentioned throughout the discussions held with individual experts, point to a serious lack of leadership support and commitment from the top echelons of the utility. Therefore, lack of knowledge leadership is an area that needs attention within the public water utility.

5.1.5 Processes

Knowledge sharing, transfer and retention practices are not formally integrated into the business processes. Lack of proper documentation systems in project environments is hindering the process of storing, transferring and retaining knowledge within the utility. Due to workload and time constraints, experts are unable to properly document their knowledge of

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[221] Skyrme, D. and Amidon, D. 1997. The Knowledge Agenda. *The Journal of Knowledge Management*, 1(1): 27-37.

the processes and procedures. Therefore, it is not surprising that workload and time constraints were also considered to be barriers to successful knowledge transfer and retention. Knowledge is continuously being created in the organisation, but the processes and practices that support and facilitate knowledge transfer and retention need to be managed.

5.1.6 Human resources

Part of the formal knowledge management system lies with the human resource management division. Lack of retention strategies, incentives, succession planning, formalised coaching and mentoring and a performance management system were considered to be barriers to knowledge transfer and retention within the organisation. There seem to be pockets of best practice and excellence in some of the key business areas, such as scientific services and some of the engineering departments. Some of these divisions have adopted elements of coaching and mentorship, whereby the experts are involved in coaching and mentoring young scientists and engineers. However, such good intentions are not formally driven by human resource policies and strategies. Employees' skills, expertise and knowledge are the soft infrastructure that is critical for the overall knowledge transfer and retention strategy. Therefore, human resource management within the utility has a role to play in addressing the soft issues that are identified. It will need to devise strategies to counter the organisational challenge of high staff turnover.

5.1.7 Information Technology Infrastructure

Corporate library and information technologies, such as groupware, intranets, databases and the Internet are available to meet the information and knowledge needs of the engineers, scientists, technicians and other employees in the organisation. However, there are some challenges, such as insufficient technical, engineering and scientific information, both print and electronic, in the library. Accordingly, the experts who were interviewed highlighted the information gaps and needs that should be addressed, as illustrated by Table 5 in Chapter 4. Information technology infrastructure can facilitate knowledge sharing activities within the organisation. A good network infrastructure can assist in hosting collaboration tools such as groupware, intranets, document management systems, policies and procedures, and organisational web pages, to mention a few. Information technology support seems to be available, but mainly in support of first generation knowledge management. Such an infrastructure is useful in terms of providing the right information to the right people at the

right time. Table 9 below provides a summary of the key findings of the study and the proposed strategies to address the issues that were raised.

Table 9: Summary of the findings of the study

Key aspect	Findings	Proposed strategies
Human Resources/ People	• Lack of retention strategies • High turnover, early and mid-career resignations and retirements • Performance management system • Affirmative action • Race factor • Lack of motivation • Workload and time constraints • No incentives and rewards for knowledge transfer and retention activities • Lack of knowledge management roles and functions • Pockets of best practice and excellence such as informal coaching, mentorship and job shadowing	• Retention strategies such as succession planning, recognition, incentives and rewards, formalised coaching and mentoring, job shadowing, training • Link mentoring to performance contracting of aging experts • Programmes for retiring knowledge experts, including, but not limited to, the above • Skills audit and inventory • Collaboration and partnership with talent feeders into the system, such as university and technical colleagues • Attractive salaries for young professionals • Making the environment attractive to the young and mid- career generations • Increase employee loyalty and commitment towards the utility • Create opportunities for learning and development • Promote double-loop learning • Programmes for retired

		experts, such as contracts to formally train, coach and mentor younger generations • Generational mix of individuals in project environments • Defined knowledge management (KM) roles and responsibilities • Adoption of appropriate initiatives and their formalisation through human resource development strategies and policies
Leadership and management	• Lack of knowledge leadership and stewardship • Lack of management and leadership motivation • Lack of commitment towards and sponsorship of knowledge transfer and retention • Poor visibility and action with regard to knowledge transfer activities • Non-existence of knowledge management roles	• Alignment of knowledge transfer and retention plans with the overall business strategy • Top leadership and management buy-in, commitment and sponsorship in terms of the implementation of KM projects • Leadership visibility, driving change adaptation • Employee engagement and consultation • Knowledge leadership and stewardship • Clear KM roles and responsibilities within the organisational structure

Culture and structure	- Turf protection - Leadership distrust - Silos - Culture of knowledge hoarding - Competition due to performance management contracts - Individual-based incentives and rewards - Structure dictates a strong, fixed relationship with the boss due to functional reporting lines - Fear - Risk-intolerant culture, intolerance of trial and errors - Lack of recognition - Organisational structure that is too hierarchical	- Collaborative organisational culture - Linking rewards to culture - Promotion of inter-generational knowledge sharing and transfer - Personnel rotation across strategic business units - Making knowledge transfer and retention part of performance contracting - Stress team-based compensation and rewards in order to stimulate and nurture knowledge transfer and sharing among group members - Rewards for risk-taking attitude, creativity and innovation - Storytelling to promote a positive knowledge sharing culture - Expert forums - Establishment of CoPs for mission-critical business processes - KM roles and functions - Corporate KM CoP - After action reviews - Matrix structure - Promote a risk-tolerant culture i.e. tolerance for imperfections - Promote a culture of

		experimentation
		• Culture of recognition, knowledge incentives and rewards
		• Project matrix teams
		• Communication upfront
Change	• Too much change • Culture of resistance to change • Turf protection • Race factor • Fear	• Visible change management agents • Equip managers and employees with organisational change-related skills • Link rewards to organisational change • Leadership competencies for effective knowledge sharing behaviour • Embrace and promote a culture of diversity • Selling change, not imposing it • Leadership and management walking the talk • Culture of knowledge sharing • Break the silo culture through inter-departmental knowledge sharing platforms
Information Technology	• IT infrastructure only limited to first generation knowledge management • Limited to the supply side of codified knowledge • Limited social network and	• Develop and adopt an IT infrastructure that supports the individual creation of knowledge, including knowledge sharing • Implement technology that

	collaboration tools • No proper document management system in place	promotes inter-generational knowledge transfer i.e. Web 2.0 technologies such as wikis, blogs and other social network media • Tacit video capture • Teleconferencing • Lesson learnt systems • Expert locators • Virtual collaboration • Proper collaborative document management system • Harmonise KM infrastructure with organisational culture
Information and corporate library	• Insufficient access to technical, engineering and scientific information • Gaps in industry-related standards, specifications and codes of practice • Limited subscription packages for online technical sites	• Information audit and needs assessment of users • Unlimited access to relevant technical and scientific sites and databases • Closure of the gaps in the library collection • Corporate library should provide CoPs with relevant information • Library should be turned into a knowledge centre and hub • Providing knowledge space for expert forums and discussions • Facilitate storage and retrieval of lessons learned

5.2.   Recommendations for Rand Water

A holistic, integrated organisational knowledge transfer and retention strategy, with a business strategy orientation and alignment, will offer the best solution for the knowledge issues identified. In order to deal with the knowledge transfer and retention challenges highlighted in this and the previous chapter, the organisational strategy of the public water utility should first and foremost take a knowledge-based view of the firm's approach. This will help to maximise the results of the firm's knowledge generation, storage and application process.[222] The adoption of Boisot Information space (I-Space) should be factored into the overall knowledge transfer and management system of the public water utility. I-Space brings together the three dimensions of codification, abstraction and diffusion within the organisation. This could go a long way towards transferring the tacit knowledge of the experts in various core processes of the business. With this conceptual tool, the organisation can explore the behaviour of information and knowledge flows. Through this, the creation and diffusion of knowledge within and across business units can be identified, understood and improved.   Codification and abstraction are mutually reinforcing in that both, acting together, can greatly facilitate the diffusion of information and knowledge throughout the organisation. The more that the experts' tacit knowledge is codified and abstracted, the greater the diffusion of this knowledge to recipients within the organisation. Once the tacit knowledge is abstracted and codified, it can reach the larger population both within and outside the organisation. However, codification and abstraction is only one part of the overall knowledge transfer and retention model. For knowledge status and situations such as those found to exist within the utility, a holistic, integrated approach is needed in so far as knowledge transfer and retention issues are concerned.

Sometimes, applying technology alone to extract knowledge is insufficient. An ideal knowledge transfer and retention system should include a variety of mechanisms, both social and technological, in order to support knowledge processes. The social means of facilitating knowledge transfer and retention could include the following:

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[222] Boisot. M.H. 1999.

1. Programmes for retired and retiring knowledge or subject matter experts, such as getting them involved in the formal coaching and mentoring of protégés, workshops, training, course presentation, storytelling, debriefing interviews and expert forums.

2. Employee rotation to eliminate silo knowledge sharing, as well as the induction and initiation of new employees.

3. Shadowing of retiring subject matter experts and succession planning should be incorporated into strategic planning by those at the apex of the public water utility and those driving the talent management strategy within the organisation.

4. After action reviews. Other interventions such as mentoring and job shadowing may be the most effective way of transferring tacit knowledge and expertise from one person to another, but sometimes, the knowledge that one is trying to retain is less well understood and more likely to exist in larger groups. For transferring and retaining this type of knowledge, a process known as the after action review will be more appropriate.

5. Communities of Practice (CoPs). The public water utility will need well-organised communities of practice that will encourage employees to share their expertise more widely, thus making knowledge more likely to survive in the organisation after the experts leave or retire. These retiring knowledge experts should play leadership and facilitating roles in the communities of practice within their respective areas of expertise.

6. Collaboration and partnership with relevant universities that feed the utility in the critical skill areas. This could be facilitated through the provision of bursaries and sponsorships to aspiring young engineers, scientists and technicians. Furthermore there is a need to make effective use of Rand Water chairs at the University of Johannesburg and Tshwane University of Technology, in order to coordinate the process of recruiting young, aspiring engineers and scientists at these universities. These chairs are currently limited to research and development with regard to water-quality related issues. Extending such a mandate could facilitate the process of student internships at the utility and open up postgraduate research and mentorship for current employees involved in postgraduate studies in the field of water.

These social means work through socialisation, which is the synthesis and transfer of knowledge among individuals in the organisation, usually through joint activities, instead of

written or verbal instructions.[223] It is a person-to-person interaction and knowledge transfer. However, some knowledge within the public water utility will call for the codification approach - in other words, a person-to-document approach that transfers knowledge of the procedures into manuals and other media. Therefore, a balance between codification and socialisation strategies needs to be achieved.

5.2.1. Knowledge Management stewardship and top management

Leadership and management must act as good examples of knowledge sharing. There is a need for them to be seen walking the talk and discouraging a culture of knowledge hoarding within the organisation. Organisations that have achieved the greatest success in knowledge transfer and retention are those that have appointed a senior-level executive to assume the role of full-time Chief Knowledge Officer (CKO). The function of such stewardship should focus on top management encouraging processes that will promote cross-boundary knowledge learning and sharing within Rand Water. This will include assisting the executive team (five senior management executives) to set up and possibly fund knowledge transfer activities and networks in their respective divisions and external networks. Since the company is contemplating the implementation of knowledge management, the appointment of a knowledge manager is seen to be imminent, and this person will have the following responsibilities:

1. Drive organisational knowledge transfer and retention strategies.
2. Provide financial support for knowledge transfer and management initiatives.
3. Manage the flow of knowledge and incorporation of knowledge transfer activities into the organisation's business processes and business partners, in order to ensure that the knowledge transfer and management system is maintained.
4. Oversee the processes and technologies related to knowledge transfer and retention.
5. Leverage the technological infrastructure in order to better manage the transfer and flow of explicit knowledge assets.
6. Ensure that high level committees/communities of knowledge practice are established across organisational boundaries, in order to investigate the direction of knowledge management within the organization.

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[223] Becerra-Fernandez et al. 2004:33.

7. Set up organisational knowledge reward and incentive systems to promote a culture of knowledge sharing throughout the organisation.

5.2.2. Human Resources

Knowledge transfer and management is not an organisational issue to be left to the whim of one department. The Human Resource Department needs to be at the forefront of activities to devise workplace skill transfer and retention strategies. Knowledge is the main ingredient of intellectual and human capital, and tacit knowledge in the minds of employees consists of know-how, experiences, skills and creativity is the source of it all and must therefore be nurtured and protected.[224] The organisation will need to attract and retain a generational mix of individuals. In order to close the growing knowledge gaps and deal with the disintegration and decreasing pool of experienced knowledge experts, the strategic human resource management division will need to develop strategies for the retiring and retired generation of workers. The HR department should take a closer look at introducing the following interventions as part of the overall knowledge transfer and management effort:

1. Development of retention strategies, i.e. attractive salaries to keep young engineers and scientists from being poached by competitors.

2. Workforce skills planning i.e. including but not limited to a skills audit inventory, as well as a list of experts retiring in the next five years and those already retired.

3. Succession planning that includes job shadowing for young engineers, scientists and technicians. The job shadowing approach will need to allow two people to share one job. Having retiring experts being shadowed by young professionals will go a long way towards transferring job skills, expertise and knowledge to the potential successor.

4. Training, in order to gradually move retiring experts towards focusing more on training development and consultancy issues. This involves training them to prepare and present training materials for the young and mid-career generations.

5. Engaging retirees in knowledge transfer activities, such as retaining them on ad-hoc contracts to transfer skills as needed.

6. Coaching and mentoring. This needs to be formally adopted in the human resource management system and policies, as well as with regard to the performance contracting of the most experienced senior managers and experts. Making mentoring mandatory for

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[224] English, M.J. and Baker, W.H. Jr. 2006. Rapid Knowledge Transfer: The Key to Success. *Quality Progress*, 39(2):41-48.

retiring senior experts will go a long way towards transferring technical know-how skills and expertise within the organisation. There is a need to create a conducive environment for protégés, so that they have a sense of belonging and appreciation within the utility.

7. Incorporating knowledge transfer activities into the performance contracting system.

8. Knowledge incentives and rewards that are linked to knowledge transfer and retention indicators. Such incentive schemes should aim to foster a culture of knowledge sharing, not hoarding.

9. Programmes that promote recognition of the experienced generation of workers.

10. Promotion of learning and a risk tolerant culture that is attractive to the young generation of workers.

11. Employee rotation in strategic knowledge domains or mission-critical business process areas.

5.2.3. Information Technology Infrastructure

In addition to the proposed human resource solutions as part of bigger system of knowledge transfer and management, the organisation needs to redefine its information technology infrastructure to focus more on the demand side of knowledge management. Technology for supporting people and facilitating processes needs to be implemented. There is a need to take full advantage of the existing technological infrastructure to launch knowledge transfer and management solutions that promote inter-generational knowledge sharing. For example, the introduction of social media network and collaboration tools in the form of Web 2.0 technologies such as wikis and blogs will help to further this objective. The introduction of online expert forums, expert locator systems, document management system and lessons-learnt databases will promote knowledge sharing throughout the inter-generational mix of workers. Expert directories should list experts, their areas of expertise and their contact information. Mechanisms for knowledge transfer and integration, such as expert locators and expert forums, will help to identify individual employees as relevant experts with specific knowledge, experience and skills in the fields of problem-solving and decision-making processes.

5.3. Theoretical reflection: implications for knowledge transfer and retention

This study was more than just a knowledge audit. The presentation of the results in Chapter 4 feeds back into the theory of knowledge transfer and retention, as discussed in Chapter 2. Knowledge transfer and retention is not a simple process of just exchanging knowledge through a simple codification process, as suggested by the proponents of the traditional knowledge transfer model. Nonaka,[225] Boisot,[226] McElroy[227] and others seem to argue that knowledge transfer is a simple process of codifying tacit knowledge into documents, manuals, books and other mediums in order for it to move from the sources to the recipients. Using Rand Water as a case study with regard to knowledge transfer and retention, what one learns from the results of the knowledge audit process is that knowledge transfer is a complex process, and that not all knowledge is easy to transfer and retain within organisations. Knowledge is sometimes sticky and difficult to transfer.[228] The origin of such stickiness lies in the process of transferring such knowledge. Szulanski[229] views the origins of stickiness as being intrinsic to the knowledge transferred or pertaining to the situation in which the knowledge is transferred. The public water utility is facing this exact challenge. There is a need to unstick valuable knowledge, in order to expand the scope of its use throughout the organisation.

Lack of trust and motivation have been identified as the main barriers to knowledge transfer. This study has established the fact that some retiring knowledge experts are not motivated and willing to transfer their knowledge and expertise to young professionals, because they fear that once these young professionals reach the expected level of expertise and performance, they will be poached by competitors. Furthermore, the experts indicated that some people are scared to share their knowledge and expertise because of the fear of a reduced ability to perform and value to the organisation. Young engineers, technicians and scientists want to move up the ladder quickly, before they are fully established and have accumulated sufficient knowledge in their positions. This discourages established experts

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[225] Nonaka, I. 1994 & 1995.
[226] Boisot, M.H. 1999.
[227] McElroy, M.W.2002.
[228] Szulanski, G. 1995, 1996, 2000 & 2003.
[229] Szulanski, G. 1995.

from willingly sharing their knowledge and expertise. The findings seem to be in general agreement with much of the literature on knowledge stickiness presented in Chapter two. Knowledge experts, who are supposed to be knowledge sources, clearly lack motivation to transfer knowledge and expertise: "The motivation of the source of knowledge to expend efforts and resources and share its expertise may impact the degree of difficulty experienced during a transfer".[230] In a nutshell, the lack of motivation of the source and recipients is correlated with the stickiness of knowledge. The knowledge sources may be reluctant to share and transfer crucial business knowledge for fear of losing ownership of that knowledge to external companies.

The stock of prior related knowledge determines the absorptive capacity of a recipient.[231] According to Szulanski, "a recipient that lacks adsorptive capacity will be less likely to recognise the value of new knowledge, less likely to assimilate that knowledge and less likely to apply it successfully to commercial ends". [232] The knowledge experts interviewed had well-established knowledge networks outside the public utility. Such knowledge networks and contacts assist them to exploit outside sources of knowledge for the commercial gain of the public water utility. In relative terms, the young professionals will lack absorptive capacity, since they are relatively new to their positions and have not yet been fully exposed to external knowledge networks in the water industry, both locally and internationally, as experts have been. Job shadowing, coaching and mentoring will go a long way towards exposing young professionals within the utility to industry knowledge networks. This will serve to increase their absorptive capacity to make use of internal and external knowledge. In addition, such interventions will serve to increase their level of prior related knowledge in the field, as it is argued in the literature that the ability to exploit sources is largely a function of the level of prior related knowledge.[233] There are many barriers and contributors to knowledge transfer stickiness, with organisational culture issues topping the list, as shown in Table 7 of Chapter four.

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[230] Szulanski, G. 2004: 353.
[231] Cohen, W.M. & Levinthal, D. 1990: 128.
[232] Szulanski, G. 1995:438.
[233] Szulanski, G. 1995 & 1996.

Organisational culture is not assisting, but rather contributing towards the level of knowledge transfer stickiness in the public water utility. Another important contextual aspect for both the source and the recipient of knowledge is the nature of their pre-existing relationships.[234] Lack of trust, motivation, turf protections, a risk intolerant culture, poor communication, work silos, and a lack of recognition in the water utility all serve to build a barren organisational culture. This organisational context does not assist and facilitate knowledge transfer and retention initiatives. It only serves to affect the gestation and evolution needed to transfer knowledge throughout the organisation. Szulanski defines such a culture as a barren organisational context and argues that an organizational context that facilitates the development of transfer could be said to be fertile.[235] The organisational structure has been shown to be too hierarchical, and as a result, the knowledge does not flow freely within the organisation. The highly hierarchical organisational structure only increases knowledge transfer stickiness. Formal structures and systems of the organisational context can influence the number of attempts to recreate knowledge and the fate of these attempts.[236] The organisational structure should be flattened in such a way that it facilitates the flow of knowledge, vertically and horizontally, throughout the organisation. Furthermore, building a culture that promotes and nurtures close relationships, rather than arduous ones, helps build intimacy among employees. Such intimacy facilitates communication and knowledge transfer, whereas arduous relationships can create additional difficulties in terms of knowledge transfer, thereby increasing its stickiness.

The conditions in which knowledge transfer occurs are critical to studying and understanding the theory of transfer process. The proponents of the traditional models disregard the social conditions in which the knowledge transfer process takes place. Their emphasis is only on codifying knowledge from the sources. The point that they are missing is the fact that knowledge is found in the relationships within organisations. The theory of knowledge stickiness, as advanced by Szulanski, Argote, Brown & Duguid, Inkpen & Tsang in the literature, attempts to recognise the complexity involved in the knowledge transfer process. Knowledge transfer is not a simple process of extracting knowledge from the source to the potential recipient. It is a very complex process. Individuals and groups develop networks of

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[234] Szulanski, G. 1995: 439.
[235] Szulanski, G. 2004: 354.
[236] Argote, L. et al. 1990 & Ghoshal, C.A. 1994.

relationships that are crucial for the organisation. The majority of experts interviewed in this study had strong internal and external networks. It is interesting to note that some of them had extensive external networks with key stakeholders in the water industry, both nationally and internationally. It is also of critical importance that the organisation capitalises on such vital social capital networks. The proponents of the social capital theory, such as Szulanski[237], Brown et al.[238] and Inkpen et al.[239], argue that social networks and structures are equally important in the transfer process. Social capital represents the ability of actors to secure benefits by virtue of membership of social networks or other social structures.[240] The social capital dimensions of networks affect the transfer of knowledge between network members. Knowledge transfer activities are socially embedded in networks that incorporate a diverse set of organisational actors or individuals. The central issue in terms of social capital is that networks of relationships are valuable assets for the organisation. Hence, social capital is critical to organisations and the theory of knowledge transfer. Knowledge transfer is the process by which one network member is affected by the experience of another.[241] The case of the public water utility in South Africa indicates that there cannot be knowledge transfer and retention under conditions of mistrust and work silos.

In exploiting knowledge, the public water utility faces the dilemma of silos across its business units. It is argued that the relationships between individuals and their social identity contribute towards making knowledge sticky or leaky.[242] Similarly, relationships that are too cold and distant only serve to perpetuate knowledge transfer stickiness within the organisation. It has been established that service units are working in silos, and as such, the communication and knowledge flows are very restricted within these silos. This study proposes that conditions and the organisational culture should be conducive to facilitating and nurturing knowledge transfer and retention activities in the public water utility. Depending on the network types existing within the organisation, different conditions will certainly affect how social capital dimensions influence knowledge transfer and retention. It is therefore

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[237] Szulanski, 1995 & 1996.
[238] Brown J.S. & Duguid, P. 2001.
[239] Inkpen, A.C. & Dinur. 1998.
[240] Inkpen, A.C. & Tsang, E.W.K. 2005. Social Capital, Networks and Knowledge Transfer. *Academy of Management Review*, 30(1): 143-163.
[241] Argote, L. & Ingram, P. 2000.
[242] Brown, J.S. et al. 2001 and Szulanski, G. 1995, 1996 & 2000.

important for the utility to understand how knowledge flows within the organisation, and how the organisational networks affect the movement of knowledge.

In summing up the theoretical reflection, the findings of this knowledge audit process do indeed contribute to the theory of knowledge transfer and retention, in that it has highlighted factors and organisational knowledge issues that hinder knowledge transfer and retention in the public water utility. The purpose of this study was therefore not only to develop an ideal knowledge transfer and retention strategy, but also to build on the theory of knowledge transfer and retention. Knowing what knowledge exists and identifying where it exists is not enough to initiate a knowledge transfer activity: "It presupposes a great level of participation from the source and the receiver and also requires a strong association or relationship between them"[243]. It is indeed true that a knowledge transfer process can often go wrong if the stakeholders involved in the process are unwilling to share knowledge due to motivational, organisational and cultural difficulties, and also due to the fear of losing and lessening competitive advantage and performance ability. An accurate diagnosis of organisational culture, structure and leadership will go a long way towards cultivating a knowledge sharing culture.

5.4. Conclusion

A large portion of the key knowledge and expertise in Rand Water will literally walk out of the door when people retire. The knowledge audit conducted focused on the knowledge experts who were identified, and highlighted critical issues and factors related to knowledge transfer and retention. As a result, solutions that are related to the actual knowledge problems that hinder the process of transferring and retaining knowledge have been addressed in this study. Many of the experts interviewed are retiring in the near future. This leaves the utility exposed to some serious capacity and production risks in the mission-critical areas of the business. The pool of experienced knowledge experts is shrinking in the public water utility, as experienced scientists, engineers and technicians are retiring. High turnover amongst young and mid-career professionals is further aggravating this situation. The public water utility is approaching a crisis if immediate actions are not taken in so far as knowledge transfer and retention are concerned. The problem of the retiring aging workforce, coupled

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[243] Liyanage, C., Elhag, T., Ballal, T. & Li, Q. Knowledge communication and translation: a knowledge transfer model. *Journal of Knowledge Management*, 13(3):118-131.

with a general high turnover, especially among young professionals, will lead to some serious knowledge disintegration and deficits in the future, unless something is done now to reverse the situation. A well-balanced and holistic approach is needed to contain this phenomenon. A retiring expert's programme aimed specifically at encouraging knowledge sharing prior to subject matter experts' retirement should be part of the immediate plans of knowledge transfer and retention efforts. For the knowledge transfer strategy, the starting point should be a discussion with the human resources department to determine who will be retiring within the next five years. In addition to this, the succession debate should ideally and strategically include identifying those who need to be developed in the competencies associated with retiring experts. Of course, certain retiring experts may not want to keep working for the public water utility, as they may be looking forward to starting a new life when they retire. In cases like this, the transfer and retention process needs to be accelerated prior to their departure. Possible strategies should include inviting them to present at expert forums, project meetings or after action reviews, and encouraging them to be leading members of communities of practice and assigning young engineers, scientists and technicians as their shadows, in order to ensure that their knowledge is shared. Specialised reward and incentive schemes can act as extrinsic motivating factors encouraging employees to share and transfer knowledge. A culture of recognition and reputation for retiring knowledge experts can also serve to further motivate them to stay longer, thus promoting organisational loyalty and commitment.

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Appendix

Knowledge Audit Interview Questions

1. How long you have been at the utility?

0 – 10 years	
10 – 20 years	
20 – 30 years	
30 years plus	

2. Have you worked in other positions prior to your current position?

YES	NO

3. What do you think are the core competencies of this organisation?

4. In which of the following fields do you have expertise?

Abstraction	
Purification	
Distribution	
Infrastructure and Maintenance	
Technology Development	

5. Do you think your expertise and knowledge are valued?

YES	NO

6. With whom, internally, do you transfer knowledge and collaborate?

7. With whom, externally, do you share knowledge?

8. How is this knowledge shared?

9. In which fields would you like to develop expertise?

10. Who are your mentors in the organisation?

11. Do you formally mentor employees in the organisation?

YES	NO

12. Who are your mentors outside the company?

13. Are you currently involved in coaching and mentoring employees in the utility?

YES	NO

14. Are you involved in knowledge transfer activities in the organisation?

YES	NO

15. If yes, which transfer activities?

16. What are your key information needs?

17. How do you currently find information to meet your key information needs?

18. Which departments do you deal with mostly in the organisation?

19. Which external industry companies do you deal with the most?

20. Who are the main external contacts that are critical for your business operations?

21. Do you think that the organisational culture supports knowledge transfer and retention?

YES	NO

22. Are employees motivated by management to share knowledge and understand the benefits of knowledge retention activities?

YES	NO

23. What do you consider to be barriers to successful knowledge transfer initiatives in the utility?

24. What do you consider to be barriers to successful knowledge retention initiatives in the utility?

25. Do you trust your colleagues enough to share your expertise and knowledge with them?

YES	NO

26. Are people rewarded for sharing knowledge – financially, through promotion or recognition?

YES	NO

27. What knowledge, critical to the utility's success, would you like to retain?

28. How would you like this knowledge to be retained?

29. What critical expertise would you like to share before retirement?

30. How would you like this knowledge to be transferred to the next generation of workers?