
Knowledge management as a sustainable competitive advantage in the steel industry

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KEY WORDS

Sustainable competitive advantage, sustainable wealth creation, sustainable development, knowledge value chain, organisational performance, knowledge sharing, knowledge management, organisational learning, continuous learning organisation, explicit knowledge, tacit knowledge, information management, dynamic contextual training, knowledge management frameworks, intellectual capital, core competencies, collaboration, communication processes, communities of practice and knowledge management program

ABSTRACT

The aim of this study is to conduct a thorough theoretical study on the relevant aspects involved in knowledge management and organisational learning, and to assess the maturity level of knowledge management within the South African steel industry.

Various aspects of knowledge, knowledge management and organisational learning with specific relation to **sustainable competitive advantage** are discussed in the literature study. During the literature research several factors which either promote or hinder the effective management of knowledge were identified and a list of lessons learned by other successful knowledge focused companies, are discussed. The critical success factors for a successful knowledge management program are also discussed.

Knowledge can create a sustainable competitive advantage within an organisation, if successfully applied to make value adding decisions and to enable learning, and if it is applied to make decisions which are superior to that of its rivals across the supply chain. An integrated approach needs to be followed when KM is pursued and the knowledge must be applied to make value added decisions and facilitate learning across all processes in the value chain. The focus must be to retain an organisation's **tacit knowledge** as this is a key success factor to ensure a sustainable competitive advantage.

The study includes research on whether knowledge management is effectively used as a **sustainable competitive advantage** in the South African steel industry. The maturity level of the application of knowledge and learning principles implemented within the South African steel industry is assessed and compared to the maturity level of ArcelorMittal, Monlevade, located in Brazil. A survey was designed and distributed to determine the knowledge management and organisational learning maturity levels at two steel facilities of ArcelorMittal in South Africa and one facility in Brazil.

The key problem areas as identified through the empirical research are discussed and it is concluded that South African facilities do not effectively use knowledge management as a sustainable competitive advantage. The maturity level of knowledge management in ArcelorMittal, South Africa is low compared to the maturity at Monlevade and rival companies such as Tata and Posco steel.

A significant effort needs to be made in order to allow the effective creation, acquisition, sharing and leveraging of knowledge within the South African steel facilities. The key factors which constrain effective knowledge management is related to ineffective Human Resource policies, organisation structure, lack of knowledge exchange forums, collaboration and communication, coaching, and a lack of incentives to share tacit knowledge.

It is also evident that knowledge is not seen as a sustainable competitive advantage by many respondents and that they perceive they do not have the time or capacity to transfer knowledge. Ten practical design principles were constructed and a knowledge management framework was developed to guide South African steel companies during the design and execution of a knowledge management programme which will ensure that knowledge management will result into a sustainable competitive advantage.

SLEUTELWOORDE

Volhoubare mededingende voordeel, volhoubare welvaartskepping, volhoubare ontwikkeling, kennis-waardeketting, organisasie-prestasie, kennisoordrag, kennisbestuur, organisasie-kundigheidsontwikkeling, deurlopende organisasie-kundigheidsontwikkeling, uitdruklike kennis, onuitgesproke kennis, inligtingsbestuur, dinamiese kontekstuele opleiding, kennisbestuursraamwerke, intellektuele kapitaal, kernvaardighede, samewerking, kommunikasieprosesse, tegniese spesialisgroepe en kennisbestuursprogram.

OPSOMMING

Die doel van die studie is om kennisbestuur- en organisasieleer-konsepte indringend te ondersoek en om die huidige vlak van kennisbestuur in die Suid-Afrikaanse Staal-industrie te bepaal. Verskillende aspekte van kennis, kennisbestuur en organisasieleer in verhouding tot **volhoubare mededingende voordeel** word as deel van die literatuurstudie ondersoek en bespreek. Verskillende faktore is geïdentifiseer wat 'n positiewe of negatiewe impak op effektiewe kennisbestuur het. 'n Lys van "lesse geleer" deur ander suksesvolle kennisbestuursgerigte ondernemings is opgestel en breedvoerig bespreek. Die kritiese suksesfaktore vir 'n suksesvolle kennisbestuursprogram word ook bespreek.

Kennis kan gebruik word om 'n volhoubare mededingende voordeel te bewerkstellig indien die kennis aangewend word om besluite te neem wat waarde toevoeg tot 'n maatskappy. Indien kennis gebruik word om besluite te neem wat beter is as dié van 'n maatskappy se mededingers, kan dit lei tot 'n mededingende voordeel. Kennisbestuur en organisasieleer is van toepassing op al die prosesse in die totale waardeketting van 'n organisasie. Maatskappye moet fokus om onuitgesproke kennis te behou omdat hierdie kennis 'n belangrike kritiese suksesfaktor is vir volhoubare mededingende voordeel.

Die studie sluit 'n ondersoek in om te bepaal of kennisbestuur effektief gebruik word as 'n volhoubare mededingende voordeel in die Suid-Afrikaanse Staalindustrie. Die toepassing van "beste praktyke" kennisbestuurs- en organisasieleerbeginsels in die

Suid-Afrikaanse Staalindustrie word bespreek en vergelyk met die vlak van toepassing van die beginsels in ArcelorMittal, Monlevade, gestasioneer in Brazilië. Die stand van die kennisbestuurs- en organisasieleerbeginsels is getoets met behulp van 'n gestruktureerde vraelys. Die vraelys is versprei na twee staalfasiliteite in Suid-Afrika en een in Brazilië.

Die kernprobleemareas soos geïdentifiseer tydens die empiriese navorsing word bespreek en daar is bepaal dat die twee Suid-Afrikaanse fasiliteite kennisbestuur nie as 'n volhoubare mededingende voordeel gebruik nie. Die ontwikkelingsvlak van kennisbestuur by ArcelorMittal in Suid-Afrika is laag vergeleke met die vlak by Monlevade, Brasilië en ander kompeterende staalmaatskappye soos Tata en Posco steel.

Daar is gevind dat die Staalindustrie in Suid-Afrika nog baie moet verrig om die bestuur van kennis te optimiseer. Faktore wat effektiewe kennisbestuur negatief beïnvloed is oneffektiewe menslikehulpbronbeleide, organisasiestruktuur, die afwesigheid van formele forums, die algemene vlak van samewerking, kommunikasieprosesse, mentorskap en onvoldoende hulpmiddels om werknemers te motiveer om onuitgesproke kennis te deel.

Volgens die resultate van die vraelys is dit duidelik dat kennisbestuur nie as 'n mededingende voordeel gebruik word in die Suid-Afrikaanse Staalindustrie nie. Sommige respondente het aangedui dat hulle nie voldoende kapasiteit of tyd het om kennis uit te ruil nie. 'n Praktiese kennisbestuursraamwerk is voorgestel om die bestuursplan te help om 'n effektiewe kennisbestuursprogram te ontwikkel en te implementeer wat sal lei tot 'n volhoubare mededingende voordeel vir die maatskappy.

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LIST OF ABBREVIATIONS

AM	ArcelorMittal
AMSA	ArcelorMittal South Africa
ANOVA	Analysis of Variance
BBBEE	Broad-Based Black Economic Empowerment
CIO	Chief Information Officer
CTO	Chief Technology Officer
CoP	Communities of Practice
EBITDA	Earnings before Interest, Tax, Depreciation, and Amortization
EVA	Economic Value added
HR	Human Resources
IC	Intellectual Capital
KMP	Knowledge Management Programme
KPI	Key Performance Indicator
KM	Knowledge Management
LO	Learning Organisation
MIS	Management Information Systems
MAKE	Most Admired Knowledge Enterprises
NOPAT	Net Operating Profit after Tax
OL	Organisational Learning
LTI	Lost time Injury
ICT	Information and Communication Technology
IM	Information Management
ROI	Return on Investment
ROIC	Return on Invested Capital
SOP	Standard Operating Procedure
TSR	Total Shareholder Return
WBCSD	World Business Council for Sustainable Development

CHAPTER 1

ORIENTATION AND PROBLEM STATEMENT

1.1 INTRODUCTION

While the traditional three factors of production – Land, Labour and Capital – have become easier to handle in the 21st century, a fourth factor is increasingly and fast becoming a hurdle or bottleneck for companies to grow. This is "**Knowledge**", which is at the heart of much of today's global economy (Carbaugh, 2007:7). Knowledge management (KM) is a sub category of Information Management. The management of knowledge has become vital for companies' competitiveness within a rapid changing business environment (Kok, 2004:2). Effective KM is being increasingly recognized as a distinguishing feature in a growing number of industries (Davenport & Prusak, 2000:xxiv; Liyanage, Li, Elhag & Ballal, 2008:1,2). Organisational knowledge or Intellectual Capital (IC) gains more and more acceptance as being the most valuable resource for a sustainable successful economic future (Auer, 2004:1).

The creation of sustainable growth is typically measured using different financial measures such as Return on Investment (ROI), Economic Value Added (EVA) or Return on Invested Capital (ROIC) (Megginson, Smart & Gitman, 2007:773). Much more emphasis is given today to the non financial information or Key Performance Indicators (KPIs), and public listed companies must include non financial reporting such as social and environmental performance reporting (Correia, 2008:43, 827).

In this research project the definition of company performance is based on both financial and non financial performance reporting. It is also referred to in literature as the triple bottom-line reporting (Correia, 2008:850). Investors are demanding to invest in companies that have a positive ROI, EVA and ROIC, as well as to include sustainability and social responsibility in the business strategy and operations.

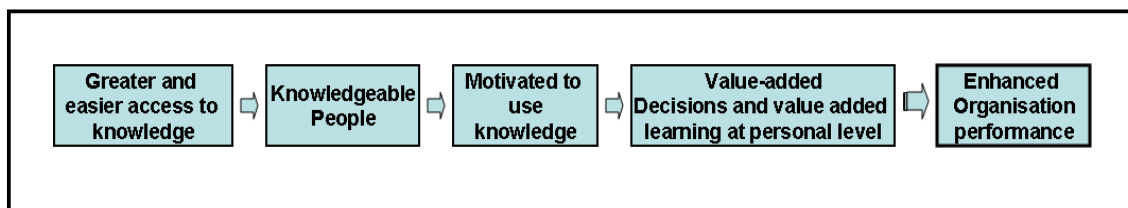
The impact of globalisation and new technologies has brought about an environment of radical and continuous change. The rapid changes require employees to learn new skills and knowledge continuously. KM is an important factor in building a

learning organisation committed to high performance where new knowledge needs to be created, maintained and shared between employees. KM and organisational learning (OL) are interrelated change processes. OL focuses on the organisation's capability to acquire and develop new knowledge and KM focuses on how the knowledge can be organised and used to provide competitive advantage (Cummings & Worley, 2009:161). Literature suggests that if OL and KM initiatives are correctly applied that it will result into improved organisational performance and competitiveness (Johannessen & Olsen, 2003:287).

Knowledge is typically used to make business decisions or to perform manufacturing processes which are superior to that of competitors. Value is added through the application of information and knowledge during the manufacturing, marketing, financial, commercial and other business processes used to provide Steel products to the customers. Nippon Steel have identified different ways how information can be used for sustaining competitive advantage in its existing business segments, creating new competitiveness by developing and implementing Management Information Systems (MIS) and developing competence in emerging technologies. Nippon Steel has realized that a company can gain considerable business advantage by getting maximum value from knowledge and information (Freeman, 2001:45).

De Robillard (2007:36) asserts that the benefits of KM can be summarised through the following process model:

Figure 1.1: Knowledge management value chain to enhance organisation performance



Source: Adapted from De Robillard (2007:36)

The higher the maturity of KM the better the business decisions will be and the higher will be the performance of the company in terms of the performance metrics (Buckman, 2007:33). The study assesses how knowledge must be managed to enhance organisation performance.

The knowledge management programme (KMP) of ArcelorMittal is an example of how knowledge can be used to improve performance. The key performance indicators (KPIs) of the output of physical and business processes are made available to all sites and are benchmarked quarterly to identify why the results differ and what lessons can be learned. Newcastle Works benefits from the knowledge-sharing agreements and direct access to process and operational know-how of the many plants across the group. These agreements are used to perform internal benchmarking and to use this knowledge to further improve operations and skills. The KMP also operates on a more operational level through global participation in weekly networking forums on marketing and operational issues which facilitates knowledge sharing of best practices across the group of ArcelorMittal companies (ArcelorMittal, 2007:20).

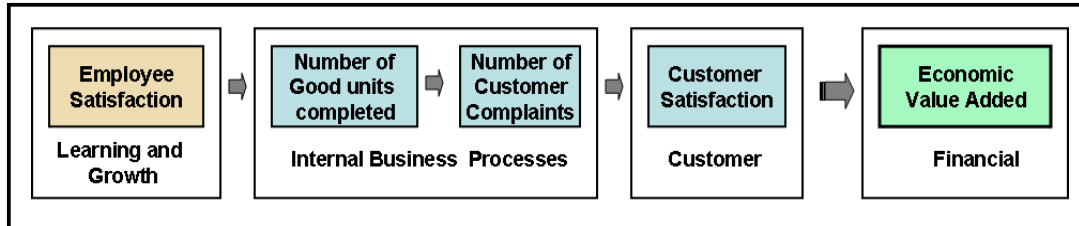
Knowledge management includes the codification of explicit knowledge and the management of tacit knowledge. Tacit knowledge refers to the know-how of making steel, industry knowledge, marketing and commercial contacts or simply to the brainpower used to make business decisions or manufacturing challenges which cannot be codified into systems. Tacit knowledge is difficult to copy or to be imitated by competitors, and organisations must focus on the application of tacit knowledge to improve competitiveness (Van Beek, 2008:25).

Although 90% of knowledge in a company are in the heads of people (tacit knowledge) management typically spends 75% of their time on knowledge that is written down (explicit knowledge) (Buckman, 2007:40).

According to Ramalho (2010), should the knowledge of a specific process only be embedded in the mind of a single individual who resigns, this can result in either a reduced quality product, or it may negatively impact operational efficiencies, customer service, or can result in unsafe working conditions. A person with inferior skills and knowledge will most probably take longer to fix a problem which will result in lower plant availability, or the person may not have sufficient safety training which can result in a lost time injury (LTI). The loss of knowledge can result in lower customer service or lower employee motivation, or can also negatively impact the organisational climate.

This can ultimately result in an increase of customer complaints which will result in lower customer satisfaction. Lower customer satisfaction can lead to lower sales which will negatively impact EVA (Correia, 2008:670). The causal linkage between the different elements in the balanced scorecard is explained in figure 1.2. In this study, the potential impact of effective KM on EVA is assessed.

Figure 1.2: Causal linkages in the balanced scorecard



Source: Adapted from Correia (2008:670)

The learning and growth perspective of the balanced scorecard focuses on the infrastructure that a firm puts in place to deliver long-term growth and improvement. Management must focus on the capabilities of the organisation to be developed to achieve superior internal processes which will create value to the customers and shareholders.

The learning and growth perspective measurements are typically measured in terms of employee capabilities (training and skills), information system capabilities (percentage of customer service employees having real-time access to customer information) or in terms of the organisation climate for employee motivation and

initiative (number of employees whose goals are aligned with that of the company) (Correia, 2008:670).

Successful companies have skilled people at all levels in the company, leaders must develop sound strategic visions, managers must make value-adding decisions and design efficient business processes, and train and motivate the workforces to implement the company strategy (Brigham & Erhardt, 2007:3).

Based on the previous studies on successful KM implementations, the KM strategy must focus on the sharing of tacit knowledge and it must be done parallel to the implementation of OL concepts (Johannessen & Olsen, 2003:286). Lastly but not least important, effective communication and the culture must be ready to “share knowledge” (Buckman, 2006a:6).

1.2 CAUSAL FACTORS

The causal factors for this study were the following:

- There is an increasing threat of the global skill shortages in the Steel industry and particularly in South Africa.
- Lessons learned from the international benchmarking exercise with a similar steel plant in Brazil claims that the establishment of a learning organisation and the application of KM principles form an important part of their business strategy in creating sustainable competitive advantage.
- There exists a high level of vacancies at Newcastle and average time to attract new engineers, technicians and millwrights.
- Newcastle's workforce has been classified as an ageing workforce with average age of close to 45 years with 25% of the workforce younger than 20 years.
- There is a high rate of skilled employee turnover.
- The introduction of new legislation and laws has drastically increased the liability of companies to: adhere to safe labour practices, address

environmental issues, achieve Broad-Based Black Economic Empowerment (BBBEE) targets and to undertake social investments.

- Problems experienced at ArcelorMittal related to knowledge or expertise gaps due to resignations or vacancies. This includes lower plant availability and production yield performance due to availability of skilled personnel.
- Planned plant expansions planned over the next five years within the steel industry will require knowledgeable resources.
- Success has been achieved by other competing companies such as Posco and Tata Steel by implementation of Communities of Practice (CoP) and the creation of knowledge pieces (KP) to share tacit knowledge.

1.3 OBJECTIVES OF THE STUDY

The objectives of the study are split into primary and secondary objectives.

1.3.1 Primary objective

The primary objective of the research was to establish whether the Steel industry in South Africa is effectively using KM as a sustainable competitive advantage.

The level of maturity of the application of KM principles implemented within the South African Steel industry was assessed and compared to the maturity level of ArcelorMittal, Monlevade, located in Brazil.

1.3.2 Secondary objectives

To achieve this primary objective of the study, the secondary objectives to be realized were as follows:

■ Theory evaluation:

- Perform a literature study to research the different aspects of knowledge and KM with emphasis on the relationships between OL, culture, sustainable growth and competitiveness
- To determine the definition of wealth creation in financial, social and environmental measurements and to assess the relationship of these to KM
- Provide an overview of KM implementation frameworks or models found in literature with emphasis on the improvement of competitiveness and sustainable growth
- Identify how other Steel and non Steel companies are using KM and OL concepts to improve competitiveness and develop a list of lessons learned
- Perform a high level assessment of the current status of KM in competing Steel companies

■ Empirical research:

- Investigate the opinions of respondents of the maturity levels of different KM and OL principles within the Steel industry in South Africa and Brazil
- Investigate the readiness of ArcelorMittal to manage knowledge with specific emphasis on incentives and culture (Newcastle, Saldanha and Monlevade Steel)
- From both the theory and empirical research the final objective was to recommend practical design principles which can be used to implement a knowledge management programme (KMP) which will result into a sustainable competitive advantage to the South African steel companies.

As can be seen from the above objectives, a number of aspects relating to KM and OL principles were researched. A survey was developed which was

used to determine ArcelorMittal South Africa's and Monlevade's level of adoption of KM and OL principles. From the study, recommendations were made regarding best practises to be followed when knowledge is used as a key enabler to improve the competitiveness of the South African Steel companies to increase wealth creation.

1.4 SCOPE AND DEMARCATION OF STUDY

This study focused on KM, culture and OL concepts to assess the maturity level of OL and KM within the Steel industry of South Africa. The study confirmed how KM can be used to improve **competitiveness** to ensure sustainable growth and wealth creation within the Steel industry.

The study was limited to primary sources of information gained from the Steel industry in South Africa, with specific reference to the Newcastle and Saldanha facilities of ArcelorMittal South Africa and ArcelorMittal Brazil available up to October 2010. Secondary sources of information were limited to those generally available on the Internet, in the form of English language documents, and generally available literature sources.

The empirical study focused on ArcelorMittal Newcastle Steel, Saldana Steel and Monlevade; all these sites are remote sites in South Africa or Brazil. The scope included all managers, engineers, technologist, technicians and specialists across all functions.

1.5 RESEARCH METHODOLOGY

Both primary and secondary sources of information were used during the study. Secondary sources from publications and text books were used to study the different KM principles. Primary information was also gathered by means of an empirical study. A quantitative research approach was used in order to be able to provide an objective base to meet the research objectives. Questionnaires were distributed to the relevant managers and specialists within ArcelorMittal Newcastle, Saldanha and

the Monlevade facilities. All information obtained from the different business areas were kept confidential.

1.6 DIVISION OF CHAPTERS

This dissertation is divided into four chapters. Each chapter has different focus areas and will be discussed in the section below.

Chapter 1

The aim of chapter one is to discuss the causal factors and to confirm the problem statement that forms the basis for conducting this study. A brief overview is given on the relation between competitive advantage, OL concepts, KM and company performance and wealth creation. The difference between explicit and tacit knowledge is discussed using some practical examples and it is emphasized that the application of tacit knowledge adds value in terms of operational performance and wealth to stakeholders. The research methodology used as well as the target population is discussed.

Chapter 2

Chapter two consists of a literature study on KM and focuses on competitive advantage, wealth creation metrics, knowledge, KM, KM strategies and OL principles and frameworks. Best practices of how tacit knowledge can be managed in the corporate environment are discussed. The literature study includes the identification of the lessons learned by companies which have successfully implemented KMPs that have improved their competitiveness.

Chapter 3

Chapter three outlines the methodology used during the empirical study. A short overview of the Steel industry is given and a summary of the most recent SWOT analyses of the case company is presented. The design of the questionnaire is discussed as well as the sample design and process of analysis and evaluation of data. The results from the survey questionnaires are presented in relation to the literature study.

Chapter 4

Chapter four presents a summary of the opinions from the respondents within the Steel industry on certain KM and OL principles. A comparison of the maturity level of KM and OL between Brazil and the South African Steel industry is presented. A list of practical design principles for the successful implementation of a KMP within the South African steel industry is proposed. Final recommendations are made to improve the state of KM within the South African Steel industry. The dissertation is concluded by identifying opportunities for future research.

1.7 CONCLUSION

The main conclusion that can be drawn from chapter one is that the retention and nurturing of specialised tacit knowledge is critical to ensure sustainable growth in the highly competitive Steel industry. The focus of knowledge management must be on **tacit** knowledge management as this is where value and wealth will be generated. Over the long term the only sustainable source of competitive advantage is an organisation's ability to learn faster than its competition through the creation and the use of knowledge. Successful knowledge management initiatives are highly dependent on the readiness of the organisation culture. The research objectives were confirmed as well as the research methods to be applied were discussed. A chapter overview has also been provided.

1.8 CHAPTER SUMMARY

The aim of this study was to assess the maturity level of knowledge management within the Steel industry in South Africa, and to identify best practices or lessons learned from other successful knowledge enterprises. Subsequently, a proposal was put forward to improve the management of tacit knowledge within the South African steel industry. The aim was to establish a culture in an organisation where knowledge is used as a **sustainable competitive advantage**.

The literature study will be discussed in Chapter 2.

CHAPTER 2

LITERATURE STUDY

2.1 INTRODUCTION

Knowledge management (KM) includes capturing, creating, sharing and using know-how. That know-how includes explicit and tacit knowledge. It is not about books of wisdom and best practices, it's more about the communities that keep know-how of a topic alive by sharing what they know, building on it and adapting it to their own use. KM can be defined as 'performance through learning', 'shared knowledge', or simply 'working smarter' (IFAD report, 2007:4).

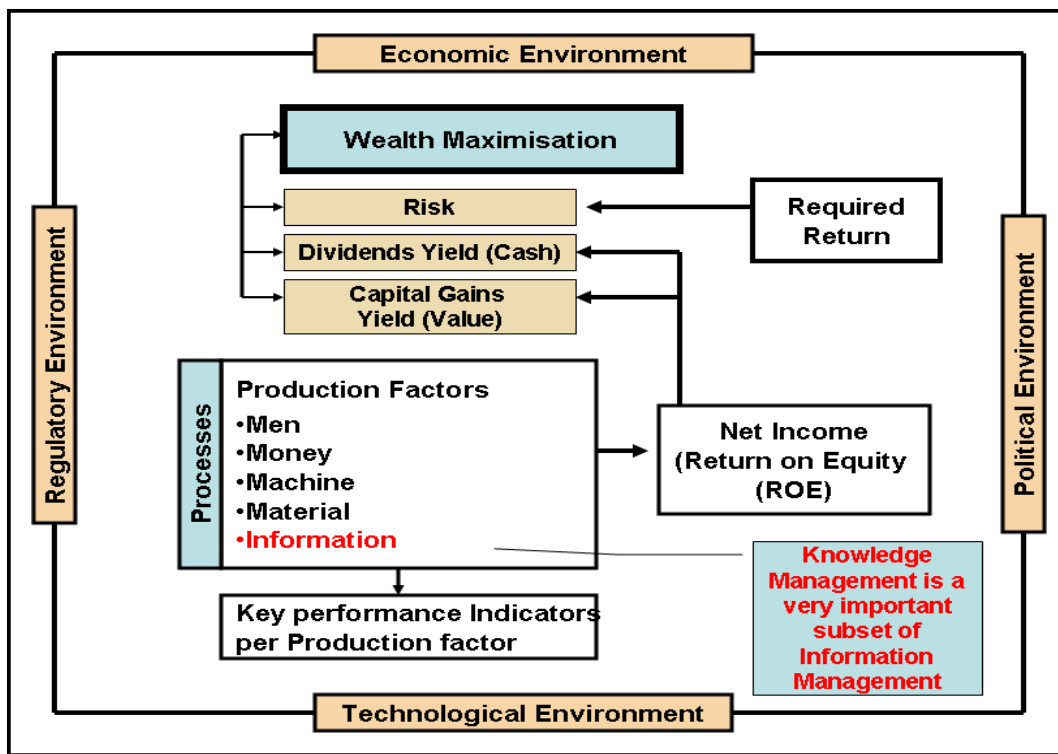
Several mini-dissertations have been done on the effective use of KM and OL concepts (De Robillard, 2007:85; Van Beek, 2008:92; Lupton, 2009:82). The focus of this literature study is on how knowledge and learning concepts can be used to create sustainable competitive advantage and growth which will increase the wealth of all stakeholders. The intent of the literature study is thus to focus on how knowledge and learning principles need to be applied to gain a **sustainable competitive advantage** in the South African Steel industry based on literature and case studies of companies which have successfully used knowledge to improve competitiveness.

2.2 DEFINING SUSTAINABLE WEALTH CREATION AND COMPETITIVENESS

Shareholders invest their equity to become wealthy now and in the future, which means that they are also interested in the sustainability of wealth creation. The primary objective of companies should be shareholder wealth maximization which translates to maximizing the stock price of a company. The potential to create wealth and value for shareholders of any business depends to a large extent on the ability of the business to respond to changes and expected changes in its business environment. The result of this is that companies must continuously adapt to remain competitive. Companies must improve their agility and must **continuously learn** and adapt to these changes (Nel, 2005:93).

Nel developed a conceptual model which explains the different factors that must be pro-actively managed to maximize wealth creation. Although Nel's model was developed from a shareholder wealth creation perspective it is a good model to explain the different factors that must be managed to ensure wealth creation. Figure 2.1 is an adapted model as developed by Nel indicating that a business operates in a dynamic environment which consists of controllable and uncontrollable factors that must be managed (Nel, 2005:94).

Figure 2.1: Conceptual Wealth Maximisation Framework



Source: Adapted from Nel (2005:94)

The model indicates that wealth creation is influenced by inputs received from changes to the economic, political, regulatory and technological environments. The model illustrates that three variables influence wealth creation, namely the cash generated or paid out as dividends, value caused by growth and the risk-return relationship.

The model further shows that different Production factors such as Men, Money, Machines, Material and **Information**, are applied to generate goods or services.

The model also indicates that investors want to understand risk prior to investments. According to the model developed by Nel, the higher the risk the higher the required return from investors. These risks as perceived by the investors are impacted by internal performance of the company as well as by the macro environments which are in constant flux (Nel, 2005:94). The model of Nel can be applied to the Steel industry where different production factors are applied including information and knowledge to transform raw materials such as Iron Ore and alloys into final steel products. The products are sold which result in a return that can be paid to shareholders in the form of dividends (cash) or it will result in a higher stock price, referred to as capital gains or value. The Steel industry is a capital intensive industry and low production cost is a key differentiating factor for sustainable competitive advantage.

The creation of sustainable growth is typically measured using different financial measures such as Return on Investment (ROI), Economic Value added (EVA) or Return on Invested Capital (ROIC) (Megginson *et al.*, 2007:773). The financial EVA model of value or wealth creation is perceived to be one of the best methods to express and quantify shareholder wealth creation.

EVA is a single-period measure of a firm's ability to create wealth for its shareholders. EVA is an estimate of a business's true economic profit for the year, and it differs sharply from accounting profit. EVA represents the residual income that remains after the cost of all capital, including equity capital, has been deducted, whereas accounting profit is determined without imposing a charge for equity capital.

$$\text{EVA} = \text{NOPAT} - (\text{WACC} * \text{Operating Capital})$$

NOPAT refers to the Net operating profit after tax.

The following variables have an impact on EVA:

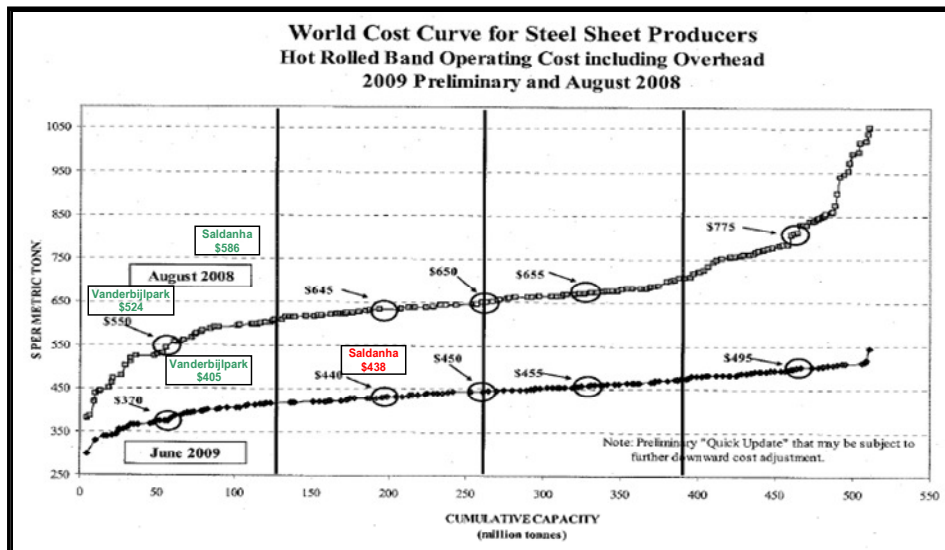
- $\text{NOPAT} = \text{Sales} - \text{Operating expenses} - \text{Taxation (Tax rate)}$
- $\text{WACC} = \text{Weighted average cost of capital}$
- $\text{Capital (Net Operating Capital)} = \text{Net working Capital} + \text{Net Fixed assets}$

Source: Hall (2002:29)

The competitiveness of a company within the steel industry is frequently measured by the economic value which is added or the rate of return on investment. During 2008, ArcelorMittal (AM) added R4.9B to shareholder value and a NOPAT of R9.5B was achieved. The past actual mean return of ACL was 35.8% over the period (2003 to 2008) and hence the investors received more than the required return of 24.6% (ArcelorMittal, 2008).

A critical success factor for growth and sustainability within the Steel industry is to be cost competitive. NOPAT is largely impacted by the dollar per ton produced and as such is a very important metric. The relative cost position of ArcelorMittal is reflected in figure 2.2. ArcelorMittal's relative cost position falls within the lowest cost quartile.

Figure 2.2: World cost curve for Steel sheet producers



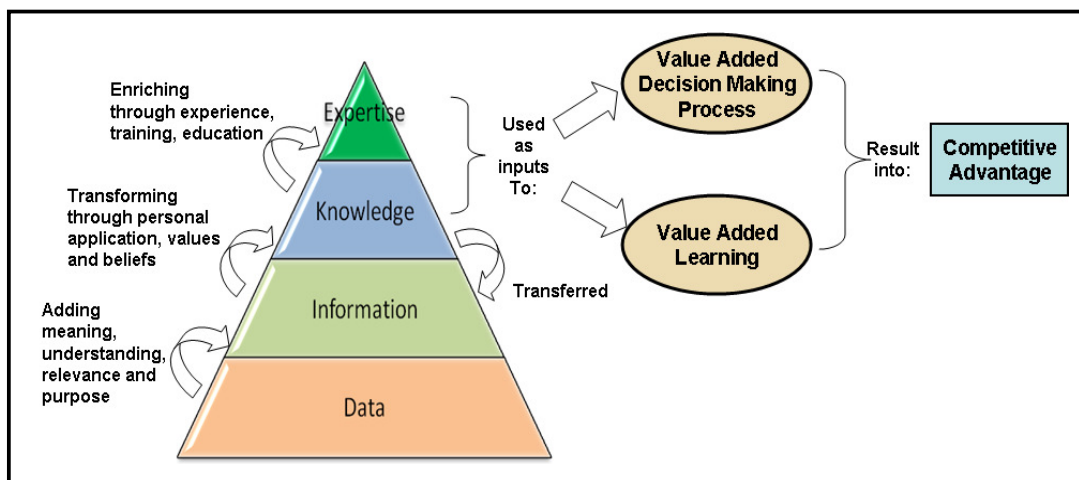
Source: Adapted from CRU price data (2010)

This metric is monitored continuously by independent research companies (CRU, 2010). Based on the historic performance of ArcelorMittal, in terms of the EVA to shareholders, the ROI and its competitive position relative to the international cost curve of steel producers, it can be concluded that ArcelorMittal is very competitive. What role can effective knowledge management play to further improve the sustainable competitiveness of South African steel companies such as ArcelorMittal?

2.3 DEFINING KNOWLEDGE AND RELATION TO SUSTAINABLE COMPETITIVE ADVANTAGE

Competitive advantage is a result of optimal decisions which are made through the **application** of knowledge and skills. Figure 2.3 represents a high level process model to explain how information, knowledge and skills are used to create competitive advantage. These decisions are made daily based on the application of explicit and tacit knowledge (De Robillard, 2007:36). In general **tacit** knowledge is the knowledge that, when applied result into competitive advantage as it is not easy to be copied by competitors. Tacit knowledge is a key success factor to ensure competitive advantage (Van Beek, 2008:25).

Figure 2.3: Knowledge and expertise and relation to competitive advantage



Source: Adapted from Van Beek (2008:8, 25)

Knowledge can be seen as a resource and the competitive power of a resource can be measured by the following principles:

- Is the resource really competitively valuable and does it really contribute to competitive advantage?
 - Is the resource strength rare and is it something that rival companies lack?
 - Is the resource strength hard to be copied by rival companies?
 - Can the resource strength be replaced by a substitute resource strength?
- (Thompson, Strickland & Gamble, 2010:109).

The South African Steel industry is very competitive and has the capability and skills to keep operating costs the lowest in the world (ArcelorMittal, 2007:128). The focus of the literature study is to investigate how knowledge and expertise (tacit knowledge) can be used to further improve or create sustainable competitive advantage in the South African Steel industry. Tacit knowledge is competitively valuable, rare and difficult to imitate and is difficult to be replaced by substitutes.

2.4 DEFINING SUSTAINABLE DEVELOPMENT

Sustainable development includes three elements, namely economic, environmental and social development. An organisation called Buried Treasure developed a business value matrix which summarises the impact of sustainable development issues on financial value creation (Heemskerk, Pistorio & Scicluna, 2001:3).

According to the model developed by Buried Treasure, sustainable wealth creation is not only impacted by financial performance and drivers but is also impacted by sustainability dimensions. Intellectual capital as a financial driver is, for example, positively influenced by the workplace conditions whereas operational performance is negatively influenced by socio-economic development and human rights (Heemskerk *et al.*, 2001:13).

Evidence available for the various relations between sustainability and value generation is summarised in table 2.1. The model developed by Heemskerk and

others illustrates that knowledge management is not limited to improve traditional dimensions of business success, but must also assist to improve the new dimensions of business success.

Based on table 2.1 it is evident that wealth creation in the new economy cannot be limited to the traditional financial performance criteria, and sustainable growth and competitiveness will need to include sustainable development indicators as defined in table 2.1. Optimal decisions to be made by employees and management must **not** only focus on core operations but also on dimensions such as environment, socio-

Table 2.1: Sustainable Business Value Matrix

Sustainable development performance	Ethics, Values and principles	Accountability & transparency	Triple bottom line commitment	Environmental process focus	Environmental product focus	Socio-economic development	Human rights	Workplace conditions	Engaging business partners	Engaging non-business partners	
											Traditional dimensions of business success
Financial performance											Shareholder value
											Revenue
											Operational efficiency
											Access to capital
Financial Drivers											Customer attraction
											Brand value & reputation
											Human value & intellectual capital
											Risk profile
											Innovation
											Licence to operate
	Governance	General	Environmental	Socio-economic	Engagement						
No Impact			Negative Impact			Weak to moderate positive impact			Strong positive Impact		

Source: Adapted from WBCSD (2001:13)

2.5 IMPACT OF EFFECTIVE INFORMATION MANAGEMENT ON COMPETITIVENESS

A quantitative analysis of information technology's impact on shareholder value was done by the CIO Executive Board (Dutta *et al.*, 2006:23). The impact of the information technology management competency on firm performance was assessed as well as the use of information technology (IT) to enhance **competitive differentiation**. The study done by the CIO Executive Board in 2006 concluded that

the overall competency in the Information Management function can increase the firm's market performance by as much as **20%**. The overall information management competency boosts the ability of other functions such as sales and marketing to drive firm performance. The results of the survey showed that information management competency does not only impact a firm's Total Shareholder Return (TSR) but also other financial measures such as Free Cash Flow and Earnings before Interest, Tax, Depreciation, and Amortization (EBITDA) through IT enablement (Dutta, Acker, Foster & Shah, 2006:23). The analysis was done over the period 2000 to 2004 through a survey which was completed by 800 respondents in 119 publicly traded organisations in different industries, company sizes and management levels (Dutta *et al.*, 2006:23).

A standard metric referred to as TSR was defined across industries which reflect the share price appreciation plus dividends. The relationship between 25 different information management capabilities with TSR and the performance on working capital efficiency were done through regression analyses to determine positive and negative correlations. The study found that the competency level of **IT-enabled collaboration** which allows distributed staff to effectively share information and collaborate, have a **strong** impact on company competitiveness if measured through TSR and working capital efficiency. The study group recommended that companies must foster communities of practice and must launch enterprise-wide collaboration platforms to improve knowledge sharing to improve competitiveness (Dutta *et al.*, 2006:41). Table 2.2 provides a summary of the 11 key IT competencies which companies must focus on to ensure maximum impact on competitive advantage.

Table 2.2: Impact of key IT attributes on five-year TSR

Grouping	Competency (Percentage Impact in brackets)
Talent management	Leadership development.....(20%) Performance management.....(14%) IT staff development..... (13%)
Business enablement	Process digitization (18%) IT-enabled Collaboration.....(14%)
Lifecycle ROI accountability	Lifecycle Cost efficiency.....(18%) Business Case discipline.....(15%) Performance reporting.....,(13%)
Strategic management	Strategy and planning.....(14%) Business continuity planning.....(13%) Enterprise architecture..... (10%)

Source: Adapted from Dutta *et al.* (2006:24)

The result of this survey confirms that the application of the information and explicit knowledge through the sharing and use of tacit knowledge have an impact on both organisation performance and shareholder value. The result of this study is aligned with the experience at Monlevade communicated by Ramalho (2010); value is only added when information and knowledge are applied using skills and experience.

The relationship between KM and competitive advantage was also investigated by Chuang (2004:460). He undertook an empirical study which confirmed that an organisation's KM capability is **significantly** related with competitive advantage. The study included 177 companies across different industries. He separated KM into Social KM and Technical KM resources and found that there is a positive correlation between competitive advantage and Social KM. His study concluded that a negative correlation exists between technical KM (also referred to as IT capability) and competitive advantage, which support literature and the study made by the CIO Executive Board in 2006. If KM is used to improve competitive advantage it must form part of the business strategy and be driven by the business or information

management and not by information technology (Leigh, Donoghue, Bruce & Weitzman, 2007:1; Ndlela & Du Toit, 2001:156).

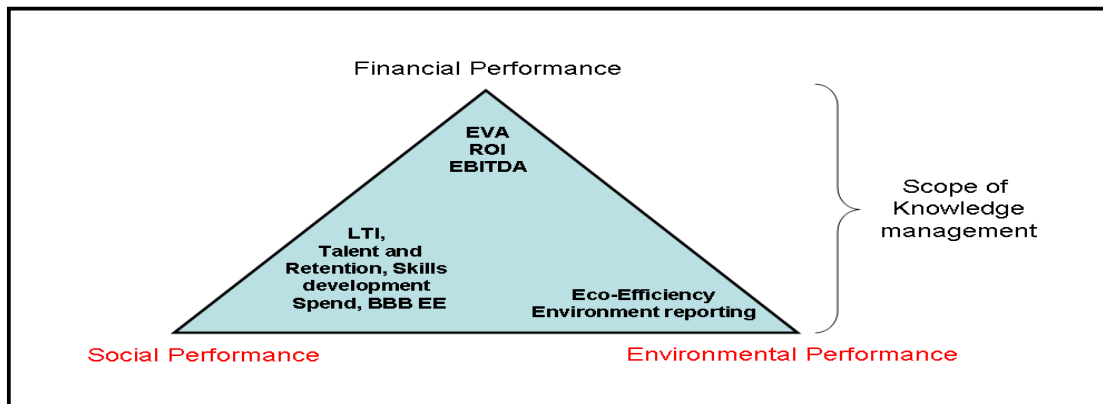
2.6 DEFINING ORGANISATIONAL PERFORMANCE AND SCOPE OF KNOWLEDGE MANAGEMENT

Sustainable wealth creation is impacted by the relative competitive position of a company within an industry, according to the Boston Growth-Market Share Matrix (Kotze, 2010:31). It can be assumed that a company will only achieve and maintain a competitive position if its growth rate is higher than the industry and if the organisation's performance is continuously superior to its rivals.

Organisation performance includes financial, social and environmental performance. Superior organisation performance will create wealth to all stakeholders. Stakeholders refer to shareholders, employees and communities, including the government. Superior organisation performance will result in a competitive advantage.

In this study, the definition of company performance is based on both financial and non financial reporting. It is also referred to in literature as the triple bottom-line reporting. Investors are demanding to invest in companies that place sustainability and social responsibility as part of their business strategy and operations as defined in table 2.1. The relation of organisation performance and key performance indicators are summarised in figure 2.4 which is also referred as the triple bottom-line reporting principle.

Figure 2.4: Organisation performance (triple bottom-line)



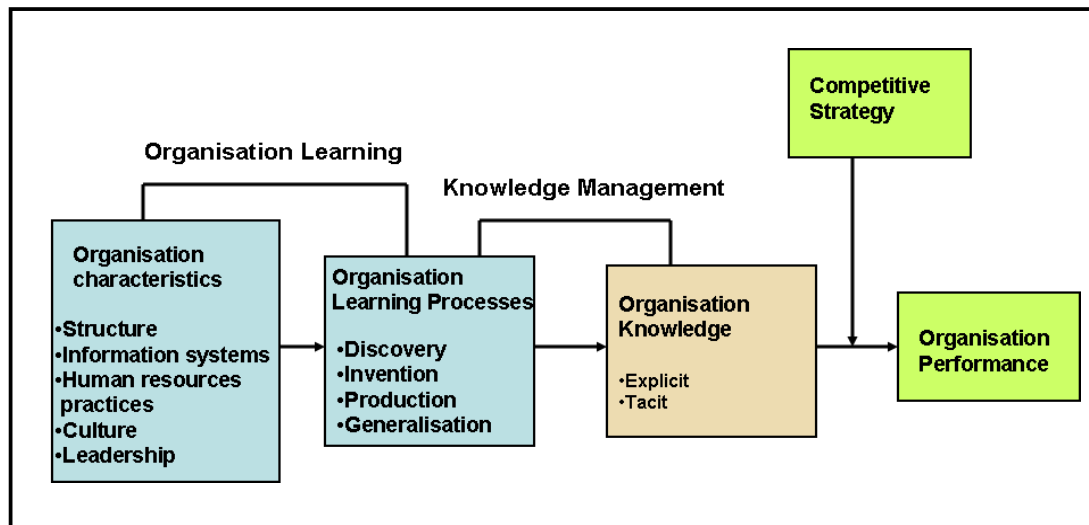
Source: Adapted from Correia (2008:850)

Figure 2.4 shows that organisation performance is measured in terms of financial, social and environmental performance. Knowledge and skills must thus be applied to improve financial, social and environmental performance (Nel, 2005:4).

2.7 THE RELATION BETWEEN KNOWLEDGE MANAGEMENT, ORGANISATIONAL LEARNING AND ORGANISATION PERFORMANCE

Cummings and Worley (2009:541) have developed an integrative framework which explains how OL and KM interrelates. As shown in figure 2.5 the key outcome of learning is knowledge, and organisation performance depends on the organisation knowledge and competitive strategy.

Figure 2.5: Relation between organisational learning and knowledge management and organisation performance



Source: Cummings and Worley (2009:541)

Literature suggests that there is a correlation between the maturity level of knowledge management and learning to the level of sustainable competitive advantage (Johannessen & Olsen, 2003:287).

A study done of 31 KM projects across 20 organisations revealed that KM contributed to a fundamental transformation of only three of the firms studied. Many companies did, however, indicate that KM did result in operational improvements in customer service, product development, education and training, and patent management. Most reports on the outcomes of OL and KM is based on results from case studies and more systematic research is needed to assess the effects of these change interventions in different industries (Cummings & Worley, 2009:550).

A distinctive competence is a competitively important activity that a company performs better than its rivals and thus represents competitively superior resource strength. Knowledge is typically used to make business decisions or to perform manufacturing processes. If the application of the knowledge represents a level of proficiency which rivals do not have, the resource strength is defined as a distinctive competence (Thompson *et al.*, 2010:108). Value will thus be added in the Steel industry through the application of knowledge and skills during the manufacturing,

marketing, financial, commercial and other business processes used to provide Steel products to its customers (Ramalho, 2010).

2.8 THE MATURITY LEVEL OF KNOWLEDGE MANAGEMENT IN COMPETING STEEL COMPANIES

Information published on the POSCO Steel and TATA Steel companies websites were researched to determine the knowledge management strategy and progress made by these companies. Tata Steel based in India and Posco Steel based in Korea, started with knowledge management programmes in 1999. Both companies have received several global awards to recognise the progress made by these companies in their journey to become world-class knowledge enterprises (Anon., 2009, 2010).

It is stated on Tata Steel's website (Anon., 2010) that they made a decision to change the focus for growth from physical assets to the **development of intellectual capital**. They state that this has made the company a visible leader in excellence in Asia.

The company was selected as the winner of the 2003 Asia's Most Admired Knowledge Enterprise. It also received the award for the most admired Asia-Pacific's best employer in the same year. The TATA Group has been recognised as one of World's Most Admired Knowledge Enterprises (MAKE) in 2006. The website (Anon., 2009) also revealed that it receives over 1 100 hits on its KM website with more than 200 new additions of knowledge pieces (KPs) daily. Tata Steel started its KM journey in 1999 during the fifth phase of its modernisation known as '*Modernisation of Mind*'. Managing knowledge effectively is the key to success for a growing organisation, as stated by the managing director.

Posco received the Knowledge Management Grand Award in 2005 and 2006 as Korea's most outstanding knowledge management company. Posco also received the Maekyung-Booz Allen Knowledge Management Award for three years in a row since 2004. This reward is given to companies that have greatly contributed to Korea's national competitiveness through knowledge management. POSCO

received the Asian MAKE (Most Admired Knowledge Enterprise) Award by Teleos, a knowledge management research institute based in the UK, for two years in a row since 2005 (Anon., 2010). POSCO employees are **actively participating** in the KM programme and the average daily logins to its Knowledge Management System (KMS) is **7 000**. Around 200 to 300 knowledge articles created through the daily work or **Communities of Practice** (CoP) activities are posted in the system daily. As of January 2007, around 360 000 articles have been registered in KMS which are utilized to perform daily tasks or learning material (Anon., 2010).

The website further states that as of January 2007, **2 907** CoPs have been formed and been participated by 69 051 employees, representing 3.9 CoPs per employee. A survey indicates that 93% of the employees have used a CoP for their work and that CoPs greatly helped to improve close bonding between employees (Anon., 2010).

It is thus evident that other Steel companies have actively pursued the management of knowledge as a key enabler for sustainable growth. Based on information on the website of ArcelorMittal a formal KMP is in place but this is rather based on benchmarking and operational review meetings where knowledge is shared. The KMP of ArcelorMittal is to a large extent Top down driven based on KPIs per process and KMPs are limited to specific managers or employees. Some operating facilities such as Monlevade in Brazil and Gent in Belgium have made some progress to translate tacit knowledge into explicit knowledge (Arcelormittal, 2010).

No evidence could be found of any KM system which is updated and used on a daily basis by all employees and no evidence could be found of any global KM rewards received by ArcelorMittal. The assumption is made that if a company does not measure the general usage or number of established CoP or knowledge sharing forums or number of knowledge pieces created, it is lagging behind other world-class KM companies.

2.9 THE KNOWLEDGE MANAGEMENT AND ORGANISATIONAL LEARNING APPROACH FOLLOWED BY ARCELORMITTAL, MONLEVADÉ FACILITY

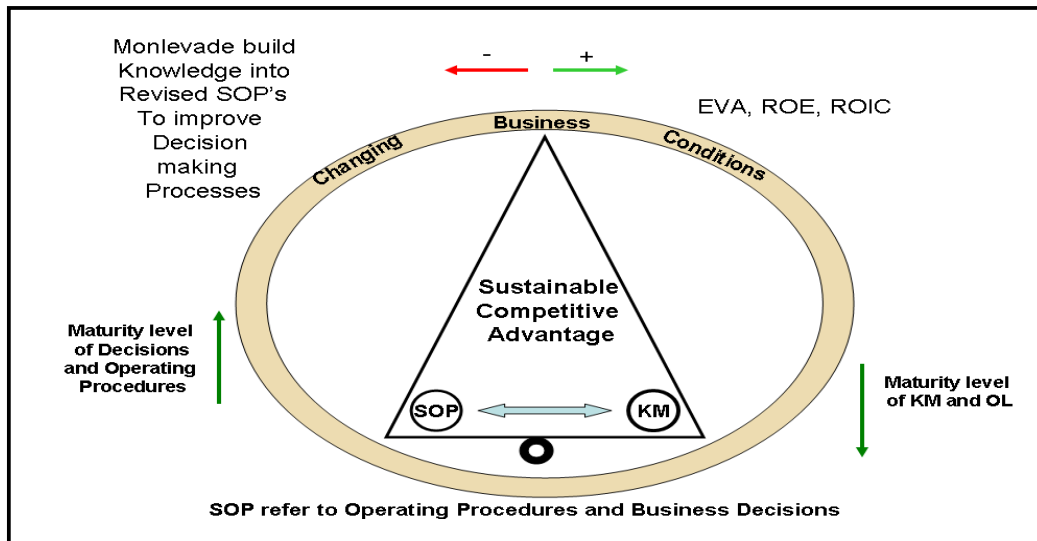
During a recent international benchmarking exercise with a Long Steel plant, Monlevadé in Brazil, it became evident that the company's competitiveness is based on a highly structured management system based on formal KM and LO principles developed by Campos Falconi over a 20-year period. ArcelorMittal Monlevadé focuses on the management of both explicit and tacit knowledge. Monlevadé has successfully applied the principles of knowledge management (KM) to create a learning organisation to improve its performance and sustainability. Monlevadé approaches the management of knowledge and learning as a key part of their business strategy to be superior to their competitors (ArcelorMittal, 2009).

Monlevadé argues that the higher the maturity of KM the better the **business decisions** and the higher will the **performance** of the company be in terms of the performance metrics (Ramalho, 2010).

The successful application of knowledge and learning organisation principles resulted in Monlevadé winning the award of the most admired Steel company to work for in 2007 and 2008. Although Monlevadé has a higher manufacturing cost per ton compared to Newcastle, its wealth creation and competitiveness are seen as **sustainable** over the long term. It seems that the key difference between Monlevadé and sites such as Newcastle and Saldanha is based on culture differences with specific emphasis on application of LO principles, organisation structure and different human resource policies applied at Monlevadé (Ramalho, 2010).

Figure 2.6a provides a conceptual model of the relation between the level of wealth creation and KM and LO as perceived by Monlevadé.

Figure 2.6a: Relationship between competitive advantage and financial measurements and maturity level of decisions based on knowledge management and organisational learning



Source: ArcelorMittal (2009a)

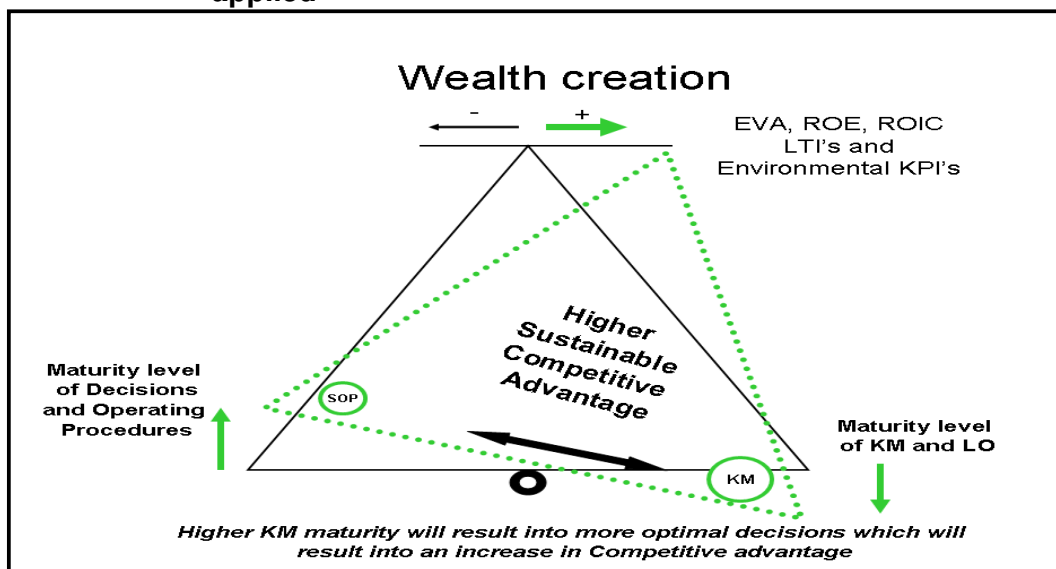
The model suggests that the competitive advantage of a company is relative and is based on changing business conditions. The company must **constantly change** due to changes in business conditions. These changes require that a company must **constantly learn** to ensure that optimal decisions are made which are superior to rival companies. The higher the maturity of KM, the triangle will move down to the right hand side which will result in an improved EVA, ROE or ROIC. This is further explained in figure 2.6b. The triangle is balanced on a pivotal point and companies must decide on a strategic level whether they want to improve competitiveness by increasing the maturity of knowledge as a resource (Ramalho, 2010).

The Monlevade model is limited as it does not take other sustainability factors into account but is still a useful model to explain how KM can be used to improve competitiveness. The model further assumes that existing processes can be improved through the use of tacit knowledge whereas other authors such as Murray

(2002:76) suggest that the application of KM in existing processes will not create a sustainable competitive advantage as the knowledge is already available.

The traditional approach of KM was to focus on improving the existing, traditional resources and their deployment following the DIKAR model developed by Venkatraman (Murray, 2002:74). The Monlevade approach is based on the traditional model as developed by Venkatraman.

Figure 2.6b: Conceptual model to show impact of performance, wealth creation and maturity of knowledge management principles applied



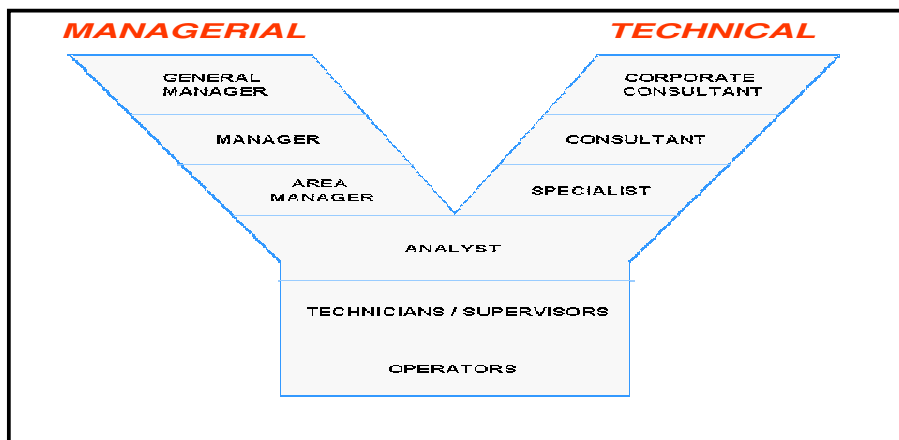
Source: ArcelorMittal (2009a)

Monlevade transforms tacit knowledge by translating tacit knowledge into explicit knowledge embedded into new Standard Operating Procedures (SOPs). The best specialists are selected to join a special interest group similar to a CoP which is responsible to develop or revise new SOPs within a specific area (Ramalho, 2010).

The best specialists combine the group's **tacit knowledge** and revise the SOPs based on the latest knowledge and business conditions. The outcome of this is improved SOPs which includes inputs from the best specialists. The revised SOPs

are used to facilitate the decision-making processes which are monitored daily. This is referred to as Daily Routine Management which has been developed by Falconi (2006:12). The rest of the employees in the company will then work strictly according to the new revised SOPs until the business conditions change and the process is repeated. There is a clear split in the organisation regarding who develops the SOPs and the rest of the workforce who are measured in terms of whether they adhere to the SOPs. Knowledgeable people decide what and how to do things based on knowledge and experience and the rest of the employees get measured on conformance to the SOPs. The organisation structure of Monlevade supports KM, as knowledge is seen as a key attribute for promotion. It is not uncommon for a knowledge worker to earn more than a plant manager or general manager. It is not about the number of people who report to an employee, it is about the influence that an employee has through his or her acquired knowledge and experience which is the key element for remuneration. Monlevade has introduced the so-called Y-career model which is summarised in figure 2.7. The **Y-organisation model** is used as an enabler to retain and develop the skills of specialists (Ramalho, 2010).

Figure 2.7: Y-organisation model used at Monlevade



Source: ArcelorMittal (2009a)

The holders of managerial and technical positions, within the same level, have the same treatment in all aspects (wages, benefits, and more). The evolution in managerial and technical careers depends on the company need and the level of competency and performance of the professional. This model ensures that

specialists are retained and also ensures that good specialists become better specialists. In companies that do not have a Y-organisation model it typically happens that good specialists become average managers to obtain improved benefits and remuneration (Ramalho, 2010).

Although Monlevade has made progress to translate tacit knowledge into explicit knowledge through updated SOPs, it is evident that Posco and Tata Steel KMPs are superior as knowledge is shared by more than 90% of employees (Anon., 2009).

2.10 THE IMPORTANCE OF KNOWLEDGE AS A CRITICAL RESOURCE FOR GROWTH

Knowledge differs from the other resources as it multiplies itself by using and/or sharing it (Auer, 2004:4). Companies which do not actively manage knowledge as a key resource will not be able to sustain growth and competitiveness.

The Steel industry in South Africa is planning large expansions over the next five years and it is evident that one of the key constraints to realise these expansions is not labour, land or capital but the availability of knowledgeable personnel to drive the expansions. Based on the planned expansions and new processes to be developed and implemented it can be assumed that ArcelorMittal will need the relevant knowledge and skills to achieve its expansion targets.

It is evident that ArcelorMittal, the largest steel company in South Africa, struggles to attract and retain knowledgeable personnel to maintain its existing manufacturing facilities. The turnover of skilled resources is high and it is very difficult to attract people especially to remote sites such as Newcastle. The impact of this is that knowledge is lost and very difficult and in many cases not possible to replace over the short to medium term. It is also evident that the retaining of skills has been identified as one of the top business risks of ArcelorMittal South Africa (ArcelorMittal, 2008).

Based on the literature and benchmark study and the problem to attract and retain skills and knowledge together with the expansion strategy, it is evident that the Steel industry in South Africa needs to focus on the creation and sharing of knowledge and creating a learning organisation on a strategic level.

The case company, ArcelorMittal Newcastle Works is currently the lowest cost producer in the world of Long Steel Products but to ensure that this is **sustainable** the company will have to retain and expand its existing knowledge base to maintain its current cost position and to support its growth strategy.

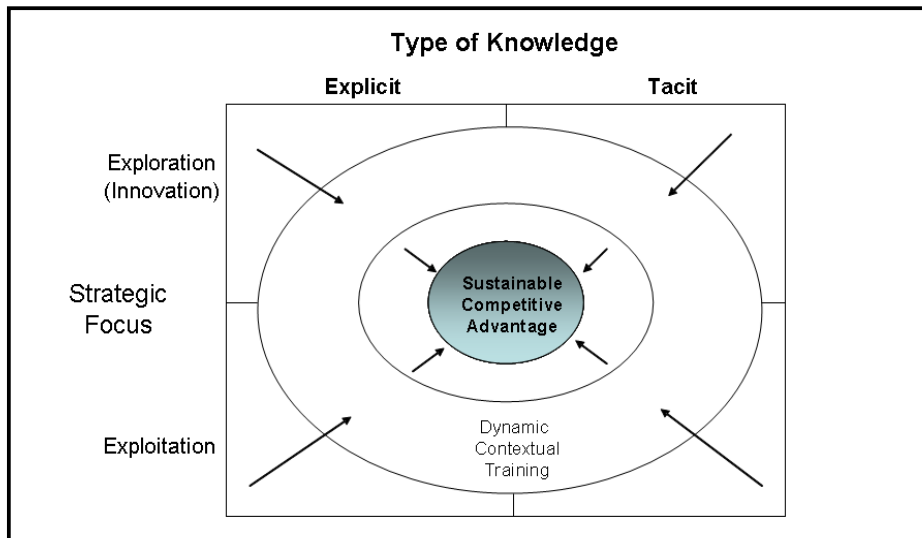
The conclusion is that knowledge and specifically **tacit** knowledge is a prerequisite for **sustainability** and growth. Explicit knowledge can be acquired, but based on the ArcelorMittal experience, people with experience or tacit knowledge are very scarce and need to be nurtured. Monlevade does not hire MBAs; they rather develop internal staff (Ramalho, 2010).

2.11 COMPETENCE DEVELOPMENT AND SUSTAINABLE COMPETITIVE ADVANTAGE

The competence development model is based on the development of competencies through training of different types of knowledge. The model is based on the assumption that explicit knowledge provided through classroom training has a **limited** impact on sustainable competitive advantage on its own and it needs to be merged with tacit knowledge to obtain competitive advantage.

It is important to follow a balanced approach regarding training of tacit and explicit knowledge. The dynamic training model is summarised in figure 2.8.

Figure 2.8: Dynamic contextual training



Source: Adapted from Johannessen and Olsen (2003:287)

Sustainable competitive advantage is most likely to result from building **core competencies** that possess a high component of **tacit knowledge** that is embedded in the organisation's processes. The training mode of tacit knowledge is experience. This is aligned with the Monlevade experience (Ramalho, 2010).

Tacit knowledge can be a barrier for innovation due to the fact that tacit knowledge is usually part of a long-term learning process in a specific environment (Johannessen & Olsen, 2003:287). According to the dynamic contextual training model, tacit knowledge must be linked to explicit knowledge and the intent is to follow an integrated training approach. To ensure training is used to develop competencies which improve the sustainable competitive advantage, explicit and tacit knowledge must be merged and the strategic focus must include exploitation and exploration. The approach at Monlevade is to ensure that every junior engineer is allocated to a senior engineer who is responsible to transfer tacit knowledge to the junior engineer.

2.12 KNOWLEDGE MANAGEMENT FRAMEWORK THAT CREATES VALUE

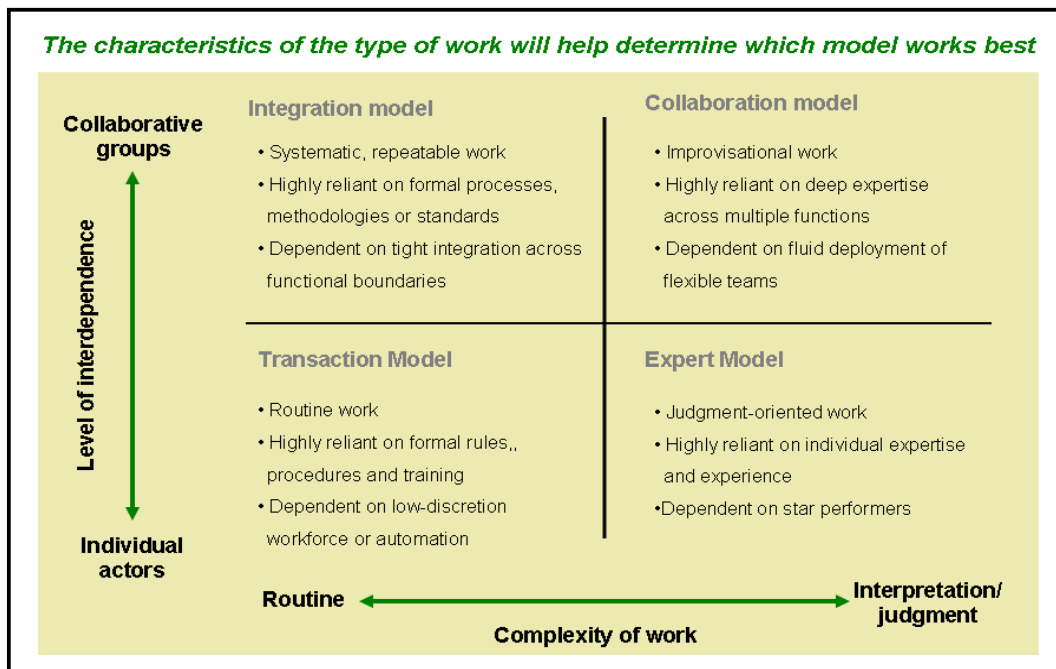
Researchers from the Accenture Institute explored the reasons why many knowledge management programmes fall short of expectations. Leigh *et al.* (2007:50) developed a framework to assist executives to make effective knowledge

management (KM) a reality in their organisations. They argue that most KM initiatives have focused on changes in tools and technologies such as intranets and Lotus Notes rather than to focus on embedding key information in systems and processes.

Too little focus has been given to apply incentives to motivate employees to share knowledge to improve capabilities. The Accenture report concludes that different KM models must be used pending on the **level of complexity of work** and the level of **interdependence** between employees performing a specific work process.

The level of interdependence involved refers to the degree to which individuals and organisations need to **collaborate** and interact to perform a work process. The level of complexity refers to the degree to which employees need to apply their **judgment** and interpret a variety of information to work. The framework is summarised in figure 2.9.

Figure 2.9: Knowledge management framework: Category of work models

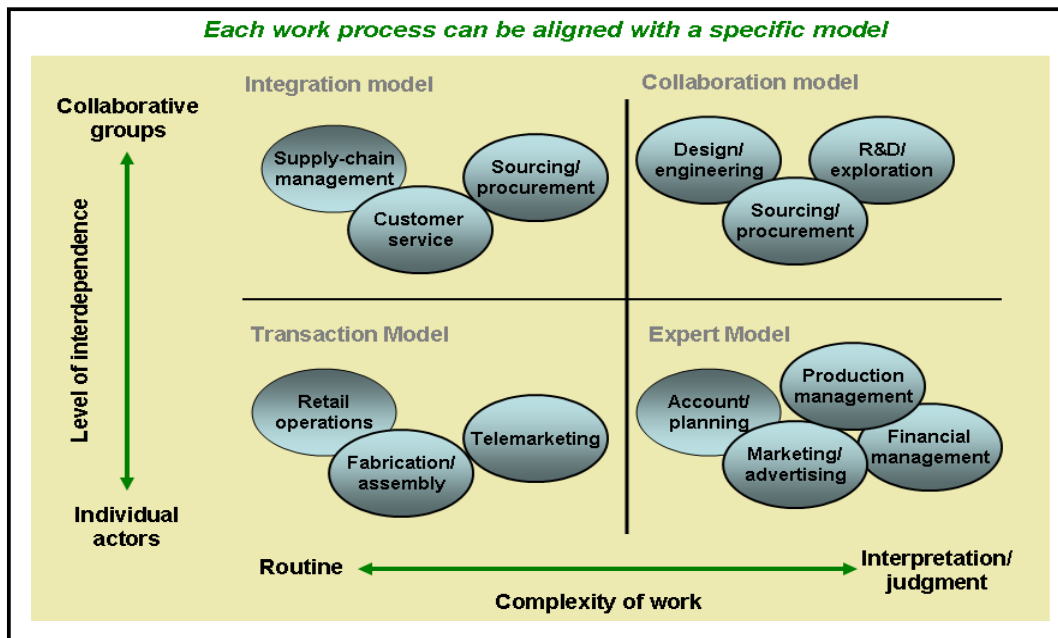


Source: (Leigh *et al.*, 2007:50)

According to the Accenture framework, work can be categorised into four work models, namely Transaction model, Integration Model, Expert model and the Collaboration model.

A given process can be mapped to one of these four categories. Supply chain management and procurement tend to fit into the Integration model as the work in these processes is often routine and activities generally involve multiple functions and organisations. Marketing and financial management tend to be Expert model work, where individuals in one functional area apply their judgment to solve unanticipated problems. The framework suggests that it is important to understand the nature of the work which will determine the most appropriate KM approach. The different process mappings of work are summarised in figure 2.10.

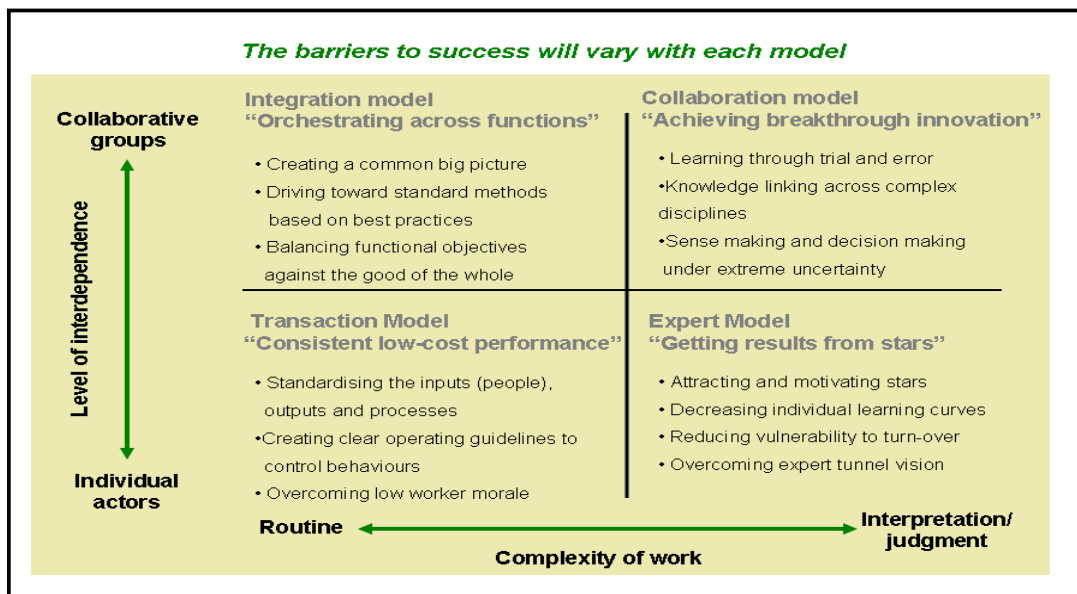
Figure 2.10: Knowledge management framework: Process mapping



Source: (Leigh *et al.*, 2007:51)

The Accenture report suggests that each work model has specific challenges which will require different KM strategies and tools. The different challenges per model are summarised in figure 2.11.

Figure 2.11: Knowledge management framework: Challenges



Source: (Leigh *et al.*, 2007:52)

The framework is an excellent starting point for companies to align its KM strategy and initiatives per work process which will result in bottom-line results. For example, work processes falling in the **Transactional model** are centered on the need to codify knowledge and ensure consistent performance. Possible KM strategies would include “automation” that embeds knowledge into systems or “routinisation” in which knowledge is built into standard operating procedures (SOPs), and training is aimed at standardizing workers’ behaviour. Monlevade is using the transactional model to develop SOPs managed through the daily routine concept (Ramalho, 2010).

The challenge in the **Integration model** is to orchestrate activity across functions and a strategy may be to standardize processes or methodologies that integrate performance across different parts of the organisation. Other tools such as cross-functional teams, shared goals and shared feedback systems may be used. Best practice benchmarking can be used as KM Strategy. ArcelorMittal uses this model very effectively with performance measurement and benchmarking through KMPs.

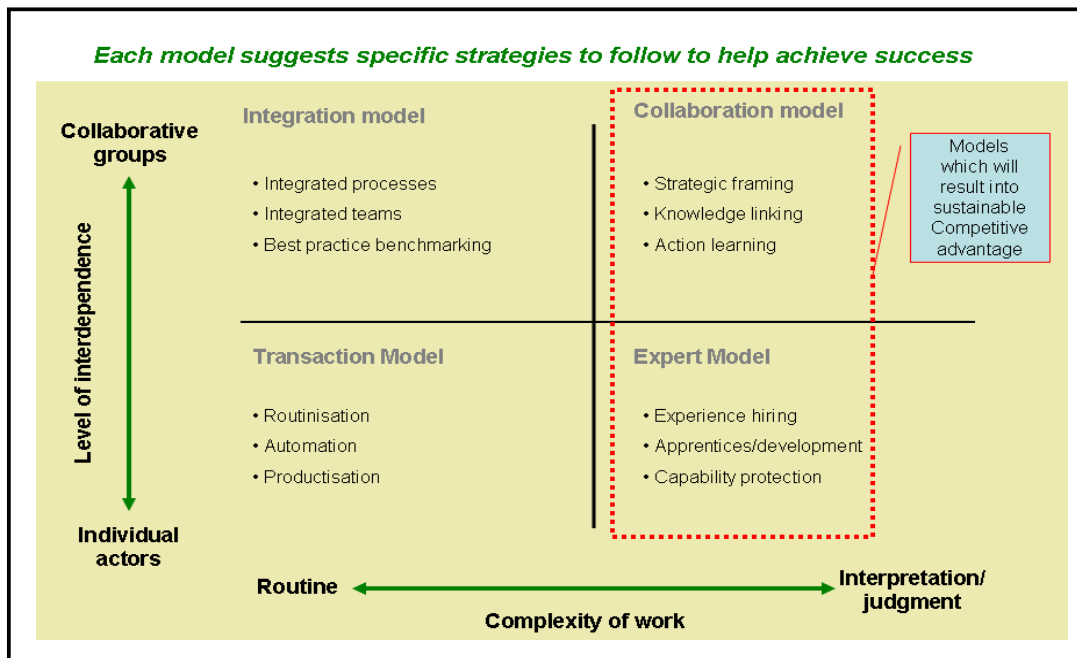
As can be seen from figure 2.11 the key challenges in the **Collaboration model** revolve around creating breakthrough innovations, which can include action learning strategies that encourage skunkworks and pilots or knowledge linking which focus on

learning through alliances. This is typically used by Buckman during product development. Monlevade also applies action learning, coaching and training as knowledge management enablers (Ramalho, 2010).

In the **Expert model** as discussed in figure 2.11, knowledgeable individuals are very important and star performers may be recruited from other companies or can be developed internally through long-term career-progression programmes, apprenticeships, mentoring and training. This model is used by Monlevade in its quest to implement supporting HR policies to support the development of knowledgeable individuals. They, however, do not believe in experience hiring as they believe in the development of internal staff. In Monlevade every engineer must, for example, complete a Masters after four to five years of work experience.

The Accenture KM Framework suggests that different strategies must be used pending on the work model and process. The model provides a different view of KM and does not define explicit and tacit knowledge. Based on the definition of tacit knowledge it is evident that the right-hand side of the model (Collaboration and Expert models) involve a higher level of tacit knowledge. The proposed strategies per work model is summarised in figure 2.12.

Figure 2.12: Knowledge management framework: Strategies



Source: (Leigh *et al.*, 2007:53)

The Accenture model can assist business to understand that using expensive technologies as a KM strategy may be proficient for work falling in the Transaction or Integration model. This will, however, not result in competitive advantage as it can be copied by other companies. The framework further explains that for work which falls in the Collaboration or Expert model the KM strategy limited to technology, will not provide bottom-line results or improve competitiveness, and other strategies must be followed (Leigh *et al.*, 2007:49).

2.13 LESSONS TO BE LEARNED FROM COMPANIES TO CREATE COMPETITIVE ADVANTAGE THROUGH THE IMPLEMENTATION OF KNOWLEDGE MANAGEMENT AND LEARNING

Buckman Laboratories can be seen as a benchmark site for the successful implementation of knowledge management. The company has received 17 awards between 1996 and 2006, including the award for the “Most admired Knowledge Enterprise”. Buckman forms part of the list of the Top 100 training companies in the world (Buckman, 2006a:8).

The focus of the lessons learned is based on how knowledge management must be approached to ensure a **sustainable competitive advantage**. Best practices have been compiled based on lessons learned and KM approaches followed by Buckman, Monlevade and other companies as discussed in literature. The lessons learned include presentations made by Brazil during a benchmark study done in October 2009.

Lesson 1 – Make KM part of the strategy and mission of the company

According to Buckman (2006a:6), KM must be embedded in the company's mission. "We, the associates of Buckman Laboratories International, will excel in providing measurable, cost effective improvements in output and quality for our customers by delivering customer-specific services and products, and the **creative application of knowledge**."

The value proposition of Buckman states that they provide the following intangible value adding services to their customers:

- Unique chemistries
- Problem-solving skills
- Application knowledge
- Knowledge of customers' systems
- Ability to establish relationships based upon faith and trust

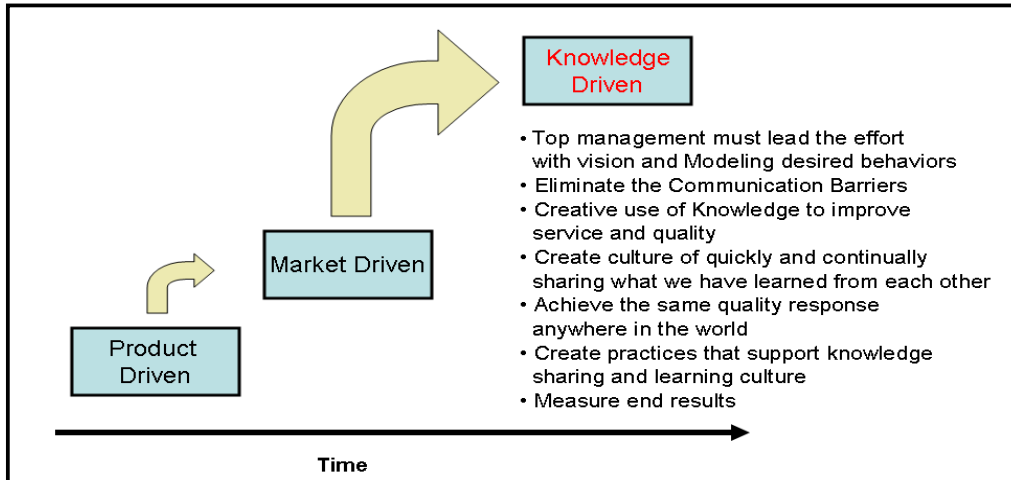
Knowledge is a core component of the company's strategic intent (Buckman, 2006a:6).

Lesson 2 – Confirm the business model of the company

It is important to understand that the new economy has evolved from a product driven or industrial economy started in the late 19th century to a service society in the late 20th century. Figure 2.13 provides a summary of how Buckman Laboratories'

business has evolved from a product focus to a market focus to a knowledge driven enterprise (Buckman, 2007:9).

Figure 2.13: Buckman business model



Source: Adapted from Buckman (2007:9)

A business must decide the role knowledge will play in making profits. In the service industry, knowledge may fulfil a more important role compared to other industries.

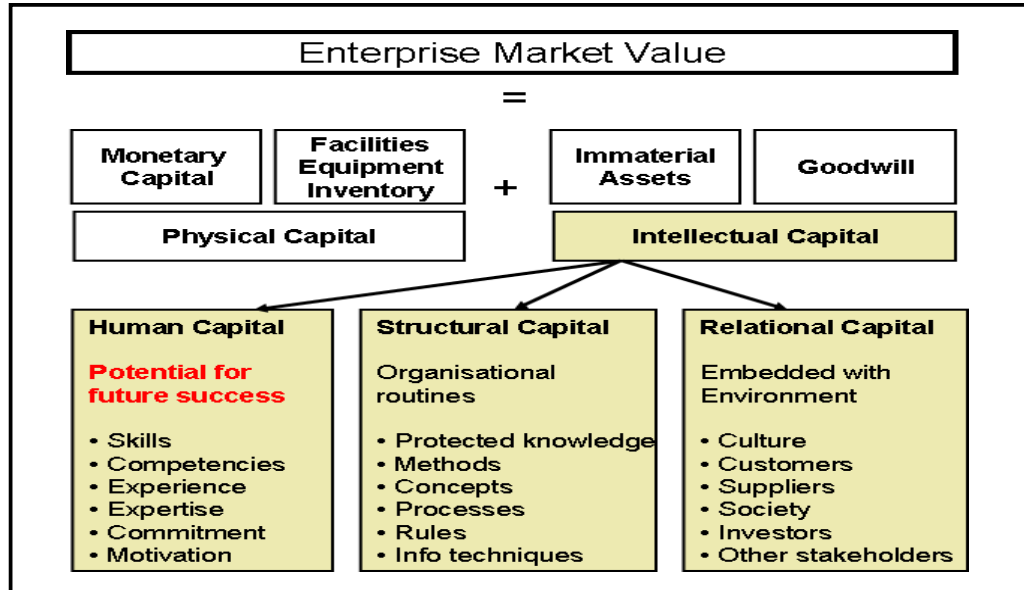
Lesson 3 - Identify intellectual capital and understand the increasing value of IC to create sustainable competitive advantage

Organisation knowledge can also refer to **intellectual capital** and can be described as the difference between the market and the book value of an enterprise. In the new knowledge society it can happen that the enterprise value is much higher than the physical capital, equipment or inventory in the balance sheet due to immaterial assets, goodwill and intellectual capital of the enterprise. “It is not what you have it is what you know” (Auer, 2004:2).

Enterprise market value consists of both physical and intellectual capital (IC). IC can be split into human, structural and relational capital. This is summarised in figure 2.14. The potential for future competitiveness and business success is depended on the **value of human capital** which includes skills, know-how, experience and expertise of employees. The three components of IC are interdependent as human

capital raises the structural capital and both of these together generate relational capital (Auer, 2004:2).

Figure 2.14: Importance of intellectual capital for future success



Source: Adapted from Auer (2004:2)

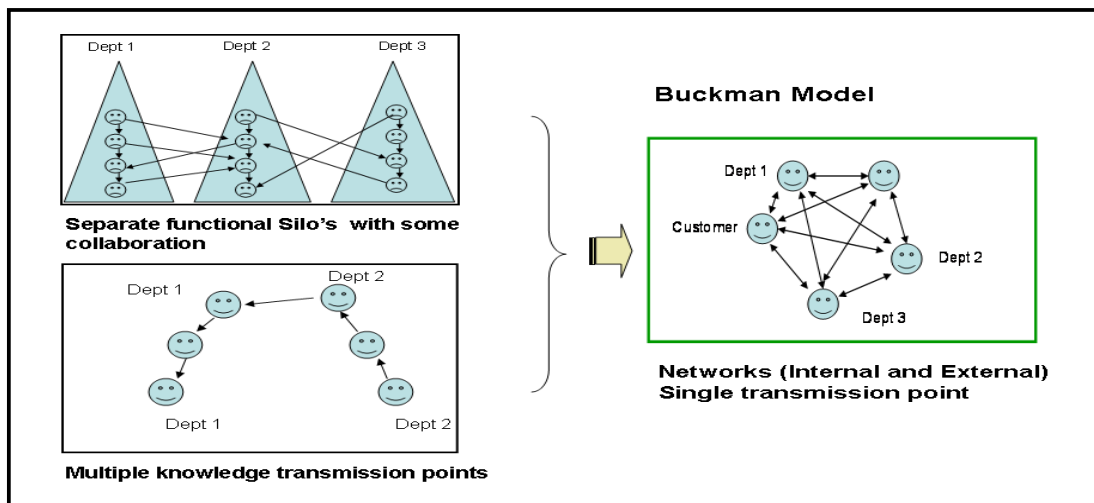
To sustain competitive advantage companies must not only focus on physical capital but must ensure that intellectual capital also receives sufficient focus. Companies must identify its intellectual capital assets and pro-actively manage these. Companies need to invest in knowledge and manage this like any other critical resource. Knowledge resources must be **strategically managed** (Van den Berg & Snyman, 2003:2).

Organisation commitment and motivation must not be under-estimated as it is very important for sustainable competitive advantage. This is achieved through employee engagement. A company that does not have engaged employees cannot be competitive over the longer term (Ramalho, 2010).

Lesson 4 – Establish an effective collaboration and communication structure and processes

Buckman (2006b) argues that companies have to establish effective communication before they can advance to effective knowledge sharing. For any knowledge management environment to be successful, a collaborative environment must exist. Organisations must move away from communication patterns which are embedded in the typical silo based organisation structures to a model which supports direct communication between the knowledgeable employees. Typical barriers to communication are different communication processes of departments, different operating entities in different countries, language barriers, security issues and culture differences. Companies in which the wealth is based on intellectual capital assets, networks must rather be used than the traditional hierarchies or functional organisation designs (Kok, 2004:5). Buckman confirmed this approach using a simple diagram, which is summarised in figure 2.15.

Figure 2.15: Maturity of collaboration model



Source: Adapted from Buckman (2007:14)

The intent is to leverage knowledge through the establishment of networks of people who collaborate directly as indicated in figure 2.15. The rationale is that people networks leverage knowledge through a “pull” action rather than to try to “push” information centrally. Buckman found that companies must reduce the number of

transmissions of knowledge to one, to achieve the least distortion of knowledge. If this is established the management must focus on the speed of responses. The **faster** the sharing and application of knowledge between individuals in a company the more **value** will be added, which will improve its competitiveness.

The following ideal characteristics of collaboration are identified by Buckman:

- Give each employee access to the knowledge base of the company.
- Allow each employee to enter knowledge into any discussion.
- The knowledge base must be available 24 hours per day.
- The technology based system must be easy to use for those who are not computer experts.
- Communication should be in whatever language which is best for the understanding of the user.
- Management must create an environment where every individual can talk or communicate directly with those that have the latest and best knowledge in the organisation.

The objectives to establish an effective communication structure and process are to enable employees to **share tacit knowledge** and to create an environment which allows employees to learn and grow and at the same time generate information to update the explicit knowledge of the company. The explicit knowledge can typically be accumulated through the capturing of relevant questions and answers.

Lesson 5 – Create a culture of trust to support knowledge sharing

A climate of continuity and **trust** must be created to enable proactive knowledge sharing across time and space. The leaders must change the organisation to move from the old paradigm of “knowledge is power” to one in which collective knowledge sharing is power. In many companies the hoarding of knowledge is used to gain power and is seen by employees as a mechanism to protect their own position. This needs to be changed to “sharing of knowledge to gain power”.

Shared values and the adoption of a common culture are the most significant aspects of a successful implementation of knowledge management. Culture can be defined as a set of collective values and beliefs that shape the way people behave. In general employees of a company tend to adopt the same values and beliefs relating to their company (Kok, 2004:6).

A high degree of trust must be established across time, space and culture. This is especially important within global companies which operate in different time zones, in different areas and different cultures. There must be willingness of individuals in the company to communicate information and on the part of the receiver employees to listen and learn from the information. The company will only create value if the learned information is **applied** (Buckman, 2007:17).

The culture must be tolerant for employees to make mistakes. This is important to create an environment where employees can experiment with new ideas. If this is not in place employees will continue with the status quo (Lubit, 2001:173).

Procedural justice is another factor which encourages trust and knowledge sharing. Based on research, managers tend to share knowledge if they perceived the strategic decision-making processes to be fair. Engagement, explanation and clarity are part of the concept of procedural justice. Engagement refers to the level of participation of employees in the decision-making processes. If they feel that they are excluded during the decision-making process that affects them, they will tend to reduce their level of knowledge sharing. The same can be said about the explanation to employees of the reasons why decisions have been made (Lubit, 2001:174).

Before, during and after the decision-making process the participants must understand what is expected of them and what decision-making rules will apply. Only when all of the factors of procedural justice apply will managers or employees be willing to share information and also provide ideas. It can be said that an investment in strengthening procedural justice within a company will result in improved communication, co-operation and collaboration which will result in the spread of knowledge. A company will only be able to achieve sustainable competitive

advantage if they have a **culture of trust** in place which nurtures employees to share knowledge (Buckman, 2007:11).

Lesson 6 – Create a continuous learning organisation

Companies that want to enhance competitiveness through knowledge management and intellectual capital can only achieve this if there is a **culture of learning**. There is an inter-relationship between knowledge, innovation and OL. OL plays an important role in ensuring that knowledge is created and transferred to promote innovation. The shared values of innovation and learning are important sources of value in the global economy and need to be managed and utilized successfully to sustain economic growth and competitive advantage (Kok, 2004:7; Ramalho, 2010).

Learning is necessary to make employees more **adaptable** to the changing environment. It is important to understand that companies must not only invest in the maintenance and improvement of fixed assets but formal investment must also be made in intellectual capital through formal training to improve skills (Buckman, 2006b:56). The following aspects are important regarding learning:

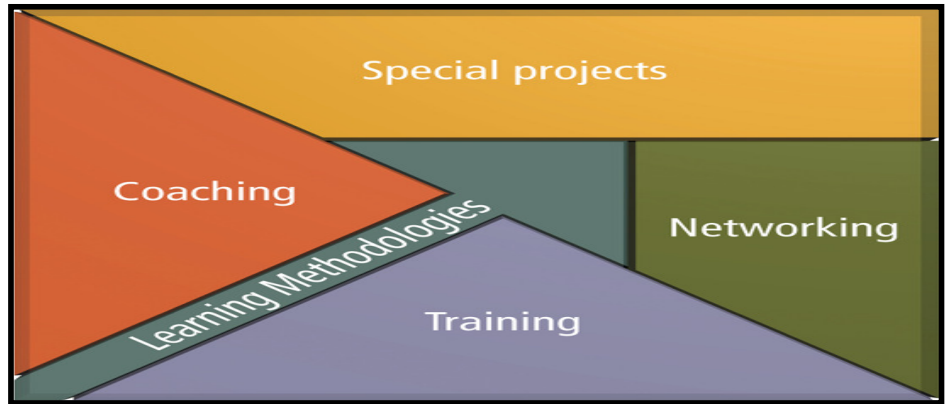
- Provide training in multiple languages and expand access to learning (available anytime, anywhere, through multiple delivery points (Web, classroom, CD, web-casting, university access).
- Implement a learning management system to record training and establish ways to facilitate the transfer of best practices and develop specific tools that will enhance the learning environment (Buckman, 2006b:57).

Monlevade states that a skilled workforce is a key driver of **competitiveness** at the company, and therefore it focuses on continuous development of its employees. This is achieved through training, networks, coaching and special projects. Figure 2.16 includes the different methods used to facilitate continuous learning at Monlevade (Ramalho, 2010).

It is clear that the company really manages the competency of employees following a structured approach. Continuous learning and improvement of **competencies** of its

employees are seen as a key strength and are used to ensure sustainable competitive advantage.

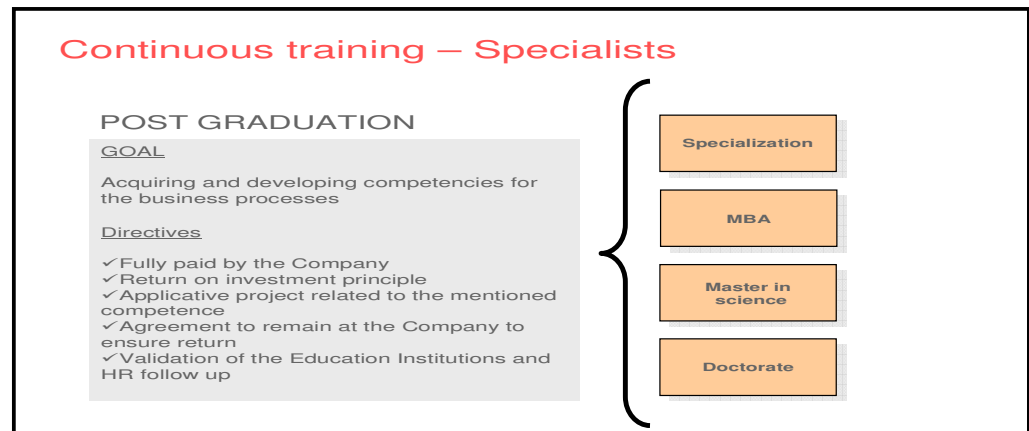
Figure 2:16: Learning methodologies applied by Monlevade



Source: ArcelorMittal (2009a)

Monlevade has implemented a **continuous training** process of specialists and they typically improve business process knowledge. The intent is that training is done based on a business case or problem to be solved. Specialists are sent away for a period to study formally with all expenses paid to resolve a specific problem. Figure 2.17 is an extract of the presentation made by Brazil, which explains the continuous learning approach that is followed by the company (Ramalho, 2010).

Figure 2.17: Continuous training of specialists approach followed by Monlevade



Source: ArcelorMittal (2009a)

Lesson 7 – Implement incentives to support knowledge sharing

While appropriate IT infrastructure is essential, the key to successful KM is found in the culture and mindset of an organisation. The right mix of **incentives** is, therefore, a prerequisite (IFAD, 2007:6).

The value of knowledge management will depend on the active participation of all employees. The culture must be embedded to share knowledge and employees must make a habit to contribute their ideas and knowledge for reuse. It is critical that employees take the time to participate and this will only be possible if the culture is supported by incentives (Kok, 2004:7). Knowledge sharing and learning must be made part of **balanced scorecards**. Managers must be measured on the number of ideas or knowledge reused from other business units in the company or outside the company, rather than to re-invent the wheel.

Knowledge which is not distributed within a company remains the property of a few people, not the property of the company and as such will have a limited impact on the company's ability to create value. This is especially noticeable when these employees leave the company or if they are acquired by competitors (Lubit, 2001:165).

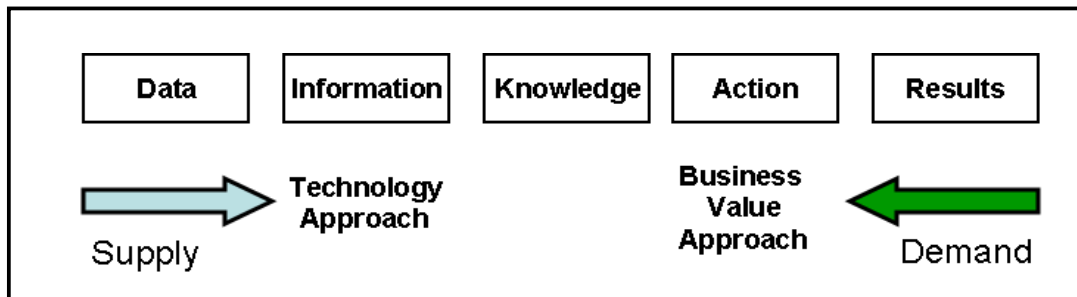
A key lesson learned since Lonmin tried to implement KM theory into practice is that the most important success factors of KM are found in the culture and mindset of an organisation. Without the necessary incentives people do not want to share knowledge, especially in an environment of continued downsizing where the lack of knowledge sharing is seen as important to ensure that you retain your position (Van Beek, 2010).

The statements made by Van Beek is in line with literature on the subject which further states that people are not only hesitant to share what they know, but they are also hesitant to use knowledge of others. It is referred to as the “not invented here” syndrome (Lubit, 2001:172).

Lesson 8 – Make knowledge management a business demand driven based on business results – not a supply or IT driven initiative

The change in culture must be led by those in “command” and not by IT personnel (Buckman, 2006b:38). The traditional approach of KM was to focus on improving the existing, traditional resources and their deployment following the DIKAR model developed by Professor N. Venkatraman. KM in the DIKAR model is conventionally interpreted from the left to the right as a **supply-side** value spectrum and argues that this will not result in sustainable competitive advantage. To ensure that KM provides a competitive advantage the DIKAR model must be read from the right to the left and to be referred to as the RAKID model, which is summarised in figure 2.18. If a business steps outside the “business as usual” and sets new targets such as growing its markets or products, the left to right reading does not explain how to achieve the business objective. The RAKID model or a **demand-side** focused approach must then be used. The RAKID model must then be read from the right to left starting with what desired results a company wants to achieve and what actions a company must take to achieve them (Murray, 2002:73).

Figure 2.18: The DIKAR model



Source: Adapted from Murray (2002:74)

The application of KM to established core processes will most probably not result in much business benefits, and companies must avoid KM initiatives on existing core processes because the Return on Investment (ROI) will be small, zero or only temporary. Companies must insist that KM teams only focus on initiatives which will make a difference to **competitiveness or profitability** and which is demand-led. This can be achieved by linking all knowledge management initiatives to **business**

objectives which are the responsibility of business owners who are responsible for the business results (Murray, 2002:76).

The objectives of KM must be aligned to the business objectives. The key question must be based on the actions needed, “what do we need to know” to perform the actions to achieve the business objectives. The “what we need to know” refers to the required knowledge enablers and resources needed to plan and execute these actions (Buckman, 2006a:13).

Knowledge management initiatives will thus only be successful if the relevant business objectives are achieved. The demand principle noted by Murray is aligned with the statements made by Buckman and it is evident that knowledge management must not be treated as acts of faith, but must be managed as other resources, be business driven and must be linked to a business objective with clear ownership.

Lesson 9 – Focus on tacit knowledge as an inimitable competitive advantage

Competitive advantage is increasingly achieved through “knowing how to do things”, rather than in having access to resources and markets (Lubit, 2001:165). Companies must internally spread tacit knowledge “knowing how” that other companies will find almost impossible to copy. Explicit knowledge “knowing what” can be written on paper or can be explained and thus can be acquired by competitors or can be copied by them. Although companies may have a competitive advantage through superior explicit knowledge this will not be sustainable as it can be copied by competitors (Lubit, 2001:167).

Tacit knowledge is acquired through considerable experience in an activity, preferably while working with experts. Lubit identified different ways to turn tacit knowledge within a company so that it becomes a **distinctive core competence**. The different alternatives are summarised in table 2.3.

Table 2.3: Approaches to turn tacit knowledge into competencies

Approach	Examples to share tacit knowledge
Working with experts	People will build mental models of the world by observing experts work through problems or by obtaining experience under supervision. Coaches must not give an answer or decision, but they must explain the process and insights they followed or used to come to a decision. It is important that the learner must understand what variables were taken into account as well as relationships between the factors so that the learner can obtain insights (tacit knowledge).
Coaching	Managers must be taught how to coach. Performance measurements must include managers' efforts to coach and train subordinates.
Networks and workgroups	Communities of practice (CoP). Groups of people sharing an interest in an issue who meet periodically, and share knowledge. The meeting may be in person or virtual. Workgroups can facilitate tacit knowledge sharing through observing how other team members approach problems and generate and evaluate solutions.
Recording tacit knowledge	Development and sharing of learning histories by other employees with similar challenges. Learning histories are written narratives of critical events in a change initiative or innovation. Learning histories focus on the mistakes which have been made. When managers read the histories of projects, they can share in the experience and improve their decisions through structured Routines or SOPs.
Making tacit knowledge explicit	Models can be developed which capture some of what the experts know and then use this to assist the skill development of young managers. The risk of making tacit knowledge more explicit is that it can be copied by other companies. The risk is limited because tacit knowledge can rarely be made fully explicit, but it remains a risk.

Source: Adapted from Lubit (2001:168)

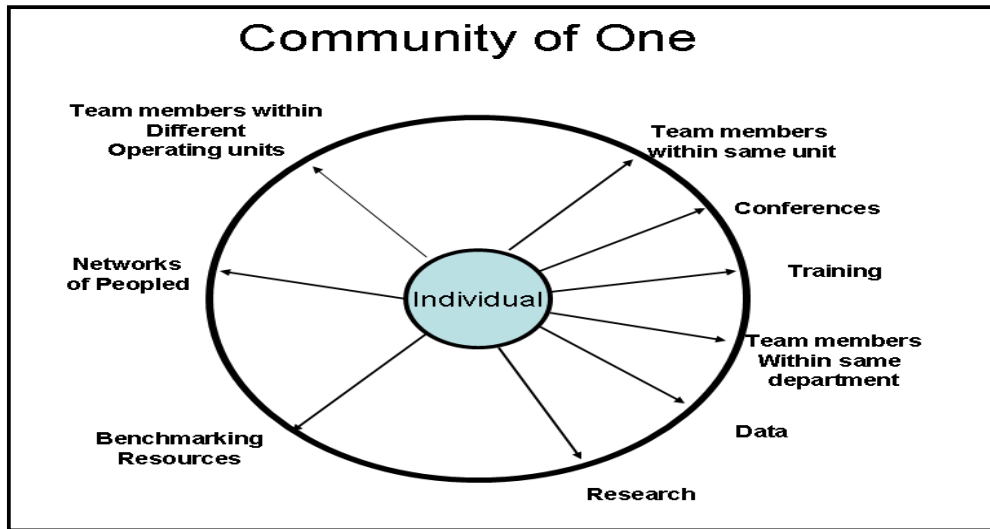
Lesson 10 – Exploit personal networks and introduce Communities of Practice as quick wins to establish knowledge management

Buckman (2006b:34) developed a model which summarises the important elements and mediums which can be used to share knowledge. The intent is to establish a so-called community of one for all knowledge workers. The community of one principle is defined by Lubit as **personal networks** which can be used as a vehicle to forge connections between people. Personal networks are used to share ideas and are important to foster knowledge sharing (Lubit, 2001:167). It is also important to define the different collaboration points and sources of information for each Individual and to confirm that this is in place for all individuals. It is especially important to ensure that new employees are aware of the different sources of available information and knowledge. Individuals in an organisation can form part of different communities which can be based on specific practices or be based around issues (Buckman, 2006b:36).

Individuals can also form part of specific project teams and can perform formal learning through, for example, formal studies or classroom training (Buckman, 2006b:36). Management must provide the necessary **infrastructure** per individual to support knowledge sharing and learning. Buckman argues that one must start with the assessment of a community of one per individual as a first step. Each individual must be encouraged to learn and to share knowledge. This can be done through training or to participate in different communities, attending conferences or to do benchmarking (Buckman, 2006b:34; Ramalho, 2010).

The concept of a community of one or personal networks is summarised in figure 2.19. The intent is to develop this per individual and to encourage the different individuals within a company to form networks among each other.

Figure 2.19: Personal networks and community of one



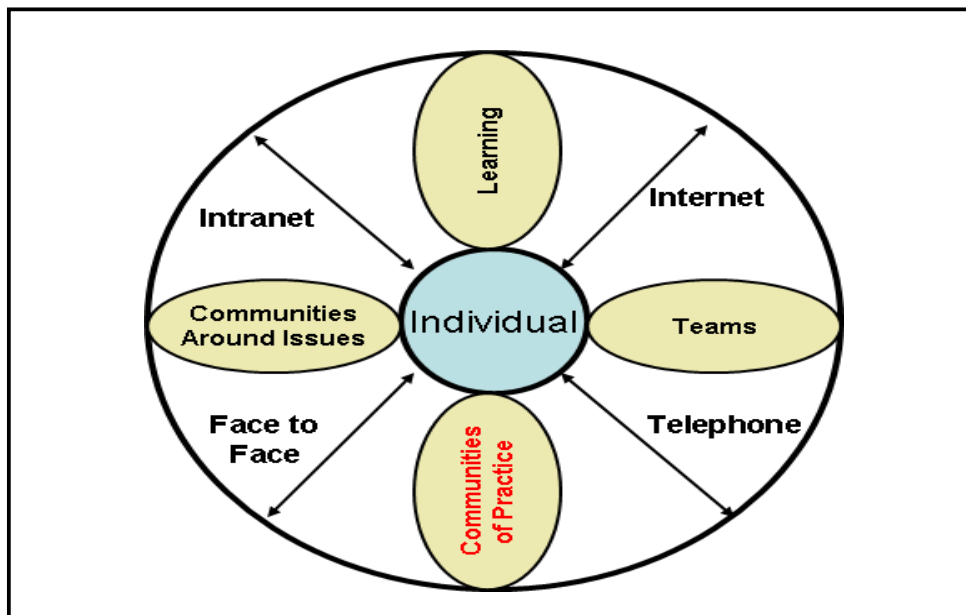
Source: Buckman (2007:18)

Individuals can form part of different CoPs which may also overlap and members of CoPs may be from cross-functional teams, or even from external sources such as suppliers or customers. It is important that the members must have an aligned objective to develop better practices.

The most important elements to improve KM can be achieved through learning, participating in project teams, participating in the communities formed to resolve specific issues, or individual can participate in CoP.

The different enablers for knowledge management as defined by Buckman is summarised in figure 2.20.

Figure 2.20: Knowledge management enablers as applied by Buckman



Source: Buckman (2007:20)

Van den Berg en Snyman performed a case study to assess the effectiveness of the implementation of **Communities of Practice** (CoP) in a large distribution company in South Africa. The company had no previous history of any formal KM principles and the CoP was selected as a tool to improve the management of tacit knowledge by introducing CoPs. A post implementation review was done after the CoPs were established for a period and this was done through a questionnaire which was completed by the members of the communities and interviews with management before and after the implementation of the CoPs. The results were positive and aligned with literature that states that CoPs have a high success rate with relatively low cost of implementation (Van den Berg & Snyman, 2003:4).

Communities of practice are typically used as a **quick win** and thus act as encouragement for companies to introduce a wider implementation of KM (Van den Berg & Snyman, 2003:4). A CoP is a social network which is mostly self organised but can also be sponsored by management. CoPs that are self organised tend to be less formal compared to sponsored CoPs. Management must create a supportive environment by providing infrastructure and support. This can include the provision

of **supporting technologies** such as telephones, fax machines, video conferencing and e-mail (Van den Berg & Snyman, 2003:3).

The formal definition of a CoP as defined by Wenger and Lave is a group of people who share an interest in something, or a problem that they face regularly in their work or in their life, and they come together to develop knowledge to set up a practice around the topic. A CoP differs from a team as it is driven by a topic not by a task and is formed to share what is known about a topic and to learn from each other. They can learn from each other through sharing best practices, past experiences, insights or knowledge.

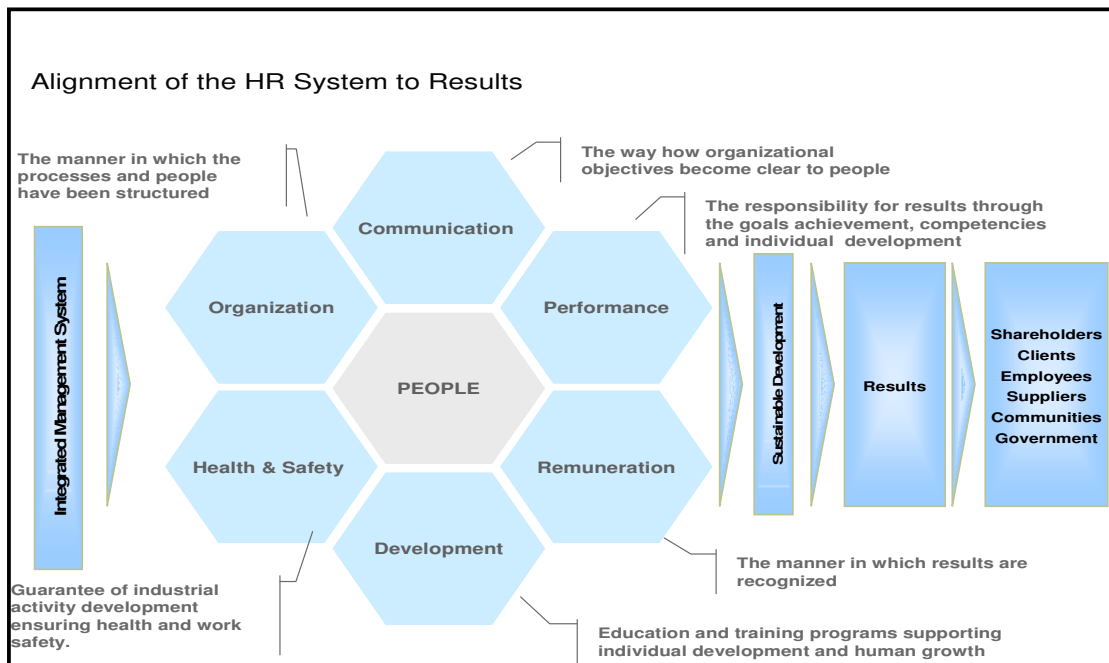
Many companies other than Buckman have achieved very good results with communities of practice including IBM, Xerox and Exxon (Van den Berg & Snyman, 2003:3).

Monlevade, a steel company in Brazil, have implemented CoPs in a formal way and the coordinators of these knowledge exchange forums are typically experts in the specific knowledge domain. The key output of these forums is **improved practices** which are reflected in updated SOPs.

Lesson 11 – Align human resource policies and systems which will drive results to all stakeholders

Monlevade identified people as a **key driver** of competitive advantage and follows an **integrative approach** to ensure sustainable development. People are seen as key to sustainable development and for results to different stakeholders such as shareholders, but also clients, employees, suppliers and communities. This is summarised in figure 2.21 (Ramalho, 2010).

Figure 2.21: Alignment of HR systems to results



Source: ArcelorMittal (2009a)

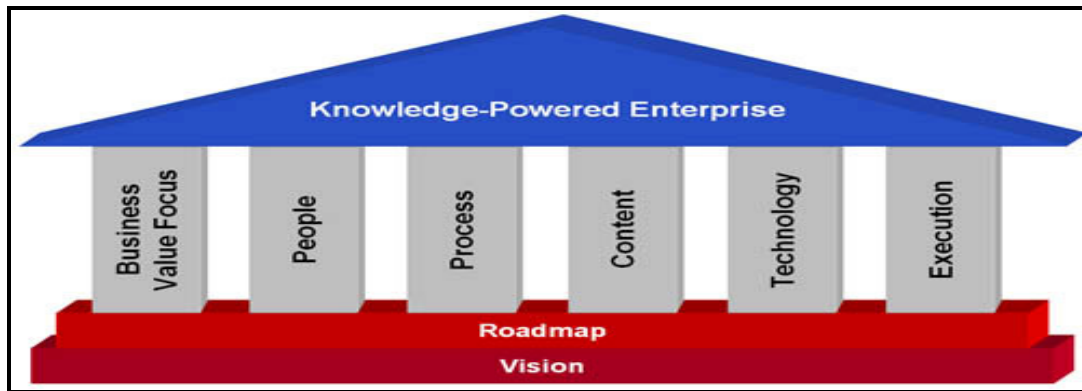
Figure 2.21 indicates that several factors must be in place to achieve sustainable development. Aspects such as the organisation structure, health and safety, communication, development, performance management and remuneration must be managed through an integrative management system to achieved business results.

2.14 CRITICAL SUCCESS FACTORS OF SUSTAINABLE KNOWLEDGE MANAGEMENT

The key challenge in sustaining a high-performance knowledge management programme is to nurture a knowledge-sharing culture. This is best done by creating a new work environment where knowledge and information are easily shared. Reid developed a model which can be used to establish a knowledge-powered enterprise (Reid, 2009:1). Figure 2.22 provides a summary of the critical success factors for a KMP and knowledge sharing culture which will result into bottom-line results.

The model is to a large extent aligned to the lessons learned as discussed previously but provides more emphasis on the execution phase where key metrics must be measured as part of execution. Different authors differ on whether knowledge management programmes' (KMPs) success can be measured in terms of specific metrics.

Figure 2.22: Critical success factors for a knowledge-powered enterprise



Source: Reid (2009:1)

A KMP must be driven by a **Vision** and supported by a **Roadmap** which forms the foundation of the KMP. The vision describes the overall business case and explains the reason why the organisation is working on KM and what new personal and organisational capabilities can be expected as a result. The roadmap lays out in general terms the order in which new capabilities will be developed and the overall timelines.

Figure 2.22 further defines six strong pillars which are essential to support the knowledge-powered enterprise. The first pillar is that a KMP must **be business value focused** and must address a compelling business need, opportunity, or value. All stakeholders must understand the value of supporting a KMP. The next pillar is **people** and all employees must understand that the norm is to share knowledge. Managers must visibly support knowledge sharing and provide support for CoPs and must ensure that knowledge sharing and contribution are embedded into balanced scorecards. Processes must be put in place so that all stakeholders understand how they are expected to share and re-use information and knowledge. The fourth pillar discussed is the availability of high quality **content** or knowledge assets. Content must be relevant and trusted and must be maintained.

Technology is an essential enabler. A KMP is not likely to be sustainable without technology that delivers the functionality needed by stakeholders. Technology must be easy-to-use, integrated and secure. Like content, technology must be subject to an ongoing maintenance process

According to the model the final pillar is **execution** which includes the measurement of the business value using specific metrics which make sense to both business managers and individual contributors.

2.15 CONCLUSION

From the above literature study various aspects of knowledge, knowledge management and organisational learning with specific relation to sustainable competitive advantage and wealth creation, have been discussed. Knowledge, if successfully applied to make value adding decisions and to enable learning, can create a **sustainable competitive advantage** if it is applied to make decisions which are superior to that of its rivals across the supply chain. An **integrated approach** needs to be followed when knowledge management is pursued and the knowledge must be applied to make value-added decisions and facilitate learning across all processes in the value chain. The focus must be to retain an organisation's tacit knowledge as this is a key success factor to ensure competitive advantage.

The rapid changing business conditions force companies to adapt and implement organisational learning principles to improve the **agility** of its employees. It can be concluded that companies must change the focus for growth from physical assets to the development of intellectual capital. It is not about what you own but what you know. Over the long term the only sustainable source of competitive advantage is an organisation's ability to learn faster than its competition and this is enabled by knowledge.

ArcelorMittal South Africa is **behind** rivals in India and Korea where they manage knowledge as a distinctive competency. Several lessons can be learned from these companies and from Buckman and AM Monlevade which have successfully implemented KMPs.

Important lessons learned are that knowledge management must form part of a company's business strategy and mission, knowledge management must be business driven by results not supply driven by IT, and an effective collaboration and communication structure and processes must be established. Knowledge management programmes will only be successful if a culture of trust and knowledge sharing is established which is supported by appropriate Human Resources policies and incentives. Different knowledge management enablers such as communities of practice, dynamic contextual learning, knowledge management systems to enter knowledge pieces and improvement of elements of individual networks can form part of a knowledge management programme. An IT-enabled infrastructure must form part of the knowledge management programme to enable networking and knowledge sharing between all employees. The content of knowledge assets must be managed. Literature differs on whether knowledge management programmes must be measured, but it is evident that companies that have measurements in place, such as Posco and Tata steel are more successful.

2.16 SUMMARY

In this chapter the various concepts relating to knowledge management and sustainable competitive advantage were discussed. Firstly, the definition of **wealth creation** was researched and it was found that wealth is created by applying different production factors, including information, to be transformed through physical and business processes to generate goods or services.

Companies must ensure that all production factors including information and knowledge are managed well to ensure wealth is indeed created not only over the short term but also over the long term. The creation of sustainable growth is typically measured using different financial measures such as Return on Investment, Economic Value Added or Return on Invested Capital.

The second concept that was explained was how information, knowledge and skills are used to create competitive advantage. **Competitive advantage** is a result of optimal decisions which are made through the application of knowledge and skills. These decisions are made daily based on the application of explicit and tacit knowledge. In general, tacit knowledge is the knowledge that, when applied result into competitive advantage as it is not easy to be copied by competitors. Tacit knowledge is a key success factor to ensure competitive advantage.

The third concept that was discussed was **sustainable development** where it was found that wealth creation in the new economy cannot be limited to the traditional financial criteria and that to ensure sustainable growth and competitiveness companies need to manage and monitor sustainable development indicators.

The fourth concept that was discussed was to assess whether evidence is available through previous surveys to confirm that a company's **information management capability** can increase its market value or working capital efficiency or if there is a positive correlation between knowledge management and competitive advantage. It was found that the overall competency in the information management function can increase the firm's market performance by as much as 20%. The competency level

of IT-enabled collaboration which allows distributed staff to effectively share information and collaborate has a strong impact on company competitiveness and has a strong impact on the company's performance measured through TSR or working capital efficiency. The conclusion was made that the availability of information and explicit knowledge will add value only if it is **applied** through the sharing and use of **tacit knowledge**. Effective knowledge management has an impact on organisational performance and shareholder value and will create a sustainable competitive advantage.

The fifth and sixth concepts discussed were to define the **scope of knowledge management** and to confirm what is meant by **organisational performance**. It was found that management and employees must not only focus on core operations but also on dimensions such as environment, socio economic and governance, also referred to as triple bottom-line reporting. The scope of knowledge management thus includes value added decisions and learning across all processes in the value chain and the conclusion is made that companies must focus on financial and non-financial indicators to ensure sustainable competitive advantage.

The seventh concept discussed was the relation between knowledge and **learning** and business performance, and the definition of a distinctive competency. It was found that there is a close correlation between the maturity level of knowledge management and learning to the level of sustainable competitive advantage. If the application of the knowledge represents a level of proficiency which rivals do not have, the knowledge strength is defined as a **distinctive competence**.

The eighth concept discussed was to assess the maturity level of knowledge management in **competing Steel companies**. It was found that competing Steel companies such as Posco and Tata steel have actively pursued the management of knowledge as a key enabler for sustainable growth. The conclusion was made that ArcelorMittal South Africa is lagging behind other world class knowledge management companies.

The ninth concept that was discussed was the knowledge management and organisational learning approach followed by ArcelorMittal, **Monlevade Steel**. It was

found that this company has successfully implemented knowledge management and organisational learning principles. They have developed a conceptual model which explains how the maturity level of knowledge management and organisational learning impact competitiveness measured in terms of financial measurements such as Economic Value Added or Return on Investment.

It was concluded that the model is limited as it does not take into account sustainability dimensions and that it only focuses on the translation of tacit knowledge into explicit knowledge through standards of practice applied to existing processes. It was further concluded that the culture and organisation structure and Human Resources policies applied at Monlevade is supportive to knowledge sharing.

The tenth concept discussed was the importance of knowledge for **future growth** of the Steel industry. It was found that knowledge and specifically tacit knowledge is a prerequisite for sustainability and growth. Explicit knowledge can be acquired but based on the ArcelorMittal experience people with experience or tacit knowledge are very scarce and need to be nurtured.

The eleventh concept that was discussed was the **competence development model** and importance of competency development to ensure sustainable competitive advantage. It was found that the competence development model is based on the development of competencies through training of different types of knowledge. The model is based on the assumption that explicit knowledge provided through classroom training has a limited impact on sustainable competitive advantage on its own and it needs to be merged with tacit knowledge to obtain competitive advantage. It is important to follow a balanced approach regarding training of tacit and explicit knowledge.

The twelfth concept includes a discussion of different **knowledge management strategies** to be applied pending on the type of work to be performed. The specific knowledge management strategy will depend on the level of interdependence involved to perform an activity and the complexity level of the work. For example, the knowledge management strategy for routine type of work and low dependency will typically involve the development of clear operating procedures to control behaviour.

This will be made available to all employees to share. The knowledge management strategy will differ when work is highly complex and involving high interdependence of different groups in the organisation referred to as the collaboration model and will involve a knowledge management strategy that encourages discovery through skunkworks and pilots or knowledge linking strategies that focus on learning through alliances.

The next section includes a discussion of **best practices** identified as the lessons learned from companies which have successfully implemented knowledge management programmes.

The final section provides a list of **critical success factors** to establish a knowledge sharing culture and a successful knowledge-powered enterprise. These include a vision for the knowledge management programme, roadmap, value driven focus, people who are willing to share information, processes which enable knowledge sharing, quality control of knowledge content, technology enabled and easy-to-use, and execution which includes measurements of a successful knowledge management programme.

CHAPTER 3

RESEARCH METHODOLOGY AND FINDINGS

3.1 INTRODUCTION

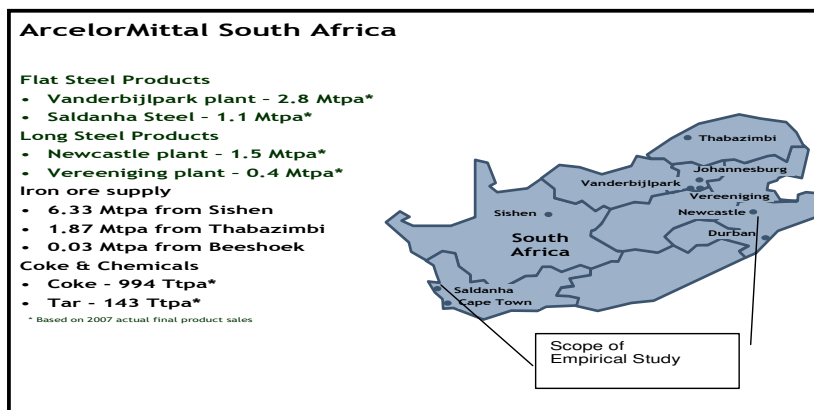
In chapter 2, numerous sources indicated that there are factors in the workplace that promote or hinder the effective management of knowledge and organisational learning. In this chapter, the focus was on the research methodology used to help meet the research objectives as laid out in §1.3. In addition, the findings from the survey are presented.

3.2 DISCUSSION OF ARCELORMITTAL

The ArcelorMittal company is listed on the Amsterdam Euronext and the New York Stock Exchange, while ArcelorMittal South Africa is listed on the Johannesburg Stock Exchange. ArcelorMittal South Africa is part of ArcelorMittal which is the largest steel producer in the world, with over 260 000 employees on five continents and is a global Steel company (ArcelorMittal, 2010).

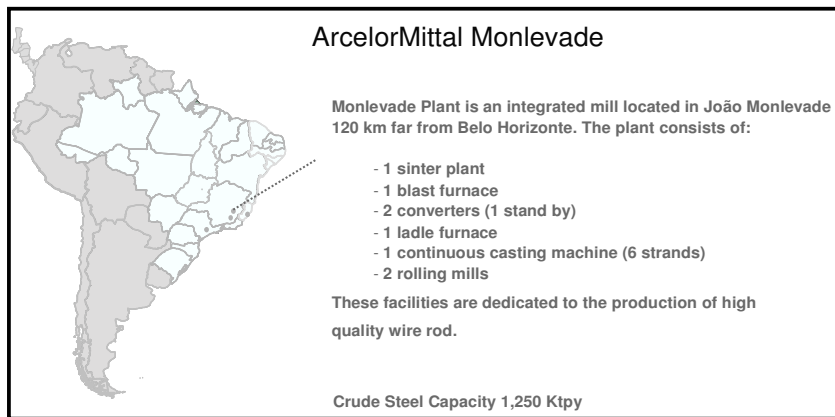
The production capacities of ArcelorMittal South Africa and the location of the Newcastle and Saldanha facilities used for the empirical study, are summarised in figure 3.1. ArcelorMittal Monlevade's configuration, location and capacity are included in figure 3.2.

Figure 3.1: ArcelorMittal South Africa facilities



Source: ArcelorMittal (2010)

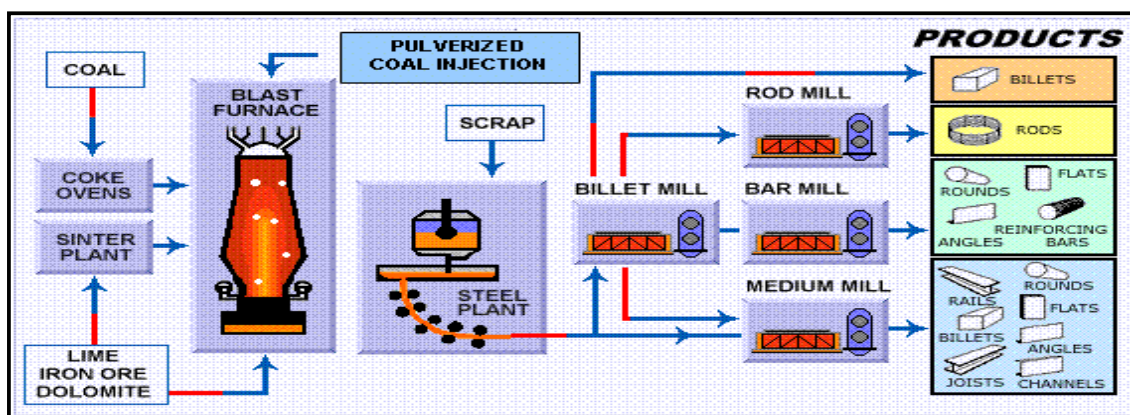
Figure 3.2: ArcelorMittal South America Monlevade (Benchmark facility)



Source: ArcelorMittal (2010)

For the purpose of this study more detail is provided of the **Newcastle facility** as this site is similar to the Monlevade site which was used as the internal ArcelorMittal benchmark site during the literature study. ArcelorMittal Newcastle is a high volume, process based, continuous manufacturing company which produces Steel profile products primarily used in the construction and mining industry. The final profile products of 1.5 million tons per annum, are marketed mainly within South Africa with only 30% of the product being exported. The Newcastle facility is regarded as the most efficient plant within the ArcelorMittal South Africa group. The plant is ranked as the third lowest cash cost producer of rod mill coils globally. The physical production configuration and detail of final products manufactured are summarised in figure 3.3.

Figure 3.3: Physical production configuration Newcastle site



Source: ArcelorMittal (2010)

The most recent SWOT analyses is summarised in Figure 3.4. It is evident that Newcastle Steel has significant strengths, with huge opportunities to grow. The most significant strengths identified are the global ArcelorMittal purchasing agreements, strong leadership and values, raw material supply agreements, **high performance culture, communication processes** and integrated production and business processes. There are, however, also some weaknesses and threats which need to be managed to ensure sustainability and growth. The key threats are the rising costs, **availability of technical skills** and dependency on Escom for power provision. The weaknesses are the quality of raw materials, location of Newcastle which increases transport cost to customers and adaptability to changes in major market demand.

Figure 3.4: SWOT analyses: ArcelorMittal Newcastle

SWOT ANALYSES ARCELORMITTAL Newcastle	
STRENGTHS • Sustainable Cash flow from Operations • Iron Ore supply agreement of at Cost (6M tons at Cost plus 3%) • ArcelorMittal controls a significant part of the coke supply chain, through coke production by MCC • Integrated Low cost producer • High Performance Culture • Integrated Business Processes and Information • Global Purchase organisation • Communication Processes • Quality certification ISO9000 and performance • Leadership and Strong Values • Excess to process knowledge in the AM Group • Part of a Global company with access to the Sub-Saharan Africa market, earmarked in the Group for exports from South Africa. • Production process and layout with lots of potential for brown fields expansion. • Very good Support Service Departments (King II and Sox compliancy)	WEAKNESSES • Quality of raw materials (Ore and Coal) • HR management aspects: Workforce literacy , skills and remuneration • Condition of specific facilities due to previous years cost cutting • Progress made with commissioning of Water Plants • Corporate Capital approval processes • Dependency on Marketing and Sales for Customer Intimacy • Adaptability to changes in Major Market demand changes • Location its distance to Customers (Transport Costs) • Dependency on Communication and Technology Infrastructure due to centralisation at Vanderbijlpark and Dubai (SAP, SMILE and Work Group computing) • Location its distance from Vendors • BBBEE behind schedule
OPPORTUNITIES • Long-term increases of real prices of Profile Products • Growth in domestic and Africa markets • Improve Customer Intimacy • Expansions (Iron, Steel and Rolling facilities) • Further improve Culture • Improve Safety performance • Reduce energy dependence • Training and Development • Social responsibility – Reputation and branding • Utilize the Group network and contacts for benchmarking and process improvement. • Commercial synergies with other expansion programs in the Group for Newcastle Work's expansion. • Demonstrate leadership to Groups.	THREATS • Increasing cost escalations • Increasing pressure on environmental standards • Availability of Project Management and Technical skills • Labour cost increases due to skills shortage • Dependency on Transnet and Eskom • Impact of China regarding demand and supply of Steel • Complacency • Africa is becoming the target market for the bigger steel producers of the world • Deterioration of raw material quality in South Africa • Rand dollar exchange rate • Global down turn in steel consumption with resulting over capacity in supply

Source: ArcelorMittal (2009b)

3.3 THE PROCEDURE AND SCOPE OF THE QUANTITATIVE RESEARCH

The empirical study focused on two steel manufacturing facilities based in **South Africa** and one plant based in **Brazil**. The maturity level of applying knowledge management and organisational learning principles was analysed, and this was compared to the lessons learned from other companies which successfully apply knowledge to drive sustainable competitive advantage. A Long and Flat Steel facility was used to assess if there are differences in the maturity levels between Long and Flat Steel in South Africa.

The reasoning behind this as a sample was that the processes at Saldanha and Newcastle are broadly comparable and both these are remote plants situated in rural areas and both facilities struggle to attract and retain people. The facility in Brazil is also remote and is an integrated Long Steel manufacturing facility similar in size to the Newcastle facility.

The Newcastle facility is an integrated Long Steel producer situated in Newcastle, Kwazulu-Natal. Saldanha Steel is a Flat Steel producer situated in the Western Cape. Monlevade is an integrated Long Steel site situated in Brazil in South America.

3.3.1 Sample group and size

The main target group of the study was the management and technical staff in ArcelorMittal at the Newcastle, Saldanha and Monlevade facilities. The scope included all managers, engineers, technologists, technicians and specialists across all functions. The population used was the F to C role managers and specialists. The sample covered a broad spectrum of participants with mixed race, gender and work experience at different levels within the organisation.

A full breakdown of the number of employees found in these groups is summarised per functional area and organisational level in table 3.1. It can be seen in table 3.1 that the total amount of employees in the population is **318**.

Table 3.1: Detail of population size

Area of responsibility	Positional Level	Number (N)
Planning and Logistics	Management team	4
	Manager	12
	Engineers and technologists	4
	Specialists	7
Engineering and Infrastructure	Management team	3
	Manager	7
	Engineers and technologists	45
	Specialists	33
Operations (Metallurgical)	Management team	5
	Manager	18
	Engineers and technologists	16
	Specialists	26
Operations (Rolling)	Management team	3
	Manager	6
	Engineers and technologists	8
	Specialists	16
Quality or Product development	Management team	2
	Manager	4
	Engineers and technologists	13
	Specialists	14
Other Supporting areas: (Sherq, Finance, Human Resources, Commercial and Information Management)	Management team	6
	Manager	12
	Engineers and technologists	16
	Specialists	43
Summary	Management team	18
	Manager	59
	Engineers and technologists	102
	Specialists	139
	Total	318

The calculation of the sample size is an important variable to ensure that results are scientific and statistically significant during the quantitative research process. If the sample is too large the results will be statistically significant but the cost may be high. It is thus important to have an optimal size. An under-sized study may be a waste of resources for not having the capability to produce useful results, while an over-sized sample may require more resources than are necessary. It is also just too cumbersome and inefficient to obtain a complete count of the target population.

From the above it can be seen that the decision of the sample size is very important. The equation for calculation of the sample size used was calculated through the application of equation 3.1.

Equation 3.1: Sample size

$$n = \frac{Z^2 \pi (1 - \pi)}{e^2}$$

Where:

n = sample size required for given parameters

Z = number of standard deviations for given accuracy (1.64 for 90% confidence level)

π = proportion of sample of interest (a value of 0.5 maximises the sample size, thus minimising the error)

e = error allowable, in this case 10%

Source: Levine, Stephan, Krehbiel, and Berenson (2008:303)

The number of employees in the population is 318 (as seen in table 3.1). For these set values it was calculated that 67 questionnaires were required. In total 127 responses were received, which is greater than the minimum required, and thus it can be assumed that the survey results are **representative** of the opinion of the population.

3.3.2 Survey instrument

There are various instruments that can be used by researchers for capturing the information needed. The schools of thoughts can be grouped into two, namely qualitative and quantitative approaches. Qualitative research is a subjective approach (Neill, 2007). In this approach the individuals' interpretation of events are important; for example, the participant observation during an in-depth interview. Qualitative research involves analysis of data such as words (as from interviews), pictures (such as video), or objects (such as an artefact). Quantitative research is an objective approach (Neill, 2007). This method seeks precise measurement and analysis of target concepts. Researchers use tools such as surveys and questionnaires for gathering the data needed. The quantitative research approach is less time consuming and the data are in the form of numbers and statistics.

A **quantitative approach** was chosen by the author in order to objectively meet the research objectives. The design decided upon for the study was a non-random purposive sampling approach. The intent was to get the maximum number of responses possible within the timeframe available.

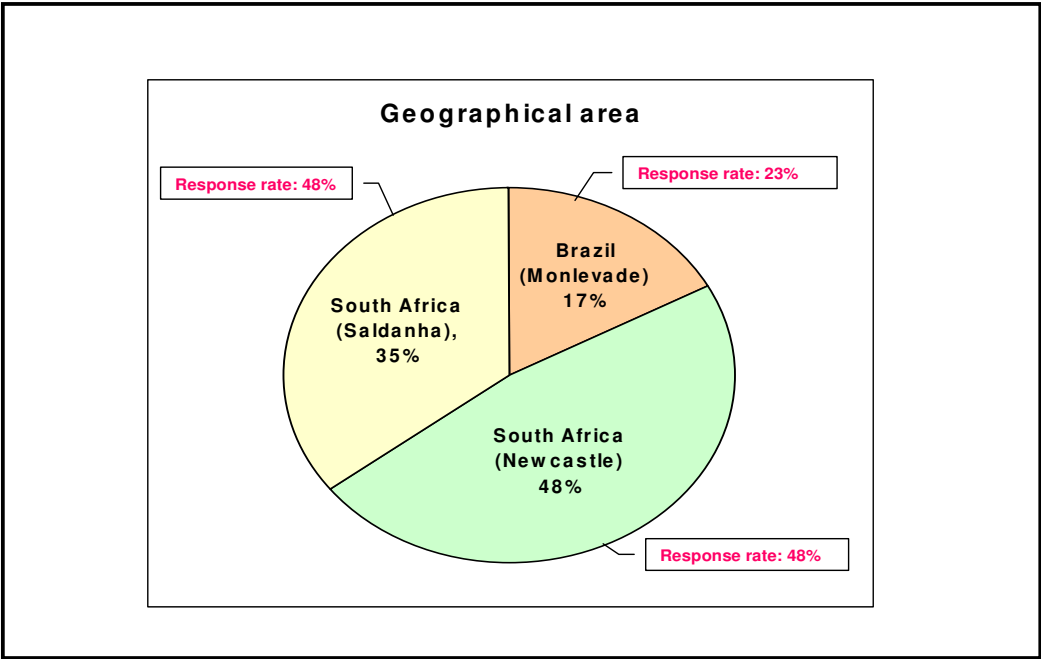
The survey instrument used in this study was a **questionnaire**. The advantages and disadvantages of using a questionnaire were considered and it justified the use in this study. A number of sources were used during the compiling of the questionnaire. These sources included Lupton (2009:92), Knowledge Board (2009), Van Beek (2008:82) and Garvin, Edmonson and Gino (2008). The questionnaire consisted of 51 selection type questions with answering in the form of a 5-point Likert scale. The scale was from 1 (strongly disagree) to 5 (strongly agree). Two open ended questions were included. Provision was also made for a selection if the respondent did not know the answer to the question. The questionnaire is included in Annexure A. The questionnaire was developed in share point portal to improve the ease of use and to ensure a high response rate. The survey was facilitated by an **external service provider** to ensure autonomy and to improve the response rate.

The method of distribution used was through the **electronic distribution** of the survey using a mail sent from the author which was hyper linked to an external share point portal survey system. The survey was activated for three weeks with reminders sent weekly.

3.4 DESCRIPTION OF DEMOGRAPHICAL INFORMATION

The percentage of respondents and response rate is summarised per geographical area in figure 3.5.

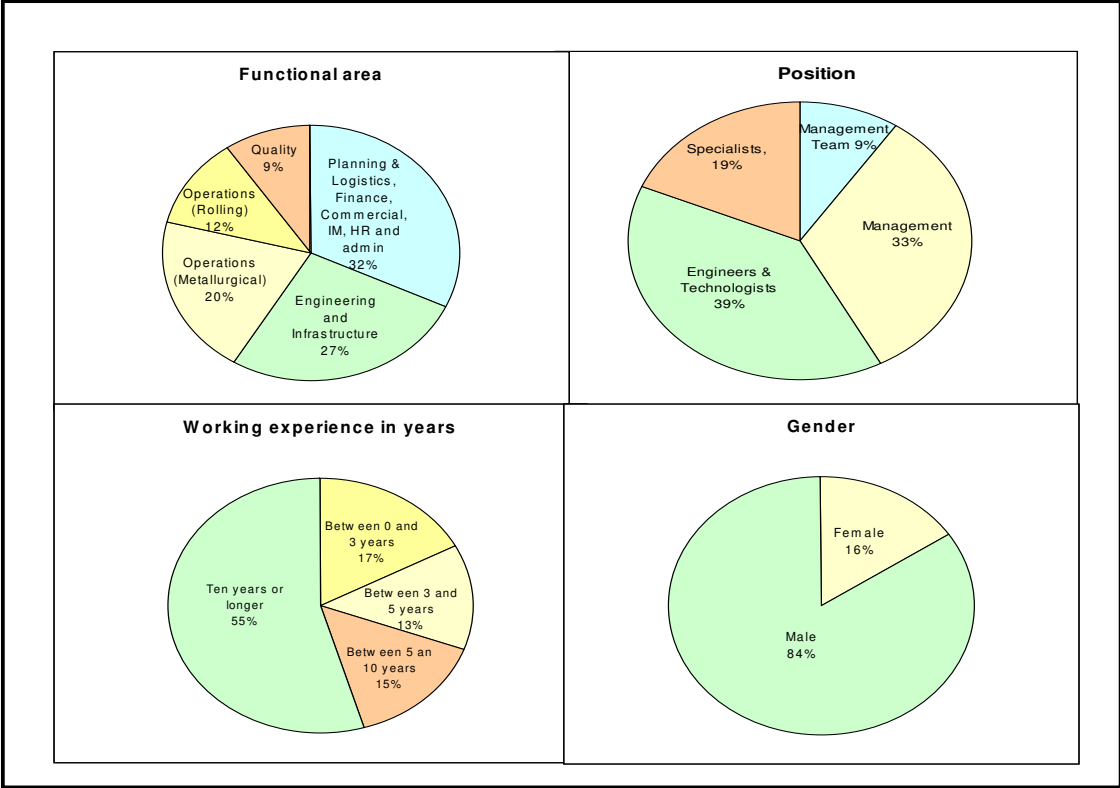
Figure 3.5: Respondents per geographical area



The response rate was 48% at both the South African facilities and 23% at Brazil. A total of 318 questionnaires were sent out and **127** responses were received back. The high response rate can be attributed to the fact that the questionnaires were disseminated internally to ArcelorMittal employees facilitated by a professionally developed user friendly electronic survey system. The lower response rate from Brazil can be attributed to technical network difficulties as well as language differences.

Other demographics of the respondents are summarised per functional area, position, years of service and gender in figure 3.6.

Figure 3.6: Respondents’ other demographics



The relative low percentage of female respondents is aligned with the population as the Steel industry is mainly staffed by males.

The number of returned questionnaires was higher than the required sample size that was calculated previously and the respondents represent all geographical areas, functional areas, positions, working experience and different gender types.

It can thus be concluded that the results from analysing the questionnaires will result in a smaller than 10% error with a confidence interval level of 90% (Levine *et al.*, 2008:303).

3.5 FREQUENCY ANALYSIS AND DESCRIPTIVE STATISTICS

The frequency analysis, descriptive statistics and the internal consistency of the questionnaire were tested using the SPSS, Statistica and SAS software packages. The frequency analysis and descriptive statistics were analysed for all items per facility and are summarised in Annexure B.

3.6 ASSESSMENT OF MARGIN OF ERROR AND INTERNAL CONSISTENCY OF THE SURVEY

3.6.1 The margin of error of answers

The margin of error of the questions was calculated at a 95% confidence level. Equation 3.3 was used to calculate the margin of error on the questions (Siegle, 2007).

Equation 3.2: Calculation for margin of error

$$L = 2 \sqrt{\frac{p(100 - p)}{n}}$$

Where:

L = the margin of error

p = the percentage of answers received back per question

n = the number of questionnaires received back

The margin of error was calculated at less than 1.8% as more than 99.5% of answers were received back per question.

3.6.2 Internal consistency of survey

The internal consistency of a survey is typically measured using Cronbach's alpha value (Field, 2009:675). Cronbach's coefficient alpha estimates the reliability of this type of scale by determining the **internal consistency** of the test or the average correlation of items within the test. It was decided to use the Cronbach's alpha test to measure the internal consistency of the subscales (questions) in this study. The equation used for the calculation of Cronbach's alpha is given as:

Equation 3-2 : Cronbach's alpha coefficient

$$\alpha = \frac{k}{k-1} \left[1 - \frac{\sum_{i=1}^k S_i^2}{S_T^2} \right]$$

Where

α = Cronbach's alpha coefficient

k = number of items in the analysis

S_i = item standard deviation

S_T = total standard deviation of all items in the construct

Although the generally accepted value of $\alpha \geq 0.8$ is appropriate for cognitive tests such as intelligence tests, dealing with psychological constructs, values below even 0.7 can be expected because of the diversity of the constructs being measured (Field, 2009:675).

The Cronbach alpha values were calculated for 13 constructs and 5 questions were identified, that seemed to have low correlations with other items in the construct. When these items were removed from the constructs, the Cronbach's alpha value improved significantly. The following questions (Q8, Q9, Q15, Q38 and Q39) were therefore removed from the constructs and analysed separately. Construct 10 was used but consisted of only one question (Q40) and the Cronbach's alpha was not calculated.

The descriptive statistics for the constructs and the five removed questions, as well as the Cronbach's alpha values of the remaining constructs are presented in table 3.2.

Table 3.2: Cronbach's alpha values for selected constructs

	Construct	Questions	Cronbach's alpha	Mean	Std. Deviation
C1	Quality of Information	Q1-Q5	0.67	3.44	0.62
C2	KM Alignment with Business Strategy	Q6-Q7	0.88	3.24	0.93
C3	KM and Profit linkage	Q8		3.84	0.96
	Knowledge used as a critical enabler to ensure sustainable competitiveness	Q9		3.67	0.90
C4	Importance of Intellectual Capital	Q10-Q12	0.70	3.20	0.96
C5	Effectiveness of collaboration and communication	Q13-Q18 (Excluding Q15)	0.61	3.70	0.56
	Language differences have a significant impact on the effectiveness of communication	Q15		2.95	1.24
C6	Level of Trust	Q19-Q25	0.73	3.67	0.58
C7	Maturity of Learning	Q26-Q35	0.72	3.31	0.54
C8	Effectiveness of incentives	Q36-Q37	0.64	2.31	0.89
C9	Our department have identified the knowledge that is critical for the department or organisations future success	Q38		3.34	0.91
	Knowledge Management is the responsibility of every section (not the responsibility of IM or IT)	Q39		4.12	0.63
C10	Business impact due to loss of skills	Q40		1.90	1.07
C11	Sharing of tacit knowledge	Q41-Q43	0.63	2.59	0.90
C12	Effectiveness of networks and forums and Coaching	Q44-Q45	0.66	2.68	0.87
C13	Effectiveness of HR Policies and structure	Q46-Q51	0.63	2.33	0.66

The alpha value of the constructs varies between 0.63 and 0.88 and is highlighted in green in table 3.2. These values are greater or close to the value of 0.7 which indicates a **high degree of internal consistency**.

Based on the above discussion the mean response count on each of the constructs in table 3.2 can be used in order to draw conclusions regarding the maturity level of knowledge management and organisational learning in the population. It is thus not necessary to analyse each of the 51 questions on its own.

3.7 COMPARISON BETWEEN THE FACILITIES

3.7.1 Mean responses for each facility

The average score per construct for each facility was compared to identify differences between the different facilities. The most significant differences in the average scores are indicated in table 3.3. The constructs or questions with a high practical significant difference are highlighted in green. Areas where the South African sites received a lower average score with high significant practical difference to Monlevade are highlighted in orange. The percentage difference indicates the difference in the average mean between benchmark facility and the South African survey with the lowest average score.

Table 3.3 must be read parallel to Table 3.4 which includes the degree of practical difference between the facilities (Constructs C2, C5, C7, C11, C12, Q9 and Q39).

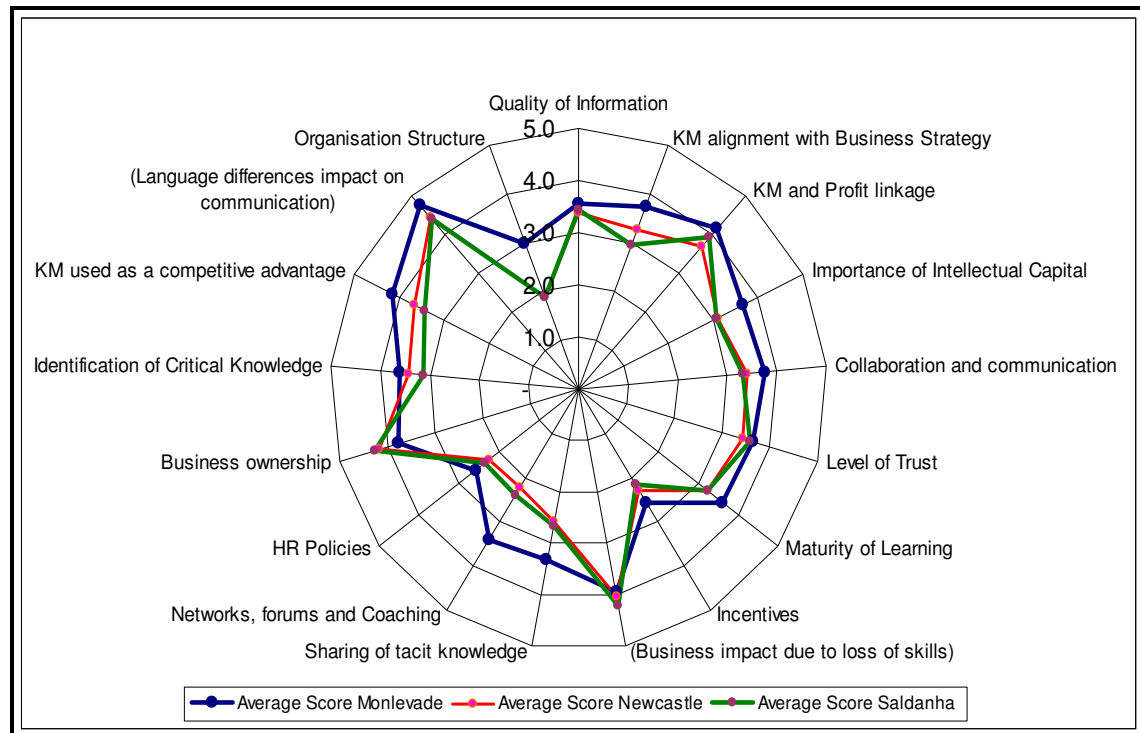
Table 3.3: Summary of survey results per facility

	Knowledge used as a sustainable competitive advantage	Average Score			Difference compared with Benchmark
		Monlevade	Newcastle	Saldanha	
C1	Quality of Information	3.6	3.4	3.4	
C2	KM alignment with Business Strategy	3.7	3.3	3.0	21%
C3	KM and Profit linkage	4.1	3.7	3.9	
C4	Importance of Intellectual Capital	3.7	3.1	3.1	
C5	Collaboration and communication	3.7	3.4	3.3	12%
C6	Level of Trust	3.7	3.5	3.6	
C7	Maturity of Learning	3.6	3.2	3.2	11%
C8	Incentives	2.6	2.3	2.2	
C10	(Business impact due to loss of skills)	4.0	4.1	4.2	
C11	Sharing of tacit knowledge	3.3	2.6	2.7	21%
C12	Networks, forums and Coaching	3.4	2.2	2.4	35%
C13	HR Policies and Organisation structure	2.6	2.2	2.4	14%
Q9	KM used as a competitive advantage	4.1	3.7	3.4	17%
Q15	(Language differences impact on communication)	4.7	4.4	4.4	
Q38	Identification of Critical Knowledge	3.6	3.4	3.1	
Q39	Business ownership	3.8	4.1	4.3	-10%

3.7.2 Graphical comparison of the results

Monlevade's results were compared to the Newcastle and Saldanha facilities. The results were categorised based on the best practices and lessons learned identified during the literature research done in Chapter 2. The summary of the results is included in figure 3.7.

Figure 3.7: Graphical knowledge management maturity comparison



The results in figure 3.7 presents the average maturity levels of knowledge management and learning between the Monlevade facility in Brazil and the South African facilities situated at Newcastle and Saldanha.

3.7.3 Comparison between the facilities by means of ANOVA

The statistical significance of the differences between the three sites were analysed through the analysis of variance or ANOVA methodology where the differences between the means of several groups were determined. According to ANOVA tests, a p-value smaller than 0.05 is considered as sufficient evidence that the difference is **statistically significant**. Table 3.4 includes the constructs and questions with p-values of less than 0.05 which indicates that the result of these constructs or questions differs significantly across the different sites.

Table 3.4: ANOVA test results per construct and question for total population

	Construct or Question	<i>P value</i> <0.05
C2	KM Alignment with business strategy	0.00741
C5	Effectiveness of collaboration and communication	0.00632
C6	Maturity of learning	0.01227
C11	Sharing of tacit knowledge	0.00138
C12	Effectiveness of networks and forums and coaching	0.00002
Q9	KM used as a sustainable competitive advantage	0.01275
Q39	Business ownership	0.00877

The small p-values of the ANOVA tests in the table above indicate that the mean responses on the constructs presented in the table were not equal. The ANOVA test, however, does not indicate in which pair(s) the difference in means lie. “Post hoc tests consist of pairwise comparisons that are designed to compare all different combinations of the treatment groups” (Field, 2009:372). Post hoc t-tests (independent t-tests) were therefore applied and the results of these tests are summarised in table 3.5.

Table 3.5: Statistical and practical significance of difference between facilities

Differences between facilities	Statistical T-tests			Practical significance		
	p<0.05			Medium >0.5, Large >0.8		
	P values			Effect sizes		
Construct or Question	Monlevade compared to Newcastle	Monlevade compared to Saldanha	Newcastle compared to Saldanha	Monlevade compared to Newcastle	Monlevade compared to Saldanha	Newcastle compared to Saldanha
KM Alignment with Business Strategy	0.2091	0.0177	0.2834	0.4233	0.6827	0.3318
Effectiveness of collaboration and communication	0.0266	0.0390	0.9777	0.6729	0.6360	0.0400
Maturity of Learning	0.0438	0.0592	0.9839	0.7074	0.6720	0.0355
Sharing of tacit knowledge	0.0071	0.0240	0.8301	0.9025	0.8019	0.1200
Effectiveness of networks and forums and Coaching	0.0002	0.0030	0.5943	1.0480	0.8678	0.2027
Effectiveness of HR Policies and Organisation Structure	0.1492	0.3864	0.7125	0.5602	0.3823	0.1594
KM used as a sustainable competitive advantage	0.1848	0.0271	0.4536	0.5432	0.7605	0.2420
Business ownership	0.1166	0.0203	0.5656	0.4863	0.6569	0.2085

Table 3.5 includes the p-values of the post hoc t-tests and the corresponding effect sizes. The effect sizes are not dependent on the sample size of the sample.

The p-values in the table give an indication of whether there are statistical significant differences between the site-pairs, whereas the effect sizes indicate practical significant differences.

It is evident that although not all differences could be proven to be statistically significant using p-values smaller than 0.05, most of the identified constructs based on effect sizes proved to have medium to high **practical** significant difference if the benchmark site Monlevade is compared to Newcastle and Saldanha. It is evident that there is no statistical or practical significance in the difference between Newcastle and Saldanha. The results thus indicate that there is **no significant difference** in the level of knowledge management and learning maturity between the Long and Flat steel facilities within South Africa.

The above tests were repeated to identify whether significant differences can be identified based on the gender, functional area or working experience but no significant differences could be found. The only moderate practical difference was that female respondents perceived that language differences are not a significant problem for effective communication where no significant difference could be identified between men.

Based on the above discussion and the **high practical significant** values it was concluded that the differences between Monlevade compared to Newcastle and Saldanha are significant in the constructs and questions highlighted in green in table 3.5. The results are aligned with the findings made during the literature study and confirm that Monlevade is indeed superior in terms of KM and OL maturity levels. The results can be used to make recommendations in terms of areas where South African steel companies can focus to improve the maturity levels of KM and OL.

3.7.4 Discussion of results

The only areas where the result of Monlevade was marginally lower were in terms of business ownership and the negative impact language differences have on communication. The question related to communication is a negative question which means that a lower score is good. It is evident that the results from Newcastle and Saldanha are to a large extent **similar**. The empirical findings are aligned with the literature study done in chapter 2 during which it was concluded that the maturity level of Monlevade in terms of KM and OL is superior to the South African facilities.

The effective use of networks, forums, coaching and organisation structure as well as the sharing of tacit knowledge at Brazil is superior to the South African facilities.

There is a significant difference in the opinion of the effectiveness of the **HR Policies and Organisation structure** between Newcastle and the benchmark site. The mean result of the individual questions of this construct was analysed and question Q40 which rates the effectiveness of the **organisation structure**, differs the most between the South African and benchmark facilities. The question Q40 measures the

opinion of the respondents regarding whether they perceive that the structure allows for enough resources in order to successfully transfer knowledge to the succession candidate.

During the literature study it was concluded that the Monlevade site has more effective **HR policies** and **organisation structures** to support KM and OL. The results are aligned with the literature study conclusion that Monlevade's HR policies are more supportive for knowledge transfer compared to the South African sites. The opinions of the respondents from Monlevade show that these can further improve. Job rotation is not optimally used to transfer knowledge between departments in Monlevade. It is also evident that Monlevade does not have a dedicated department which focuses on the management of knowledge, and the condition of employment does not state that employees must share knowledge.

The low scores rated for the effectiveness of **incentives** at all the facilities, including Monlevade are aligned with the findings made in the literature study during which it was concluded that ArcelorMittal does not measure knowledge sharing. This is clearly an area which can be improved.

Fifty percent of the respondents at Monlevade and Newcastle perceive that **language differences** have a significant impact on the effectiveness of communication while only 27% perceived that this is a problem at Saldanha.

The feedback received from the open ended questions further emphasized the general opinion of the respondents at Newcastle and Saldanha that they feel that they do not have sufficient manpower or **capacity or time** to effectively transfer knowledge. It can be assumed that the low scores received for the effective use of networks, forums and coaching as well as the sharing of tacit knowledge at the South African facilities can be attributed to the lack of capacity. The difference in the average means of 37% in Q51 between the benchmark site and the South African sites indicates that this is perceived as a key constraint at the South African facilities.

It can be argued that the opinion of the respondents may be wrong based on the lack of understanding of the advantages of KM and training. This opinion is very strong and will have to be changed to ensure effective KM within South Africa.

The effect of high employee turnover on production or customer service is perceived to be a problem at all sites, but 90% of the South African respondents agree or strongly agree that turnover has a negative impact compared to the 70% at Monlevade.

The feedback provided by the South African respondents on the open ended questions indicates that the general perception is that intellectual capital or people are not seen as important. Only 43% of the South African respondents agree or strongly agree that know-how is seen as more important than material or machines while 70% of Monlevade respondents agree or strongly agree that know-how is seen as more important than material or machines.

It was stated by respondents from South Africa and Brazil that a formal KM system needs to be implemented to standardise the capturing of lessons learned across the company and that a structured methodology must be developed and that KM must be implemented as a global project.

Some South African respondents stated in the open questions that **diversity** management must be improved as this negatively impacts knowledge sharing. The importance or impact of effective diversity management on KM is very relevant to South Africa with its many different cultures.

3.8 CONCLUSION

From the discussion about the demarcation it can be concluded that the respondents represent the whole management and technical staff of the three selected facilities. The Cronbach analysis showed that the **internal consistency** of most of the constructs are **high** and that the mean score of these reliable constructs can be used to draw conclusions regarding the state of the maturity of knowledge management and organisational learning in the South African Steel industry. The five items that did not show high correlation with other items in their construct, were considered separately.

It was found that there is not a significant difference between the Long steel and Flat steel sites in South Africa. It is however evident that there is a **significant difference** in the overall maturity of knowledge management and learning between the benchmark site in Brazil and the South African sites. This conclusion was substantiated by **statistical and practical significance tests** and it is evident that the maturity levels of specific constructs of the South African steel companies are lower compared to those constructs of the benchmark site in Brazil.

It can also be concluded that a **good fit** was found between the literature and the results obtained from the analysis of the questionnaire. There were gaps found between the best practices and lessons learned from other organisations, the benchmark organisation and the selected Long and Flat steel facilities in South Africa.

There is a **significant difference** regarding the use of knowledge as a **sustainable competitive advantage** between Brazil and the South African Steel companies. Although close to 90% of the South African respondents agreed or strongly agreed that the turnover of skilled employees had a significant impact on production performance, the link between knowledge and sustainable advantage was made by only 63% of the South African respondents compared to the 90% of the respondents from Brazil who understand the role of knowledge as a sustainable advantage.

It was found that the **culture** at the South African Steel companies is conducive for knowledge management based on the **level of trust** and the **willingness to share knowledge** but it is evident that the South African respondents feel that intellectual capital is not valued and that they do not have the capacity or sufficient time to share knowledge or to train succession candidates. The continued downsizing and high turnover of personnel in the South African steel companies over the past decade may be the reason why employees feel that intellectual capital or know-how is not important.

The rewarding of employees for sharing knowledge is an area that is lagging behind in Brazil and South Africa. The effectiveness of the HR policies and **organisation structure** and the **sharing of tacit knowledge** is the biggest challenge for the South African steel companies. The respondents in the South African steel industry feel that they are understaffed and that although they are willing to share knowledge, they do not have the time. **Formal networks and forums** are not effectively used to share knowledge and collaboration and communication within the South African companies are not functioning optimally. Coaching is another area where the South African companies are lagging.

It is evident that the quality of information, ownership of knowledge management and the link between knowledge and profit understanding compared **favourably** with the benchmark and there is a willingness on every level to share knowledge with their team members and sub-ordinates within and between sections. The respondents also in general feel that there are sufficient number of learning opportunities and learning media available. In general most employees feel that they have learned new skills over the past 12 months.

It was found that efficiency of knowledge management can be improved in the South African Steel industry, because the **critical knowledge** is not captured and shared successfully. The sharing of good work practices and lessons learned by compiling written documents is done well at Monlevade but needs to be improved within the Steel companies in South Africa.

The role of **tacit knowledge** is very important within Steel companies because a large percentage of employees believe that they have learnt more from their colleagues than from written information. It is important that Steel companies in South Africa must become aware and improve their understanding of the importance of knowledge as a sustainable competitive advantage.

3.9 SUMMARY

Chapter 3 was devoted to the research methodology and presentation of the results.

Firstly, an **overview of ArcelorMittal's operations** in South Africa and Brazil was given. The location, products and the size of the facilities, selected for the empirical study were presented. More detail was given of the production configuration of the Newcastle facility. A summary of the most recent SWOT analyses of the Newcastle facility was discussed which showed that one of the threats is the availability of technical skills which confirms the necessity of an effective knowledge management strategy.

The next part of the chapter included a discussion of the **procedure and scope of the research** used to assess the maturity level of knowledge management and organisational learning within the identified facilities in South Africa and Brazil. A quantitative approach was chosen in order to objectively meet the research objectives. The intent was to get the maximum number of responses possible within the timeframe available and the design decided upon for the study was a non-random purposive sampling approach. The minimum required responses or sample size to ensure that the survey results are representative, were calculated and it was concluded that the survey results are representative of the opinion of the population. The detail of the population was given and it was shown that the population consisted of the management and technical specialist group on the F role to C role levels responsible for different processes across the supply chain. The detail of the questionnaire as a design instrument was presented.

The third section discussed the **response rate** per facility as well as the **demographical information** of the respondents. One hundred and twenty seven members of the population of 318 responded to the survey. The response rate was 48% at both of the South African facilities and 23% at the Monlevade facility in Brazil.

The fourth and fifth discussion points were to explain what is meant by **margin of error and internal consistency** of a survey. The frequency analysis, descriptive statistics and the internal consistency of the questionnaire were tested using the SPSS, Statistica and SAS software packages. The frequency analysis and descriptive statistics were presented for all items per facility.

The measurement of the margin of error and the measurement of internal consistency through Cronbach's alpha values, were presented. It was found that the margin of error of the survey was low and that the answers of the questions had a high degree of internal consistency. The internal consistency of the constructs was good, except for five items which were considered separately. It was concluded that the mean response count on each of the constructs can be used in order to draw conclusions regarding the maturity level of knowledge management and organisational learning in the population.

The sixth discussion point was to present the **comparison** of the mean responses of each facility. Monlevade's results were compared to the Newcastle and Saldanha facilities. The results were categorised based on the best practices and lessons learned identified during the literature research done in Chapter 2 and the difference between the facilities was presented in table format and graphically.

The statistical significance of the differences between the three sites were analysed through the analysis of variance or ANOVA methodology where the differences between the means of several groups were determined. The ANOVA analyses showed that there are differences in the populations. The ANOVA test, however, does not indicate in which pair(s) the difference in means lie. "Post hoc tests consist of pairwise comparisons that are designed to compare all different combinations of the treatment groups". The results of the Post hoc t- tests (independent t-tests) were presented.

It was found that there is not a significant difference between the Long Steel and Flat Steel sites in South Africa. It was, however, evident that there is a statistical and practical significant difference in the overall maturity of knowledge management and learning between the benchmark site in Brazil and the South African sites.

The last part of the chapter includes a discussion of the results. Monlevade results are significantly higher than the South African sites for selected constructs which indicate a **good fit** between the literature and the results obtained from the analysis of the questionnaire. There were gaps found between the best practices and lessons learned from other organisations, the benchmark organisation and the selected Long and Flat Steel facilities in South Africa.

Finally, the results were used to draw conclusions with regard to the level of knowledge management and organisational learning in the steel companies in South Africa. It was concluded that there is a **significant difference** regarding the use of knowledge as a **sustainable competitive advantage** between Brazil and the South African steel companies.

The conclusions and recommendations will be discussed in chapter 4.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

The primary objective of this study was to assess if knowledge can be used as a sustainable competitive advantage in the steel industry. During the literature research several factors which either promote or hinder the effective management of knowledge were identified and discussed. The maturity level of the management of these factors in ArcelorMittal was researched through a literature study which was discussed in chapter 2. The empirical study was discussed in relation to the literature study in chapter 3.

As stated in §1.6, chapter 4 is devoted to drawing conclusions from the survey, and putting forward **recommendations** for the more effective creation, acquisition, and transferring of **tacit** knowledge to improve the **sustainable competitive advantage** of the South African steel companies. The level of maturity of knowledge management and organisational learning of the selected South African Steel companies are compared to Brazil, rival Steel companies and other knowledge enterprises such as Buckman. **Practical design principles** for the successful implementation of a knowledge management programme are proposed to be used by the South African Steel industry to effectively use knowledge as a **sustainable competitive advantage**.

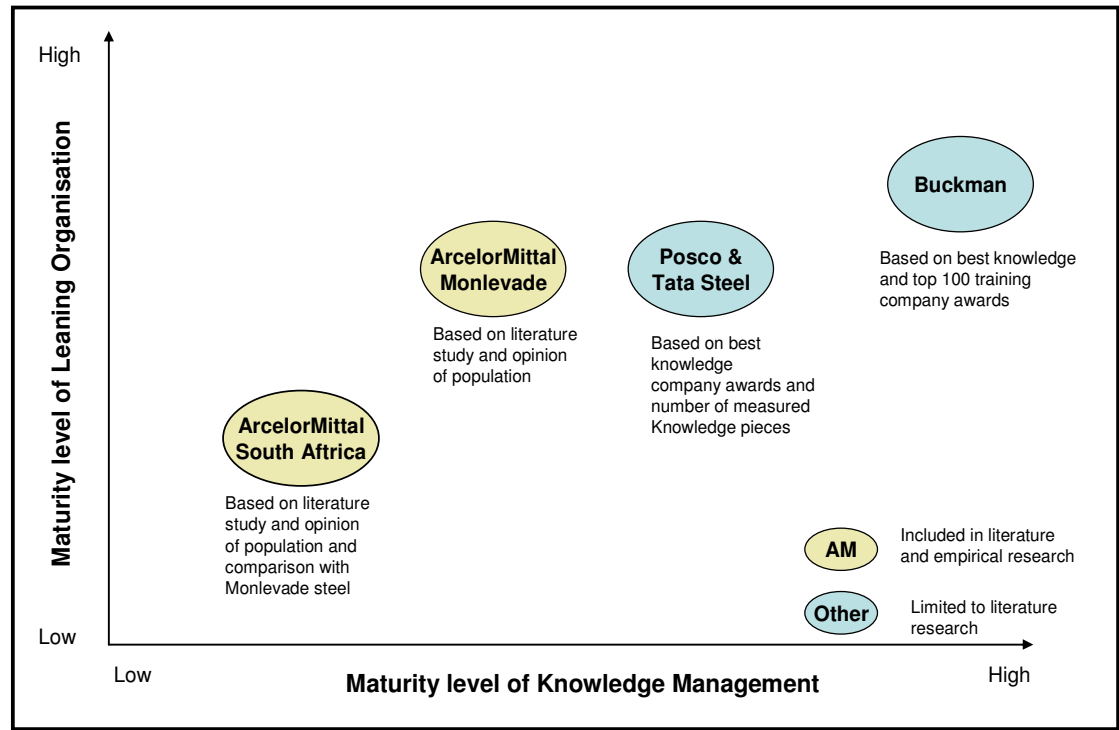
4.2 STATE OF KNOWLEDGE MANAGEMENT IN ARCELORMITTAL

The literature and empirical research done in chapter 2 and 3 confirmed that knowledge management (KM) can be used as a sustainable advantage in the Steel industry. KM must focus on **tacit** knowledge to ensure a sustainable advantage. Chapter 2 and 3 confirmed that there are factors in the workplace that promote or hinder the effective management of knowledge and organizational learning (OL). These factors must be effectively managed following an integrative structured approach.

The **literature research** results confirmed that the maturity levels of KM can be improved at the ArcelorMittal facilities in South Africa and Brazil compared to rival Steel companies and other knowledge enterprises such as Buckman.

The literature and **empirical research** results confirmed that the maturity level of both KM and OL of the Monlevade facility in Brazil, is superior to that of the South African facilities. Figure 4.1 represents a subjective maturity matrix to conceptualise the differences between the facilities and companies included in the study.

Figure 4.1: Knowledge management and organisational learning maturity matrix comparison



The findings noted in §3.7 are based on the opinions of the respondents from the South African Steel companies located in Newcastle and Saldanha and the Brazil facility located in Monlevade. The findings to be discussed on the next pages are South African focused, comparing the South African with the Monlevade survey results.

The findings are summarised as follows:

Factors which promote knowledge management and learning:

- The medium to high maturity level of existing information systems and **quality of information** which can be used to make business decisions
- The culture of relative high **trust levels** and the general willingness to share knowledge freely within and between sections
- The perception of more than 50% of the respondents that employees can make mistakes as long as they learn. This increases innovation and knowledge sharing
- The positive understanding by the majority of respondents that the application of specialist knowledge can be used to increase company profits
- Clear understanding that KM is the responsibility of each area. It is clear that most respondents understand that the **ownership** of KM lies with the different sections
- The perception that most of the respondents indicated that they have **learned** a lot the past year and that they have participated in different projects
- It is the opinion of approximately 60% of the respondents that a **participative decision-making** process is followed as an important enabler which improves the sharing of knowledge between management and team members.

Factors which constrain knowledge management and learning

- KM does not formally form part of the mission or strategy of the majority of sections. This is not supportive to knowledge management as KM must be driven by leaders.
- Knowledge, know-how or intellectual capital is **not** seen as a critical enabler for sustainable competitive advantage by the majority of respondents. This finding will be very negative for OL and KM as the importance of tacit knowledge to ensure sustainability and growth is not understood.
- There is not a clear understanding by 37% of respondents of where to store or access lessons learned and intellectual knowledge.

- The strong opinion or perception that KM will further increase the workload and that the respondents feel they do not have time to share or train succession candidates is worrying as the opposite is true as knowledge multiplies itself if it is shared over time.
- The **Human Resource policies** and organisation structure are perceived to be key constraints by 65% of the respondents. Almost 90% of respondents feel that the existing **organisation structure** is not supportive for knowledge sharing.
- More than 85% of respondents feel there are not a sufficient number of coaches and mentors available to train engineers.
- More than 85% feel that Job rotation is not practiced to transfer knowledge between departments.
- The perceived feeling of 40% of respondents that employees are seen as **less** important than machines or material will need to be addressed. Although it is stated in reports that employees are important, it is not perceived as such by the employees.
- Less than 50% of respondents are aware of a **competency and skills matrix** in their section.
- Around 65% of the South African respondents feel that **communication** is effective versus the 82% of Brazil and 33% feel that senior management communicates effectively compared to the 77% at Brazil. Effective communication is a prerequisite for effective KM and needs to be improved.
- **Language differences** have a negative impact on communication. Mainly at Newcastle where 50% of the respondents feel that it has a negative impact on communication compared to 25% at Saldanha.
- Less than 50% of respondents agree that there are a sufficient number of **learning delivery points** such as CDs, videos and internet.
- More than 33% of respondents in South Africa feel that management do not encourage continuous learning compared to the 15% of Brazil respondents, who feel that management do not encourage learning. This is a clear area that must be improved.
- DVDs are not optimally used to capture on-the-job footage and tacit knowledge
- A lack of a formal mentorship and/or coaching programme is evident.

- More than 66% of respondents feel that **tacit knowledge** is not effectively captured or that benchmarking's learnings are not shared
- There is no standardised KM system to facilitate knowledge sharing of **explicit knowledge** across the company.
- More than 80% of respondents feel that there are no formal **knowledge exchange forums** in place, or that forums are used effectively to exchange tacit knowledge.
- A general lack of **incentives** to share information is evident at all facilities.
- A lack of coordination or centrally driven knowledge management programme was identified by several respondents as a key improvement area.

Based on the above findings and discussion it can be concluded that the maturity level of KM and OL in the South African Steel companies is rather **low** compared to Monlevade, Posco, Tata steel and Buckman International. It is evident that knowledge is **not** effectively used as a competitive advantage by Newcastle and Saldanha.

4.3 PRACTICAL DESIGN PRINCIPLES FOR A KNOWLEDGE MANAGEMENT PROGRAMME IN THE SOUTH AFRICAN STEEL INDUSTRY

The focus of a KM strategy must be based on the effective creation, acquisition, and transferring of **tacit** knowledge. Although processes can be improved by codifying explicit knowledge into standard operating procedures to support routine work, this strategy will not result into a **sustainable competitive advantage**. The introduction of standard methods based on best practices will also not result into a sustainable advantage as these methods and best practices can be copied by rivals.

The design principles are based on the key assumption that steel companies want to use knowledge as a sustainable competitive advantage to ensure growth and sustainability. The design principles, if followed effectively will improve the problem areas which were discussed in §4.2.

From the research it can be concluded that specific design principles must be followed when a company wants to use KM as a sustainable competitive advantage. The ten design principles were developed in the context of the **current state** of KM in the **South African Steel industry**.

Principle 1 – KM alignment with the business strategy

The proposed KM strategy must be demand driven and aligned with the business strategy. The first step will be to confirm the business strategy, to understand the Industry competitive environment and to understand the strengths, weaknesses, opportunities and threats of the Steel company. The KM strategy and business objectives must be supportive of the business strategy and objectives. The company must confirm its strategic intent and whether it will focus on operational excellence, customer intimacy or product innovation over the medium to long term.

The KM strategy will typically include the following questions per business strategy:

Operational excellence - What knowledge and skills do we need to acquire or retain to ensure that our internal processes are superior to that of our competitors? What knowledge or skills do we need to integrate backwards or forward? What knowledge do we need to reduce the lost time frequency rate in terms of safety performance to be the best in South Africa? What knowledge or skills do we need to adhere to the changing environmental legislation?

Customer intimacy – What knowledge or skills do we need about the markets or about our customers and their processes to improve customer intimacy or to grow our markets? What skills do we need to deliver a service which is superior to our competitors? What do we need to know to be the most reliable supplier of Steel in terms of on-time delivery performance?

Product innovation – What knowledge and skills do we need if we want to differentiate our products in terms of quality from our competitors? What knowledge and skills do we need to extend our product range or capacity?

The focus of the KM strategy will not be limited to improve the status quo but will be based on the business results which must be achieved as defined in the business strategy. What knowledge and skills do we need to double the production capacity or to reduce customer complaints by ninety percent?

Principle 2 - Align KM strategy with business objective and processes

The different business objectives must be analysed to determine which processes will have to be improved or designed to support the business objectives. A business objective process map will indicate strategic focus areas for sustainable competitive advantage. The **critical knowledge** required to ensure the successful implementation of the business strategy must be identified per process to ensure that the KM initiatives can be prioritised based on whether the KM strategy will result into sustainable competitive advantage.

The appropriate knowledge strategy to be followed will depend on the **nature of work** of the process which needs to be performed to meet the business objective. The KM strategy for financial modeling, marketing or production management will differ from the strategy to be followed for routine tasks such as operations. It is important that management must understand that **different KM strategies** need to be followed to support different processes. KM will only result into a sustainable competitive advantage where tacit knowledge is involved. The collaboration model must be used for Design and Engineering, R&D and Product development while the expert model must be used for Account planning, and Marketing and Production management. Figure 2.10 summarises which KM strategy must be used per process. The KM strategies which will result into a sustainable competitive advantage, is included in figure 2.12 and discussed as part of the **collaboration and expert models**.

Principle 3 - Top management must lead the effort and business must take ownership of the management of tacit knowledge

Top management must lead the effort with vision and modeling desired behaviours. Business leaders must lead and measure the progress. The top management must confirm the importance to move from a product driven to a knowledge driven model as summarised in figure 2.13. It is important that a senior manager must be held accountable to coordinate the development and execution of the functional KM strategy for the company. This will ensure standardisation and will ensure that KM is driven through a formal structured framework and KM programme. In addition, the different plants or areas must take ownership of the management of knowledge per area. This principle is to some extent adhered to in South Africa as it is evident that the plants understand that they are responsible for KM, but more effort can be made by top management to communicate the role of knowledge in the company's business model.

Principle 4 - Confirm the understanding and the importance of tacit knowledge as a sustainable competitive advantage

It is important that all stakeholders have a common understanding of the definition of knowledge. The importance of intellectual capital and knowledge as a **sustainable competitive advantage** must be clear and understood by management and key employees. The relationship between organisational learning, knowledge management and business performance must be clear to everyone. The best approach will be to define a standardised definition and educate senior management supported by training manuals which explain the different concepts with practical examples. It is important that senior management understand the difference between information technology and knowledge. Although IT is an important enabler for collaboration and knowledge sharing, KM must be business driven. In addition, the senior management must understand that tacit knowledge or know-how will drive competitive advantage as it cannot be copied. This principle is not adhered to by the South African Steel companies.

Principle 5 - Introduce shared values and culture which are supportive of knowledge sharing

The values of the company must support knowledge sharing. Shared values such as integrity, commitment and trust are supportive to KM and OL. An organisation's culture must be in place which supports the sharing of knowledge or know-how. This can only be achieved if high levels of trust exist within the organisation. Employees must be willing to share their knowledge and to re-use knowledge from other employees. A participative decision-making approach must be followed and employees must perceive management to be fair. If employees feel that management is not fair then this will constrain information sharing. ArcelorMittal in South Africa follows this principle to a large extent, but more effort must be made to improve employee engagement as this impacts commitment. **Diversity management** must be improved as this negatively impacts effective knowledge sharing.

Principle 6 - Design and introduce effective collaboration and communication processes and infrastructure

Effective collaboration and communication processes are prerequisites for effective knowledge sharing. Employees must be encouraged by management to communicate and share knowledge across functional areas internal and external to the company. This concept was discussed in figure 2.15. The **information and communication technology** are important enablers and employees must be able to communicate and share knowledge 24 hours a day which is supported by Internet enabled information and communication technologies such as to access and share knowledge and information on the corporate portal through smart phones and social networking through Facebook or Twitter. The company must ensure that the top decision-makers can share and store information and knowledge continuously irrespective of time and place. Management must be made aware of the importance of the key enablers and must ensure that these enablers must be made available to knowledge workers. Examples of collaboration and communication enablers are Internet access, forums, portals, virtual offices, social networks, telephone & video conferences and instant messaging using smart phones. The Newcastle facility must

be sensitive to language differences as this negatively impacts knowledge sharing. A KM system must be implemented where all knowledge pieces can be stored.

Principle 7 - Introduce a continuous learning organisation

A skilled workforce is a key driver of competitiveness and therefore the South African Steel companies must focus on the continuous development of its employees. It is important that a sufficient number of training delivery points be in place to improve training. Class room training must be combined with practical training to share tacit knowledge. DVDs can also be used to capture tacit knowledge in routine type of tasks. It is important that all knowledge workers are encourage to continuously learn. An action learning approach must be implemented through special projects and formal training and coaching The different methods which can be used was illustrated in figure 2.16. This principle is adhered to by the South African companies to some extent but can be improved significantly especially in the areas of coaching.

Principle 8 – Introduce effective knowledge sharing networks and forums to share tacit knowledge

Top management must ensure that personal networks as discussed in figure 2.19, are exploited with the intent to develop the network per individual and to encourage the different individuals within the company to form networks between each other. Management must provide the necessary infrastructure per individual to support knowledge sharing and learning. The introduction of communities of practice is a very effective tool to improve the management of tacit knowledge. This concept was discussed in detail in chapter 2 and it is evident that the Steel companies in South Africa do not adhere to this principle.

Principle 9 - Introduce effective incentives to support sharing of tacit knowledge

Management must understand that the key to successful knowledge management is found in the culture and mindset of an organisation. The right mix of incentives is therefore a prerequisite. Knowledge sharing and learning must be made part of

balanced scorecards. Individuals must be measured on the amount of knowledge pieces they generate or the amount of coaching they have done or received. The metrics must make sense to both business managers and individual contributors.

Principle 10 – Introduce effective HR policies and organisation structure

The HR policies and organisation structure must be supportive to knowledge sharing and management must ensure that sufficient time is made available for knowledge sharing and learning. The organisation must be staffed to a level where sufficient capacity is available for knowledge sharing and training. It is also important that the remuneration policies ensure that specialists are retained. The Y-organisation model was discussed in figure 2.7. A policy must be developed that will ensure that the condition of employment states that new employees must share knowledge. The Job rotation policy needs to be revised to make it easier for individuals to use Job rotation to transfer or share knowledge.

4.4 RECOMMENDATIONS

It is recommended that the steel companies in South Africa develop a formal KM programme (KMP) based on the 10 design principles discussed in §4.3. Table 4.1 is a KMP framework which lists the key issues and provides a summary of the design principle(s), concepts, techniques and tools to apply to assist the Steel industry in South Africa to improve its KM and OL maturity level.

It is further recommended that the KMP must be managed as a formal **transformational change programme** sponsored by the CEO and driven by a senior executive member of the top management team. The execution of the programme will be challenging and the progress will have to be monitored on the executive management level. The critical success factors of a successful KMP were discussed in detail in §2.14 and the programme manager must ensure that all these factors are addressed as part of the KMP.

Table 4.1: KNOWLEDGE MANAGEMENT PROGRAMME FRAMEWORK

Problem areas identified during empirical research	Design Principle	Key concepts, techniques and tools
KM Alignment with the business strategy, values and leadership	1, 2, 3	Business Strategy, Vision Mission, Business modelling, SWOT analysis, Porter's five forces model, Business objective, Process mapping, KM frameworks (Accenture)
KM used as a sustainable advantage	4	Training on concepts of KM, definition of tacit and explicit knowledge and difference between information technology and knowledge, Importance of intellectual capital or know-how in a changing business environment. Importance of skills matrix, identification of critical knowledge required to execute business strategy or to sustain competitiveness
Sharing of tacit knowledge culture and shared values	5	Culture and Values, Participative decision-making, Procedural justice, Tolerance for mistakes, Change paradigm of knowledge is power to collective knowledge sharing is power, Working with experts, coaching, networks and workgroups, recording tacit knowledge, making tacit knowledge explicit and effective Diversity management
Effectiveness of collaboration and communication	6	Communication Infrastructure, Portals, Open communication approach, KM system, Multi-language approach, social networking (Facebook)
Maturity of learning	7	Link between Training and Knowledge and business performance, special projects, training delivery points, learning management system, CD, DVD, web-casting, university access and coaching, continuous training, dynamic contextual learning
Effectiveness of individual networks and knowledge exchange forums and coaching	8	Community of one principle, personal networks, conferences, research, communities of practice, KM enablers
Effectiveness of HR policies and organisation structure and incentives	9,10	Y- Organisational model, Fourth Shift principle to create capacity, Job rotation, Learning and knowledge sharing included in balanced scorecards, measure number of knowledge pieces per employee, number of communities of practice per employee, engagement surveys

4.5 RECOMMENDED FURTHER STUDIES

The dissertation is concluded by identifying opportunities for future research. Future research in this field could include research of the relation between the maturity level of knowledge management and organisational learning and the level of **innovation** of companies within the process industries in South Africa. The impact of **diversity** and **employee engagement** on the sharing of tacit knowledge can be researched within the process industries in South Africa.

4.6 CONCLUSION

The aim of this study was to assess whether knowledge management is effectively being used as a sustainable competitive advantage in the Steel industry in South Africa. The level of maturity of the application of knowledge and learning principles implemented within the South African Steel industry was assessed and compared to the maturity level of ArcelorMittal, Monlevade located in Brazil.

A survey was conducted to determine the knowledge management and organisational learning maturity level at two steel facilities of ArcelorMittal in South Africa and one facility in Brazil. The findings of the survey confirmed that the maturity level of both knowledge management and organisational learning of the Monlevade facility in Brazil is superior to that of the South African facilities.

There is a **significant difference** regarding the use of knowledge as a **sustainable competitive advantage** between Brazil and the South African Steel companies.

Although it was found that the culture at the South African steel companies is conducive for knowledge management based on the level of trust and the willingness to share knowledge, a **significant effort** needs to be made in order to allow the effective creation, acquisition, sharing and leveraging of knowledge within the South African steel facilities.

Knowledge management can be used as a sustainable competitive advantage in the South African steel industry if specific **principles** are applied during the design and

execution of a formal knowledge management programme. The application of the proposed **knowledge management programme framework** will ensure that the problem areas as identified during the empirical research are addressed. This will ensure that knowledge management is used as a sustainable competitive advantage in the South African Steel industry.

A knowledge management programme will only be successful if this is managed as a formal **transformational change programme** sponsored by the CEO and driven by a senior executive member of the top management team.

It can further be concluded that the research objectives as set out in §1.3 were satisfactorily met.

4.7 SUMMARY

In this chapter, the findings of the survey were summarised, specific design principles of a knowledge management programme were discussed and conclusions and recommendations were made to improve the level of knowledge management within the South African Steel industry.

The first discussion point was the presentation of the **current state** of KM within the South African Steel facilities through a subjective maturity matrix to conceptualise the differences between the facilities and companies included in the literature and empirical research.

Secondly, the survey results were analysed in detail to assess the current state of knowledge management within ArcelorMittal based on the **key factors** which either promote or hinder effective knowledge management. The survey results and inputs from respondents indicated that the South African facilities do not effectively use knowledge management as a sustainable competitive advantage.

The survey findings indicate that there is a **significant difference** regarding the use of knowledge as a **sustainable competitive advantage** between Brazil and the

South African Steel companies. The knowledge management and organisational learning maturity level at Brazil is higher compared to the South African facility.

Thirdly, a list of 10 principles was formulated based on the literature and empirical research findings, which if correctly applied will result into a sustainable competitive advantage.

The next part of the chapter focused on a proposed knowledge management programme framework to address the **problem or focus areas** identified during the empirical research. The framework includes key concepts, techniques or tools and design principle(s) which need to be used to address the problem areas, to ensure that knowledge management initiatives will result into a sustainable competitive advantage.

The sixth part of the chapter focused on recommendations. It was recommended that the proposed knowledge management programme framework must be used to address the problem areas identified during the empirical research.

It was further recommended that a knowledge management programme must be managed as a formal transformational change programme sponsored by the CEO and driven by a senior executive member of the top management team.

Finally, it was concluded that the research objectives as set out in §1.3 were satisfactorily met, and possibilities for future research within this field were suggested.

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ANNEXURE A

Knowledge Management & Organisational Learning Survey

- The objective of the survey is to assess the maturity level of knowledge management and learning as perceived by management and key employees in their specific business units.
- Your honest feedback is VERY important to us. We will appreciate it if you can complete it as thoroughly as possible.
- When finished, submit the questionnaire by clicking on "Submit Survey" at the end of the questionnaire.
- Your anonymity is assured.
- You will receive a confirmation email if your survey was submitted.

SECTION 1: Business position and segmentation

INSTRUCTIONS: The first set of questions is about your business position and experience. It is important that you DO answer since it will allow us to classify any rating that you give us. If you are not sure what to select in any of the drop down boxes, select the closest value that you feel represents you.

Years of working experience?	10 Years or longer	Gender?	Male
Years that you have worked for existing company?	(Click here to choose)	Level within Organisation?	(Click here to choose)
Company name	(Click here to choose) <i>If Other:</i> 	Number of personnel reporting directly to you?	
Physical location?	(Click here to choose) <i>If Other:</i> 	Number of Engineers, Technicians , Specialists within your department?	
Area of responsibility ?	(Click here to choose)	Number of Engineers, Technicians , Specialists within in your department who resigned or retired in the past two years?	

SECTION 2: General Questions

INSTRUCTIONS: The second section consists of a list of statements. We need you to rate each of the statements on the following scale:

- 0 - Do not know*
- 1 - Strongly Disagree*
- 2 - Disagree*
- 3 - Neither Disagree nor Agree*
- 4 - Agree*
- 5 - Strongly Agree*

Quality of Information and Importance of Knowledge for Competitive advantage						
	Do not know	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
1. Information is available when needed and can be trusted to make decisions	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
2. The information systems support the business processes in my responsible business area	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
3. Our information systems allows easy access to information that can be used in decision-making	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
4. Our organisation's document management system on the Portal is assisting in the transfer of knowledge	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
5. We know where to store our intellectual information or lessons learned in order for colleagues to gain access to it in order to make business decisions or resolve problems	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
6. The application of knowledge forms formally part of my section's mission statement	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
7. The application of knowledge forms formally part of my section's strategy to add business value	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
8. My section focuses on using our specialist knowledge to increase profits for the company	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
9. Knowledge is actively used as a critical enabler to ensure sustainable competitiveness in our organisation	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
10. A competency and skills matrix is available to all team members	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
11. Intellectual capital or know-how is seen as a critical enabler for sustainable competitive advantage	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Knowledge management and Communication						
	Do not know	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
12. The know-how is seen as equally or more important than other resources such as machines or materials	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
13. Communication in our plant is effective	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14. Knowledge is shared freely within my section	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
15. Language differences have a significant impact on the effectiveness of communication The communication within my section is effective	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
16. The communication from senior management in my company is effective	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
17. The communication in within my section is effective	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
18. . I feel comfortable to share knowledge with my colleagues in my section	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
19. I feel that I must not share knowledge to secure my job	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
20. I feel that in general management acts fairly	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
21. I feel that the knowledgeable members in our team tend to share information freely	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
22. I receive inputs from knowledgeable employees frequently to improve my effectiveness	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
23. I understand the rationale behind most of the decisions which are made in my section	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organisation Learning						
	Do not know	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
24. In my section one can make mistakes as long as you learn from your mistakes	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
25. . In our section we follow a participative decision-making approach	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
26. I feel that in the past 12 months I have learned a lot	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
27. I feel that there is sufficient learning opportunities in my section	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

28. I have learned more from interacting with my work colleagues than from theory on how to operate our process effectively	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
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Organisational Learning and identification of Knowledge

	Do not know	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
29. I was involved in different projects other than my usual day-to-day work and I learned	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
30. Multi-skilling is successfully driven in my section	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
31. My supervisor has coached me regarding a specific task or project the past 6 months	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
32. There are sufficient number of delivery points of learning (Intranet, Web, CDs etc)	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
33. We are encouraged by management to learn continuously	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
34. We are making use of videos or DVDs in order to capture training and on the job footage presented by key experienced employees	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
35. We have implemented a mentorship programme in order to facilitate practical knowledge exchange	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
36. The performance management system includes a part where I am measured in terms of the time and effort spent to transfer knowledge	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
37. We measure the number of knowledge pieces or articles published per employee	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
38. Our department has identified the knowledge that is critical for the department or organisation's future success	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
39. Knowledge management is the responsibility of every section (not the responsibility of IM or IT)	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Knowledge Management Enablers and HR Policies

	Do not know	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
40. High employee turnover does effect our plant's production performance or customer service	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
41. Information that was captured in files of your predecessors are used daily	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

42. Our organisation is capturing the crucial knowledge that resides in the minds of our employees	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
43. The learnings and recommendations of Benchmarking exercises are shared within our organisation	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
44. Formal structured technical knowledge exchange forums are being used in order to foster knowledge transfer	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
45. Our organisation has enough coaches and mentors to train up engineers, technicians and specialists in order to foster knowledge transfer	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
46. A formal system is in place in order for a person to shadow another person in his or her last month or two notice period to transfer know-how	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
47. Job rotation is practiced to enable knowledge transfer between departments	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
48. Succession planning forms part of our knowledge management process	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
49. The condition of employment forces me to codify my tacit knowledge and key learnings before I leave the department or organisation	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
50. We have a department that is dedicated to manage knowledge within the organisation	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
51. Our organisation structure allows for enough resources in order to transfer knowledge to the succession candidate	☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

SECTION 3: Open questions

INSTRUCTIONS: In the last section you need to answer a few open ended questions. Please use short and clear sentences.

From your perspective what can be done to improve the sharing of know-how or to retain knowledge?	
What needs to be done to improve organisation learning or training?	

**Thank you for completing the survey.
Please click on the submit button below.**

[Submit Survey](#)

ANNEXURE B

			Monlevade								
			1	2	3	4	5				
											
Statements			Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly agree	Total	Average Score	Question	Std Div
1	Information is available when needed and can be trusted to make decisions	C1	0%	9%	9%	73%	9%	22	3.82	.733	
2	The information systems support the business processes in my responsible business area	C1	5%	0%	5%	68%	23%	22	4.05	.844	
3	Our Information systems allows easy access to information that can be used in decision making	C1	0%	23%	23%	45%	9%	22	3.41	.959	
4	Our organisation Document Management system on the Portal is assisting in the transfer of knowledge	C1	9%	5%	27%	50%	9%	22	3.30	.979	
5	We know where to store our intellectual information or lessons learned in order for colleagues to gain access to it in order to make business decisions or resolve problems	C1	9%	18%	18%	45%	9%	22	3.27	1.162	
6	The application of Knowledge forms formally part of my sections Mission statement	C2	10%	0%	24%	48%	19%	21	3.67	1.111	
7	The application of Knowledge forms formally part of my sections strategy to add business value	C3	10%	0%	24%	33%	33%	21	3.81	1.209	
8	My section focuses on using our specialist knowledge to increase profits for the company	C3	0%	0%	18%	50%	32%	22	4.14	.710	
9	Knowledge is actively used as a critical enabler to ensure sustainable competitiveness in our organisation	C4	0%	5%	10%	52%	33%	21	4.14	.793	
10	A competency and skills matrix is available to all team members	C4	15%	15%	15%	40%	15%	20	3.18	1.296	
11	Intellectual capital or know-how is seen as a critical enabler for sustainable competitive advantage	C4	0%	10%	10%	43%	38%	21	4.10	.944	
12	The know-how is seen as equally or more important than other resources such as machines or materials	C4	0%	10%	19%	57%	14%	21	3.76	.831	
13	Communication in our plant is effective	C5	5%	5%	14%	68%	9%	22	3.73	.883	
14	Knowledge is shared freely within my section	C5	0%	5%	18%	55%	23%	22	3.95	.785	
16	The communication from senior management in ArcelorMittal is effective	C5	5%	5%	14%	55%	23%	22	3.14	1.246	
17	The communication within my section is effective	C5	5%	5%	5%	57%	29%	21	3.86	.990	
18	I feel comfortable to share knowledge with my colleagues in my section	C5	0%	0%	5%	14%	81%	21	4.00	1.000	
15	Language differences have a significant impact on the effectiveness of communication (Low score is good)	C6	14%	18%	18%	41%	9%	22	4.73	.550	
19	I feel that I must not share knowledge to secure my job (Low score is good)	C6	73%	18%	5%	0%	5%	22	1.45	.963	
20	I feel that in general management acts fairly	C6	5%	9%	18%	50%	18%	22	3.68	1.041	
21	I feel that the knowledgeable members in our team tend to share information freely	C6	0%	9%	23%	59%	9%	22	3.68	.780	
22	I receive inputs from knowledgeable employees frequently to improve my effectiveness	C6	9%	5%	9%	64%	14%	22	3.68	1.086	
23	I understand the rational behind most of the decisions which are made in my section	C6	0%	9%	18%	68%	5%	22	3.68	.716	
24	In my section one can make mistakes as long as you learn from your mistakes	C6	0%	9%	22%	65%	4%	23	3.64	.727	
25	In our section we follow a participative decision making approach	C6	5%	5%	36%	36%	18%	22	3.59	1.008	
26	I feel that in the past 12 months I have learned a lot	C7	0%	5%	0%	64%	32%	22	4.23	.685	
27	I feel that there is sufficient learning opportunities in my section	C7	5%	0%	14%	64%	18%	22	3.91	.868	
28	I have learned more from interacting with my work colleagues than from theory on how to operate our process effectively	C7	0%	0%	36%	45%	18%	22	3.82	.733	
29	I was involved in different projects other than my usual day to day work and I learned	C7	0%	18%	9%	59%	14%	22	3.68	.945	
30	Multi-skilling is successfully driven in my section	C7	0%	5%	36%	45%	14%	22	3.68	.780	
31	My supervisor have coached me regarding a specific task or project the past 6 months	C7	0%	18%	32%	41%	9%	22	3.41	.908	
32	There are sufficient number of delivery points of learning (ArcelorMittal University, Web, CD's etc)	C7	9%	5%	23%	45%	18%	22	3.59	1.141	
33	We are encouraged by management to learn continuously	C7	5%	9%	5%	36%	45%	22	4.09	1.151	
34	We are making use of videos or DVD's in order to capture training and on the job footage presented by key experienced employees	C7	14%	27%	32%	27%	0%	22	2.73	1.032	
35	We have implemented a mentorship programme in order to facilitate practical knowledge exchange	C7	5%	27%	36%	27%	5%	22	3.00	.976	
36	The performance management system includes a part where I am measured in terms of the time and effort spent to transfer knowledge	C8	5%	35%	20%	40%	0%	20	2.95	.999	
37	We measure the number of knowledge pieces or articles published per employee	C8	19%	62%	5%	10%	5%	21	2.19	1.030	
38	Our department have identified the knowledge that is critical for the department or organisations future success	C9	5%	9%	18%	59%	9%	22	3.59	.959	
39	Knowledge Management is the responsibility of every section (not the responsibility of IM or IT)	C9	0%	10%	14%	67%	10%	21	3.76	.768	
40	High employee turn-over does effect our plants production performance or customer service (Low score is good)	C10	0%	20%	10%	25%	45%	20	3.95	1.191	
41	Information that was captured in files of your predecessors are used daily	C11	0%	29%	24%	38%	10%	21	3.29	1.007	
42	Our organisation is capturing the crucial knowledge that resides in the minds of our employees	C11	0%	24%	38%	38%	0%	21	3.14	.793	
43	The learning's and recommendations of Benchmarking exercises are shared within our organisation	C11	9%	14%	9%	55%	14%	22	3.50	1.185	
44	Formal structured technical knowledge exchange forums are being used in order to foster knowledge transfer	C12	0%	5%	18%	59%	18%	22	3.91	.750	
45	Our organisation have enough coaches and mentors to train up engineers, technicians and specialists in order to foster knowledge transfer	C12	19%	14%	29%	33%	5%	21	2.90	1.221	
46	A formal system is in place in order for a person to shadow another person in his or her last month or two notice period to transfer know-how	C13	23%	14%	55%	9%	0%	22	2.50	.964	
47	Job rotation is practiced to enable knowledge transfer between departments	C13	23%	36%	18%	23%	0%	22	2.41	1.098	
48	Succession Planning forms part of our knowledge management process	C13	14%	14%	36%	32%	5%	22	3.00	1.113	
49	The condition of employment forces me to codify my tacit knowledge and key learning's before I leave the department or organisation	C13	23%	32%	32%	14%	0%	22	2.36	1.002	
50	We have a department that is dedicated to manage knowledge within the organisation	C13	23%	41%	23%	9%	5%	22	2.32	1.086	
51	Our organisation structure allows for enough resources in order to transfer knowledge to the succession candidate	C13	9%	23%	27%	41%	0%	22	3.00	1.024	

		Newcastle							
			1	2	3	4	5		
									
Statements		Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly agree	Total	Average Score Question	Std Div
1	Information is available when needed and can be trusted to make decisions	C1	3%	15%	10%	63%	8%	59	3.57 .963
2	The information systems support the business processes in my responsible business area	C1	3%	12%	13%	60%	12%	60	3.65 .954
3	Our Information systems allows easy access to information that can be used in decision making	C1	3%	18%	30%	42%	7%	60	3.33 .968
4	Our organisation Document Management system on the Portal is assisting in the transfer of knowledge	C1	3%	13%	38%	42%	3%	60	3.32 .776
5	We know where to store our intellectual information or lessons learned in order for colleagues to gain access to it in order to make business decisions or resolve problems	C1	10%	27%	22%	38%	3%	60	3.05 1.080
6	The application of Knowledge forms formally part of my sections Mission statement	C2	5%	22%	32%	38%	3%	60	3.18 .930
7	The application of Knowledge forms formally part of my sections strategy to add business value	C2	3%	22%	23%	45%	7%	60	3.35 .954
8	My section focuses on using our specialist knowledge to increase profits for the company	C3	2%	17%	15%	45%	22%	60	3.68 1.049
9	Knowledge is actively used as a critical enabler to ensure sustainable competitiveness in our organisation	C3	0%	17%	17%	57%	10%	60	3.67 .877
10	A competency and skills matrix is available to all team members	C4	21%	26%	17%	32%	4%	53	2.74 1.195
11	Intellectual capital or know-how is seen as a critical enabler for sustainable competitive advantage	C4	2%	30%	17%	35%	17%	60	3.47 1.112
12	The know-how is seen as equally or more important than other resources such as machines or materials	C4	10%	32%	15%	32%	10%	59	3.12 1.261
13	Communication in our plant is effective	C5	3%	23%	28%	40%	5%	60	3.30 .944
14	Knowledge is shared freely within my section	C5	2%	8%	22%	54%	14%	59	3.65 .899
16	The communication from senior management in ArcelorMittal is effective	C5	8%	27%	30%	33%	2%	60	3.25 1.216
17	The communication within my section is effective	C5	2%	12%	23%	53%	10%	60	3.03 1.025
18	I feel comfortable to share knowledge with my colleagues in my section	C5	0%	0%	0%	61%	39%	59	3.68 .792
15	Language differences have a significant impact on the effectiveness of communication (Lower score is good)	C5	5%	35%	10%	33%	17%	60	4.43 .500
19	I feel that I must not share knowledge to secure my job (Low score is good)	C6	64%	29%	3%	3%	0%	59	1.48 .792
20	I feel that in general management acts fairly	C6	12%	23%	25%	35%	5%	60	3.10 1.100
21	I feel that the knowledgeable members in our team tend to share information freely	C6	3%	7%	29%	49%	12%	59	3.58 .907
22	I receive inputs from knowledgeable employees frequently to improve my effectiveness	C6	5%	8%	24%	49%	14%	59	3.47 1.049
23	I understand the rationale behind most of the decisions which are made in my section	C6	5%	12%	17%	63%	3%	60	3.52 .930
24	In my section one can make mistakes as long as you learn from your mistakes	C6	3%	13%	27%	57%	0%	60	3.45 .852
25	In our section we follow a participative decision making approach	C6	3%	12%	13%	68%	3%	60	3.60 .848
26	I feel that in the past 12 months I have learned a lot	C7	0%	15%	22%	45%	18%	60	3.75 .895
27	I feel that there is sufficient learning opportunities in my section	C7	5%	8%	17%	53%	17%	60	3.73 1.023
28	I have learned more from interacting with my work colleagues than from theory on how to operate our process effectively	C7	2%	7%	17%	65%	10%	60	3.77 .789
29	I was involved in different projects other than my usual day to day work and I learned	C7	3%	8%	13%	57%	18%	60	3.82 .930
30	Multi-skilling is successfully driven in my section	C7	7%	17%	31%	34%	12%	59	3.36 1.126
31	My supervisor have coached me regarding a specific task or project the past 6 months	C7	12%	22%	37%	20%	8%	59	2.92 1.046
32	There are sufficient number of delivery points of learning (ArcelorMittal University, Web, CD's etc)	C7	5%	23%	30%	33%	8%	60	3.18 1.066
33	We are encouraged by management to learn continuously	C7	7%	28%	18%	42%	5%	60	3.18 1.081
34	We are making use of videos or DVD's in order to capture training and on the job footage presented by key experienced employees	C7	32%	46%	15%	7%	0%	59	2.07 .926
35	We have implemented a mentorship programme in order to facilitate practical knowledge exchange	C7	14%	31%	29%	21%	5%	58	2.53 .977
36	The performance management system includes a part where I am measured in terms of the time and effort spent to transfer knowledge	C8	20%	32%	17%	30%	2%	60	2.65 1.132
37	We measure the number of knowledge pieces or articles published per employee	C8	47%	29%	16%	7%	2%	58	1.97 1.025
38	Our department have identified the knowledge that is critical for the department or organisations future success	C9	2%	17%	32%	42%	7%	59	3.42 .855
39	Knowledge Management is the responsibility of every section (not the responsibility of IM or IT)	C9	0%	3%	5%	69%	22%	59	4.14 .629
40	High employee turn-over does effect our plants production performance or customer service (Lower score is good)	C10	2%	5%	3%	33%	57%	58	4.07 1.015
41	Old Information that was captured in files of your predecessors are gathering dust and eventually thrown away	C11	22%	37%	22%	17%	2%	59	2.42 1.070
42	Our organisation is capturing the crucial knowledge that resides in the minds of our employees	C11	20%	36%	27%	17%	0%	59	2.41 1.036
43	The learning's and recommendations of Benchmarking exercises are shared within our organisation	C11	10%	31%	25%	27%	7%	59	2.97 1.098
44	Formal structured technical knowledge exchange forums are being used in order to foster knowledge transfer	C12	26%	28%	26%	16%	4%	57	2.44 1.165
45	Our organisation have enough coaches and mentors to train up engineers, technicians and specialists in order to foster knowledge transfer	C12	48%	28%	12%	9%	3%	58	1.97 1.144
46	A formal system is in place in order for a person to shadow another person in his or her last month or two notice period to transfer know-how	C13	51%	25%	17%	5%	2%	59	1.93 1.081
47	Job rotation is practiced to enable knowledge transfer between departments	C13	38%	27%	22%	12%	2%	60	2.18 1.097
48	Succession Planning forms part of our knowledge management process	C13	28%	19%	34%	19%	0%	58	2.53 1.096
49	The condition of employment forces me to codify my tacit knowledge and key learning's before I leave the department or organisation	C13	29%	21%	36%	12%	2%	58	2.45 1.046
50	We have a department that is dedicated to manage knowledge within the organisation	C13	26%	30%	11%	33%	0%	57	2.45 1.111
51	Our organisation structure allows for enough resources in order to transfer knowledge to the succession candidate	C13	47%	28%	14%	9%	2%	57	1.88 1.061

		Saldanha							
		1	2	3	4	5			
									
1	Statements	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly agree	Total	Average Score Question	Std Div
	Information is available when needed and can be trusted to make decisions	C1	4%	13%	11%	69%	2%	45	3.64 .883
2	The information systems support the business processes in my responsible business area	C1	4%	9%	13%	56%	18%	45	3.73 1.009
3	Our Information systems allows easy access to information that can be used in decision making	C1	5%	14%	18%	57%	7%	44	3.62 .834
4	Our organisation Document Management system on the Portal is assisting in the transfer of knowledge	C1	0%	24%	31%	40%	4%	45	3.22 .902
5	We know where to store our intellectual information or lessons learned in order for colleagues to gain access to it in order to make business decisions or resolve problems	C1	11%	24%	20%	40%	4%	45	2.96 1.127
6	The application of Knowledge forms formally part of my sections Mission statement	C2	5%	32%	36%	27%	0%	44	2.86 .878
7	The application of Knowledge forms formally part of my sections strategy to add business value	C2	4%	22%	33%	40%	0%	45	3.07 .889
8	My section focuses on using our specialist knowledge to increase profits for the company	C3	0%	7%	16%	65%	12%	43	3.91 .910
9	Knowledge is actively used as a critical enabler to ensure sustainable competitiveness in our organisation	C3	0%	18%	31%	44%	7%	45	3.44 .918
10	A competency and skills matrix is available to all team members	C4	13%	29%	13%	33%	11%	45	2.91 1.291
11	Intellectual capital or know-how is seen as a critical enabler for sustainable competitive advantage	C4	5%	25%	11%	48%	11%	44	3.34 1.160
12	The know-how is seen as equally or more important than other resources such as machines or materials	C4	7%	36%	14%	36%	7%	44	3.02 1.171
13	Communication in our plant is effective	C5	5%	20%	30%	45%	0%	44	3.20 .954
14	Knowledge is shared freely within my section	C5	2%	7%	18%	56%	18%	45	3.89 .982
16	The communication from senior management in ArcelorMittal is effective	C5	13%	13%	18%	56%	0%	45	2.73 1.246
17	The communication within my section is effective	C5	0%	20%	11%	64%	4%	45	3.18 1.114
18	I feel comfortable to share knowledge with my colleagues in my section	C5	0%	2%	2%	47%	49%	45	3.53 .894
15	Language differences have a significant impact on the effectiveness of communication (Lower score is good)	C6	14%	45%	14%	20%	7%	44	4.38 .684
19	I feel that I must not share knowledge to secure my job (Low score is good)	C6	60%	33%	2%	4%	0%	45	1.47 .661
20	I feel that in general management acts fairly	C6	7%	7%	20%	67%	0%	45	3.42 .917
21	I feel that the knowledgeable members in our team tend to share information freely	C6	2%	9%	13%	62%	13%	45	3.87 .919
22	I receive inputs from knowledgeable employees frequently to improve my effectiveness	C6	7%	11%	16%	58%	9%	45	3.71 .920
23	I understand the rational behind most of the decisions which are made in my section	C6	4%	7%	18%	60%	11%	45	3.69 .925
24	In my section one can make mistakes as long as you learn from your mistakes	C6	9%	4%	29%	49%	9%	45	3.42 1.033
25	In our section we follow a participative decision making approach	C6	9%	16%	13%	58%	4%	45	3.36 1.090
26	I feel that in the past 12 months I have learned a lot	C7	7%	4%	7%	62%	20%	45	3.78 1.064
27	I feel that there is sufficient learning opportunities in my section	C7	4%	11%	11%	56%	18%	45	3.69 1.062
28	I have learned more from interacting with my work colleagues than from theory on how to operate our process effectively	C7	4%	7%	20%	53%	16%	45	3.67 .977
29	I was involved in different projects other than my usual day to day work and I learned	C7	4%	7%	18%	62%	9%	45	3.67 .929
30	Multi-skilling is successfully driven in my section	C7	4%	20%	20%	51%	4%	45	3.27 .986
31	My supervisor have coached me regarding a specific task or project the past 6 months	C7	20%	27%	24%	27%	2%	45	2.76 1.264
32	There are sufficient number of delivery points of learning (ArcelorMittal University, Web, CD's etc)	C7	0%	27%	18%	53%	2%	45	3.36 .908
33	We are encouraged by management to learn continuously	C7	7%	13%	20%	56%	4%	45	3.33 1.066
34	We are making use of videos or DVD's in order to capture training and on the job footage presented by key experienced employees	C7	16%	51%	12%	21%	0%	43	2.33 1.017
35	We have implemented a mentorship programme in order to facilitate practical knowledge exchange	C7	11%	43%	30%	16%	0%	44	2.62 1.093
36	The performance management system includes a part where I am measured in terms of the time and effort spent to transfer knowledge	C8	14%	36%	25%	25%	0%	44	2.57 1.043
37	We measure the number of knowledge pieces or articles published per employee	C8	42%	40%	16%	2%	0%	43	1.74 .819
38	Our department have identified the knowledge that is critical for the department or organisations future success	C9	2%	29%	27%	42%	0%	45	3.11 .935
39	Knowledge Management is the responsibility of every section (not the responsibility of IM or IT)	C9	0%	0%	2%	69%	29%	45	4.27 .495
40	High employee turn-over does effect our plants production performance or customer service (Not included)	C10	4%	4%	4%	33%	53%	45	4.22 1.106
41	Information that was captured in files of your predecessors are used daily	C11	9%	50%	16%	25%	0%	44	2.57 .974
42	Our organisation is capturing the crucial knowledge that resides in the minds of our employees	C11	18%	41%	23%	16%	2%	44	2.48 1.067
43	The learning's and recommendations of Benchmarking exercises are shared within our organisation	C11	5%	26%	38%	31%	0%	42	3.02 .913
44	Formal structured technical knowledge exchange forums are being used in order to foster knowledge transfer	C12	16%	39%	27%	18%	0%	44	2.52 1.023
45	Our organisation have enough coaches and mentors to train up engineers, technicians and specialists in order to foster knowledge transfer	C12	29%	38%	20%	11%	2%	45	2.24 1.090
46	A formal system is in place in order for a person to shadow another person in his or her last month or two notice period to transfer know-how	C13	36%	33%	20%	11%	0%	45	2.04 1.043
47	Job rotation is practiced to enable knowledge transfer between departments	C13	22%	38%	27%	11%	2%	45	2.36 1.048
48	Succession Planning forms part of our knowledge management process	C13	14%	45%	17%	21%	2%	42	2.70 1.059
49	The condition of employment forces me to codify my tacit knowledge and key learning's before I leave the department or organisation	C13	14%	42%	40%	2%	2%	43	2.35 .897
50	We have a department that is dedicated to manage knowledge within the organisation	C13	25%	32%	27%	16%	0%	44	2.53 1.202
51	Our organisation structure allows for enough resources in order to transfer knowledge to the succession candidate	C13	38%	40%	16%	7%	0%	45	2.13 1.036