Technology and people: an analysis of the forest workforce, technology and the sourcing decision in forest harvesting in South Africa.

By

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Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and I have not entirely or in part submitted it to any university for a degree qualification.

Killian Tendai Manyuchi Date

At:

Abstract

Manyuchi K.T., 2002. The Technology and People: an analysis of the forest workforce, technology and the sourcing decision in forest harvesting in South Africa. M.Sc. Forestry thesis, University of Stellenbosch, South Africa. 124pp.

This thesis looks at the profiles of the workforce in forest harvesting in the forestry industry in South Africa. It provides methods and models to measure and understand people (human capital) and technology. It highlights some of the current and strategic challenges in: employee conditions of employment; occupational health and safety; worker nutrition; training; worker dynamics (employee absenteeism and labour turnover); and the technology in forest harvesting.

This study puts additional emphasis towards measuring and understanding the grower company/contractor interface (i.e., the contractoring philosophy, contractor profiles and competitive strategies) and discusses the contracting decision by the grower companies. The latter, the contracting decision is important because it forms the foundation and framework upon which forest harvesting contractor businesses are built and the background for both the people and technology dynamics.

Forest harvesting employees in South Africa are working in forestry because they cannot get other jobs elsewhere. They have the following profiles and mobility characteristics: median age, 34 years; median completed school level, Standard 3; median time spent working for forest contractors and grower companies, 2 and 7 years, respectively (contractors have been in the business for a median period of 7.5 years); and median labour turnover and absenteeism, 4 % and 6 %, respectively. The employee median daily wage is R24.00 and the budgeted employee training cost per year per employee is R41.40. There is a high level of occupational safety awareness amongst both the contractors and the employees and significantly high injury rates in forest harvesting. Contractors and staff from grower companies believe that the current and future forest harvesting technology depends on the type and nature of contracts between the grower companies and the harvesting contractors, backup services from machine suppliers, the exchange rates between the Rand and other major currencies and worker health linked to HIV/AIDS.

The study shows that in forest harvesting, there is a need to develop approaches and business strategies to define and manage the workforce since it is the people and the technology that work together to generate results. The thesis concludes that, human skill and knowledge should form the base of an industry along with logic of systems or operations. The study challenges forest harvesting organisations to measure and integrate human capital and technology with business objectives. Thus, sustainability in forest harvesting in South Africa will depend on the ability of forest harvesting organisations to handle the human dimension and to develop/acquire, exploit and manage technology.

Keywords

Absenteeism, contracting, workforce, forest harvesting, human capital, labour dynamics, labour turnover, occupational health and safety, partnerships, sourcing decision, sustainability, technology colony, technology management, technology forecasting, training, worker nutrition and worker profiles.

Opsomming

Manyuchi K.T., 2002. Tegnologie en die Mens: 'n Ontleding van technnology, die dinamika van uitkontrakteer en bosontginnings arbeid in Suid Afrika. M.Sc in Bosbou tesis, Universiteit van Stellenbosch, Suid Afrika. 124 bl.

Tegnologie en die mensepotensiaal is van uiters belang in alle industrieë. Technologie moet toepasbaar wees en die mens moet van 'n geskikte gehalte wees met 'n paslike profiel. Hierdie proefskif focus op die tegnologie en die menslikehulpbron in bosontginning en evalueer Suid Afrikaanse Bosbou maatskappye se besluit om uit te kontrakteer. Dit bied metodes en modele aan om die menslikepotensiaal en tegnologie te evalueer en te verstaan. Die klem word geplaas op huidige en strategiese uitdagings in: diensvoorwaardes, beroepsgesondheid en –veiligheid, voiding, opleiding, arbeidersdinamika (arbeidsafwesigheid en -omset) en tegnologie in bosontginning.

Hierdie studie plaas verdere klem op die ondersoek en begrip van die interaksie tussen bosbou maatskappy en kontrakteur (b.v. kontrakteur's filosofie, profiel van kontrakteurs en mededingende strategie) en om die bosbou maatskappye se besluit, om oor te skakel na kontrakteurs, te evalueer. Laasgenoemde, is van uiter belang, aangesien dit die fondament en raamwerk daarstel waarom die kontrakteurs se besigheid ontwikkel en dit gee agtergrond tot die dinamika van beide die mens en die tegnologie.

Die grootste gedeelte van die arbeid in diens van die Suid Afrikaanse bosbou industrie het daarop gewys dat hulle slegs in die industrie werk omdat daar nie ander werksgeleenthede beskikbaar is nie. Kenmerke aspekte van die arbeidersmag in die Suid Afrika se bosbou industrie is die volgende: middellyn vir ouderdom - 34 jaar; middellyn vir skool qualifikasies - standard 3; middellyn vir dienstydperk by bosbou kontrakteurs - 2 jaar, en by bosboumaatskappy - 7 jaar (middellyn vir tydperk as kontakteur - 7.5 jaar); arbeidsomset en -afweesigheidis 4 % en 6 %, onderskeidelik. Daaglikse arbeidsloon is R24.00 en die begrotte opleidingskoste is R41.40 per arbeider per jaar. Beroepsveiligheid geniet 'n hoë vlak van bewustheid by beide die kontrakteurs en arbeiders. Kontrakteurs en maatskappy bestuurders glo dat die huidige en toekomstige tegnologiese ontwikkeling afhanklik is van die aard van

kontrakte, ondersteuning en diens van verskaffers, die wisselkoers en arbeiders se gesondheid (gekoppel aan HIV/VIGS).

Aangesien die mens en tegnologie gesamentlik bydra tot werksproduksie, bestaan daar 'n behoefde in bosonginning vir die ontwikkeling van naderings en besigheids strategieë om die bestuur van mense en tegnologie te defineer. Die werkstuk beslis dat die menslike kennis en vermoeë, saam met logika van stelsels of activiteite, die fondament van die industie daarstel. Bosontginnings maatskappye word aangespoor om die gebruik van tegnologie te ondersoek, en die menslike hulpbron en tegnologie te meet en met die maatskappy se doelstelling te integreer. Ten slotte, die standhoudenheid van bosonginning in Suid Afrika sal afhang van die vermoeë van bosontginnings maaskappye om die menslike dimensie korrek te kan bestuur en om tegnologie effektief te ontwikkel (of aan te koop), te gebruik en te bestuur.

Sleutelwoorde

Afweesigheid, uitkontrakteer, kompeterende voordeel, bosontginning, menslike hulpbron, arbeids dinamiek, arbeidsomset, beroepsgesondheid en -veiligheid, vernootskappe, uitkontrakteer besluit, standhoudendheid, tegnologie kolonie, tegnologie bestuur, tegnologiese vooruitskatting, opleiding, arbeidersvoeding and werkers profiel.

Acknowledgement

I would like to thank my colleagues who assisted in this research project. Of special note here are Reino Pulkki (my study leader), Erik Grobbelaar and Pierre Ackerman. Secondly, many thanks go to Mondi Forests and the University of Stellenbosch for the financial assistance for the fieldwork. Mondi Forests, Sappi, Safcol, Contractors and Forest Workers who willingly participated in the study many thanks. Andrew Crickmay (of Crickmay and Erasmus) and Mike Edwards (of Forestry South Africa, -FSA) thank you for providing additional guidance and information that was required to complete this study. Roy Engelbrecht thank you for translating my abstract into Afrikaans and for the support and additional guidance.

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1 Introduction

Over the centuries, a number of civilizations have developed (e.g., the civilization of Iraq, Egypt -along the Nile, India, China, Central America and Peru). These are expressed in the form of cities, writing, temples, monumental art, ceremonial buildings and production (de Wet, 2000b). Ancient man also practised hunting, gathering and gave precedence to pastoralism, agricultural production and industrialisation. All these livelihood strategies still exist throughout the world in one form or the other. They all have in common centralised power, law, military force, hierarchies and class divisions, but above all, they involve PEOPLE and TECHNOLOGY.

This thesis measures and analyses the profiles of the workforce and technology in forest harvesting in the forestry industry in South Africa. The hypothesis is; technology will not work without people: i.e., it is the people and the technology that work together to generate results. Therefore, in forest harvesting, there is need to develop an approach and business strategies to define and manage the two. In addition, human skill and knowledge should form the base of an industry along with logic of systems or operations. Thus, the competitiveness of an industry is based on the ability to handle the human dimension.

1.1 Background information and the need for the study

Internationally, there is general agreement that the following technical, social and economic driving forces will influence future forest harvesting operations: workers (their needs and their profiles), technological innovations, the delivered cost of wood to the mill (supply-chain costs), socio-political challenges (public pressures and government involvement), market demand for fibre/wood products, availability and utilisation of timber resources, environmental issues, globalisation of economies, and the development of information and communication technologies (FERIC, 1996; Guimier, 1999; Kellogg, 2000). In addition, the need to be sustainable and the need to involve workers, government(s), researchers and market dynamics, provide motivation for the industry to be innovative. According to Riddle (1995), the following changes have already been reported in forest harvesting operations: log merchandising decisions have been given to computers/machines as the cost of a poor decision increases with

increasing log value; there is increased popularity in the use of contractors and machines; and there is increased focus on human factors (i.e., occupational health and safety (OHS), training and worker dynamics) and certification.

Recently, in South Africa, there have been many social-economic and political changes. Amongst them are:

(a) The democratic changes in the country - in the past, the forestry industry just like any other industry had the shortcoming of seeing forest workers as *cheap labourers*. This phenomenon brought little discontent to the management of the industry. Hence, issues like absenteeism and labour turnover have only been researched for information for defence against labour movements. This has had a direct influence on industrial relations, training, involvement of workers in decision-making and organisation structures where normally Blacks are manual workers and Whites are in managerial positions.
(b) Policies and legislation - the industry has been recently spate with a host of new legislation and policies amongst them the National Forestry Action Programme (NFAP, 1997), the Veld and Forest Fires Act of 1998, the Industrial Relations Act of 1997, the Basic Conditions of Employment Act of 1997, the Employment Equity Act of 1996, the Occupational Health and Safety Act of 1993 (OHS Act of 1993), and the Skills Development Act of 1997.
(c) The keen interest by Forest Engineering Southern Africa (FESA) to improve forest engineering practices in Southern Africa and to develop strategic plans.
(d) The changes in forestry company landholding patterns; caused by the redeployment of state forest assets and the privatisation of the South African Forestry Company Limited (Safcol) by the government and joint land ownership between private grower companies and certain rural communities.
(e) The outsourcing of certain operations in the forest value chain to contractors by most grower companies.

A look at the past in forest harvesting gives an understanding of the current situation in the country. Forest harvesting in South Africa was not managed along sustainability principals. It was based on a relatively dense forest road network, labour intensive operations, few environmental restrictions and animal power. Recent developments in

clonal forestry, human factors, environmental concerns, outsourcing of operations by grower companies and a decline in new afforestation land challenges forestry organisations to evaluate and realign their business strategies. To achieve this, scientific information and analysis are important hence, this research project.

A holistic approach to the background information and the justification for such a study given above are important in order to understand some trends and patterns that will be highlighted in this thesis. This study also puts additional emphasis on measuring and understanding the contractoring philosophy, contractor profiles and competitive strategies as background information.

1.2 Research Objectives

The objectives of this study are to:

(a) analyse the contractors/grower company interface. This objective will be achieved by establishing the contracting philosophy, analysing contractor dynamics (i.e., competitive strategies, technology focus and condition of employment) and establishing the contractor profiles in forest harvesting.

(b) find a systematic way of measuring and analysing the workforce in an outsourced business environment.

(c) set a framework for measuring and understanding labour dynamics in a industry and test it in forest harvesting. Having established the extent of these dynamics e.g., absenteeism and labour turnover, it is important to understand the cost implications to the industry, the profiles of employees and job categories involved in such patterns and how these problems can be mitigated. In addition, the study will establish how contractors recruit forest workers and the selection criteria they use, and the reasons why workers join the forest industry.

(d) evaluate the levels of training in forest harvesting by measuring the academic qualifications of forest harvesting employees, the skills levels amongst the employees and the training infrastructure in the industry.

(e) present a systematic methodology for analysing OHS.

(f) evaluate the practices and understanding of workers and harvesting contractors of OHS. The objective will be achieved by answering some of the following questions:

- what are the frequencies of injuries in forest harvesting?
- how much do injuries cost forest harvesting and how does the cost compare to other industries?
- what are the practices for using and issuing personal protective equipment (PPE)?

(g) review and determine the level of technological advancement in forest harvesting and the life cycle position of the technologies on which the industry is dependent.

(h) determine the factors influencing the current and future forest harvesting technology in contractor businesses.

(i) evaluate the option of mechanising contractor forest harvesting operations.

Refer to Figure 1 showing the research project framework. The framework is a schematic presentation of all the elements (i.e., contractors, people, technology and the grower companies) that will be analysed in the study and how they link and relate to each other. The criteria (shown in the outlook box) will aid in systematically answering the following questions relating to workforce and technology in forest harvesting:

- What is the status quo?
- What are the links and trends between them?
- Where are the gaps in the people/technology interface?
- What are the probable future scenarios on technology and the workforce?
- How do you manage technology and people in the immediate, short and long term?

In attempting to answer these questions, it becomes clearer that forest harvesting has to develop foresight and competitive intelligence. This will eliminate surprises, or lessen their impact by offering a platform for responding.

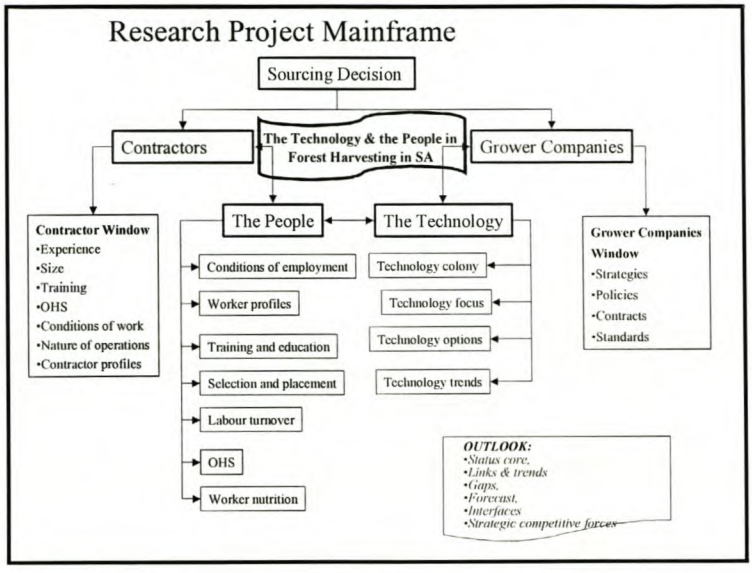

Figure 1: A research project framework developed and adopted in this study.

1.3 Definitions

a). Sourcing decision: In this study, the sourcing decision is defined as the business decision taken by grower companies whether to outsource some of their operations in the value chain to contractors or to execute them in-house. The link between contractors and grower companies is referred to as the contractor/grower company interface.

b) Exchange rate: at the time of the survey, one South African Rand was equivalent to eight American dollars. This exchange rate should be used to calculate the dollar equivalent of the Rand if desired.

c) Population groups: In this study, the word population groups will be used to describe what is often referred to as race groups; the definition for Blacks includes Africans, Coloureds and Indians; Whites include those of mainly European origin; and ethnic groupings will be used to further distinguish the Africans. The constitution of South African does not make clear distinctions on population groups. In fact, both skin colour and one's place of origin are interchangeably used. There are complex debates on these issues (Zulu, 2002)[1] and this study will adopt the definitions given above.

[1] *Pres comm.* Prof. Zulu, Department of Political Science, University of Stellenbosch.

2 Literature Review

The literature review consist of three sections. The first section is about the literature around the sourcing decision and contracting, followed by literature on the workforce situation in forest harvesting and lastly the technology in forest harvesting.

2.1 The sourcing decision and the grower companies/contractor interface

In this section, a philosophical background of outsourcing is presented. This is important in determining the sustainability of contractor businesses, the partnering relationship (between grower companies and contactors) and identifying competitive priorities that have a bearing on the dynamics of forest workers and the technology.

The following strategic competitive forces are important to forest harvesting in South Africa when looking at the grower company/contractor interface: business processes (i.e., business integration, economies of scale and bargaining leverage); capital; market forces (i.e., access to distribution and backup, relative costs and performance of substitutes, and competition); and work object variables (volume, quality and time). An overview of the grower companies and the contractors helps to give an insight into their competitive priorities.

2.1.1 Grower companies and the sourcing decision

The main reason for outsourcing operations in any value chain is to concentrate on core-business (Johnson, 1997; McIvor, 2000). However, according to Jenning (1997), outsourcing has moved from activities regarded as peripheral to the organisation, to critical activities. Almost the entire supply-chain is open to the use of outside service providers.

The sourcing decision has strategic implications for forest harvesting. A framework for the sourcing decision and strategic partnering process is shown in Figure 2. It consists of steps, motivators and outcomes that form the basis on which the sourcing decision has to be taken and partnering relationships between the contractor and grower company has to be managed.

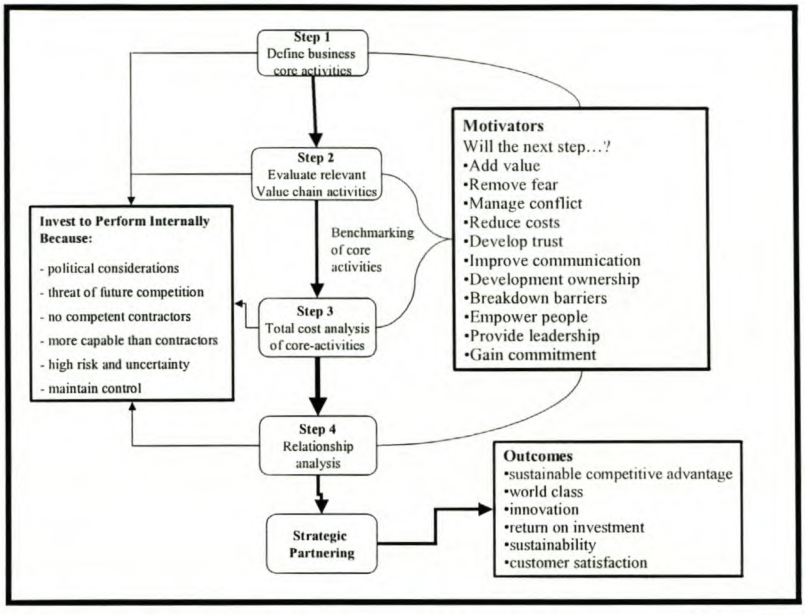

Figure 2: A framework for evaluating the sourcing decision, strategic partnering and managing relationships between contractors and grower companies (McIvor, 2000; Lendrum, 1998).

Outsourcing in South African forestry was not a clearly thought-out process. Morkel (2000), confirms this observation: outsourcing in South Africa has been a less purposeful industry approach; it has been a slow process driven by circumstances. Table 1 gives some reasons often cited by companies that adopted outsourcing as a business strategy. However, according to Morkel (2000), the South African forestry industry outsourced its harvesting expertises for the following reasons: to avoid marginal work; to avoid the disparity between workers resulting from company acquisitions and mergers in the mid to late 80's; and because of the reduced production potential of own operations. This contradicts the reasons often cited by forestry organisations: i.e., contractors are cheaper and they are flexible (they can be started, stopped and moved easily); outsourcing is a means of reducing the threat of unions and the impact of strikes; and it is a way to conform to international trends (Crickmay and Erasmus, 2001; Forestry Services & Facilitators, 2000; Khosa, 2000).

Table 1: Reasons often cited by South African and international companies that have adopted outsourcing as a business strategy (Johnson, 1997; Greaver, 1999; McIvor, 2000).

Outsourcing Reasons		**Main reason:** To concentrate on core-business
MAJOR REASONS: Organisationally driven, improvement driven, financially driven, revenue driven, cost driven, employee driven.	**Top-five tactical reasons**	▪ to reduce or control operating costs ▪ to reduce capital requirements ▪ cash injection; plants and equipment are often sold to the contractor resulting in cash injections ▪ to secure resources not available internally ▪ to address operations which are difficult to manage or control
	Top-five strategic reasons	▪ to improve business focus ▪ to access world-class expertise ▪ to accelerate the business re-alignment processes ▪ to share the business risk ▪ to direct resources from non-core operations to operations with higher return on investment.

Internationally, it is evident that most companies will continue restructuring and moving towards open (i.e., with external service providers), lean (i.e., fewer management employees) and flat (i.e., less hierarchical) organisations. Thus, sourcing management should be adopted as a wider business concept not just to educate the contractor (McIvor, 2000). In addition, sourcing management should realise the developing knowledge gap between the grower companies that have outsourced their operations and the contractors (Figure 3). If knowledge is measured in units of technological standing, over time, contractor expertise is bound to increase and surpass grower company's because the contractors work infield (on the ground) and build operational capacity, whereas, the grower companies spend little time infield (except in monitoring) and reduce their in-house capacity.

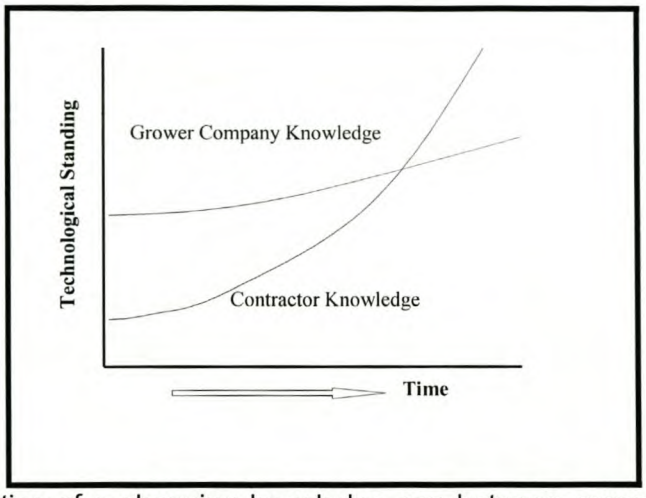

Figure 3: Illustration of a changing knowledge gap between grower companies and contractors over time.

According to McIvor (2000), there is evidence to suggest that some organisations are not achieving the desired results from outsourcing because sourcing decisions are rarely taken from a strategic perspective. Many organisations adopt a short-term perspective (McIvor, 2000): primarily the search for short-term cost reductions motivates them. Often, most outsourcing decisions are made by default, with little consideration of the strategic competitiveness of the organisation.

2.1.2 Contractors

Forestry contracting has become more sophisticated (Klotz, 2000). A partnership between the grower company and the contractor has to be fostered; both the contractor and the grower company have to produce a market driven commodity product, subjected to every possible analysis to reduce the cost. Therefore, it is important to understand the competitive priorities of contractors and their profiles (i.e., their racial composition, annual volume cut, number of employees, forestry contracting experience and types of operations).

2.1.3 Additional important contractor background information

(a) General information

There are about 157 contractors working in the South African forestry industry of which 61 % are harvesting and transporting contractors and 39 % silviculture contractors

(Forestry Services & Facilitators, 2000). According to Khosa (2001), in South Africa most contractors have been in business for over 5 years and about 21 % of them have an annual turnover of less than R1 million, 74 % between R1 – 10 million, and 5 % over R10 million. According to Edwards (2000) and Forestry Services & Facilitators (2000), between 20 000 and 35 000 workers are directly employed by contractors in the industry (Table 2).

Table 2: A general outlook of forestry contractors in South Africa (Brink, 1998; Edwards, 2000; Forestry Services & Facilitators, 2000).

Percent of operations outsourced	**1988**	**1998**
▪ Harvesting	30 %	75 %
▪ Transport	50 %	80 %
▪ Silviculture	25 %	50 %
Current total number of contractors		157
▪ Number of Harvesting and Transport contractors		96
▪ Number of Silviculture contractors		61
Average number of employees per contractor		126
Number of workers employed by contractors		19 782 – 35 000
Annual contractor turnover		R600 million
Regional contractor distribution (% of total number of contractors)		
▪ Mpumalanga & Northern province		56 %
▪ KwaZulu Natal		40 %
▪ Eastern & Southern Cape		4 %

(b) Industry contractor initiatives/programmes

The competitiveness, sustainability and growth of an industry will depend on how it organises itself and mobilises resources (e.g., financial, human capital and marketing structures). The South African forestry industry has initiated and adopted a number of contractor related programmes, summarised in Table 3. These programmes have many objectives and the overlying one is to improve the competitiveness of the industry.

Table 3: A summary of the forestry industry's contractor support related initiatives (programmes) to improve contractor competitiveness (Forestry Services & Facilitators, 2000; FOA, 2000; Crickmay & Erasmus, 2001).

Initiatives	Item	Characteristics
Contractor upliftment programme (CUP)	Objectives	Programme to benchmark contractors against each other and to monitor contractors' performance against identified improvement initiatives.
	Characteristics	Membership: CUP, 60 contractors, Started in 1997
Emerging Contractor Upliftment Programme (e-cup)	Objectives	Programme to support and benchmark (against established contractors) emerging contactors.
	Characteristics	Programme was started in 2001.
Logistics Improvement Initiative (LIP)	Objectives	The programme is mainly targeting the transport haulers in the forestry industry and the grower companies. It aims to monitor and improve their logistics e.g., turn around time and lead distances.
	Characteristics	The programme was started in 2001
Forestry Contractors Productivity Initiative (FCPI)	Objectives	Improve the productivity of contractors. The major thrust areas are: identify constraints and set strategy workshops; and execute skills audits, needs assessments and productivity and quality improvement.
	Characteristics	Membership: 40 contractors Section 21 company, the Department of Trade and industry (DTI) provides 65 % of the funding for the programme and the reminder was provided by the forestry industry.

Initiatives	Item	Characteristics
Forestry Services & Facilitators (FS&F)	Objectives	Service the interest of the contractor
	Characteristics	Membership: 210 contractors FS&F was started in 1989 Function: audit and support member contractors
Contractor forum	Objectives	Discuss issues of mutual interest between the major grower companies and the contractors.
	Characteristics	Composed of representatives of contractors and all the grower companies. Meetings coordinated by an elected chairperson and the secretary are held periodically.

2.2 The workforce situation in forest harvesting: labour dynamics

2.2.1 Understanding intellectual capital

Any level of technological development requires a certain calibre of person, with certain skills and knowledge. People are the forest industry's most valuable asset, however, they are an intangible asset. They take precedence over all other assets in any industry, hence, buzz words like intellectual capital, human capital and human resources (Edvinsson, 1997; Sveiby, 2000).

Edvinsson (1997) and Sveiby (2000) define intellectual capital as the integration of human capital (knowledge, skill and motivation), structural capital (systems to share and transport knowledge) and relationship capital (customer loyalty, brand equity, supplier relations and investor trust). In short, it is the sum of human, structural and relationship capital.

Human capital cannot be owned due to its dynamic nature; it can only be rented. It is the most dynamic asset in any industry and according to Edvinsson (1997), when valuing an industry it is more important to focus on it than any other assets (e.g., land holdings and other physical structures). This stems from the metaphor that it is more important to nurture the roots of a tree than the fruits.

The following approaches are often used to understand human/intellectual capital in industries: human resources accounting; intellectual capital balance sheet; intellectual capital audit; the human focus; and the intangible asset monitor (Edvinsson, 1997; Sveiby, 2000). The human focus and intangible asset monitor will be briefly discussed in this section.

(a) Human Focus: According to Edvinsson (1997) the new knowledge era requires a knowledge economy. The human focus measures human capital using the following criteria: number of employees; employee turnover; employee average age; average years of service with the organisation; number of permanent employees; number of temporary employees; share of employees under the age of 40; motivation index; leadership index; training expense per employee; time in training, (days per year per

employee); number of managers and number of employees per manager; and gender ratio and the empowerment index (measure of how much employees feel they are in control of their work).

(b) The intangible assets monitor (Sveiby, 2000), measures several indicators of growth and renewal, efficiency, and stability. It also evaluates the status of the external and internal structure of an organisation and individual competence (Figure 4).

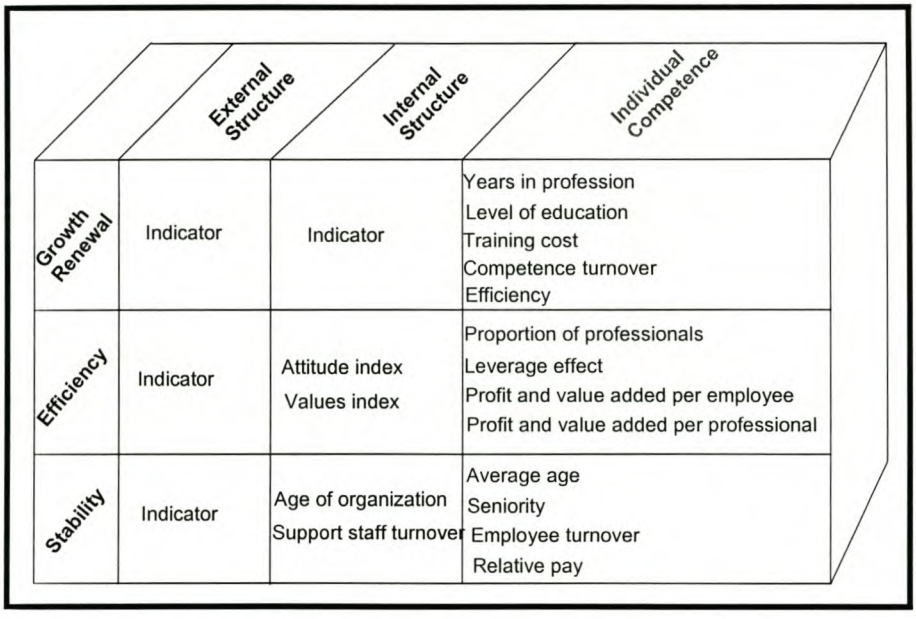

Figure 4: The intangible asset monitor, showing several indicators that can be used to measure human capital in an organisation (Sveiby, 2000).

2.2.2 Labour turnover window

In today's economy, it is difficult to find highly trained employees and to retain them (Bhasin, 2000). One of the biggest obstacles towards achieving this and maintaining well-trained workers is turnover. Turnover is an expensive aspect of labour, therefore, an understanding of its theories, levels, types and reasons is important to forest harvesting. Figure 5 shows the key elements in the labour turnover window. The elements help to diagnose if there is a problem or not in labour turnover, establish the cost and suggest short, medium and long-term management interventions.

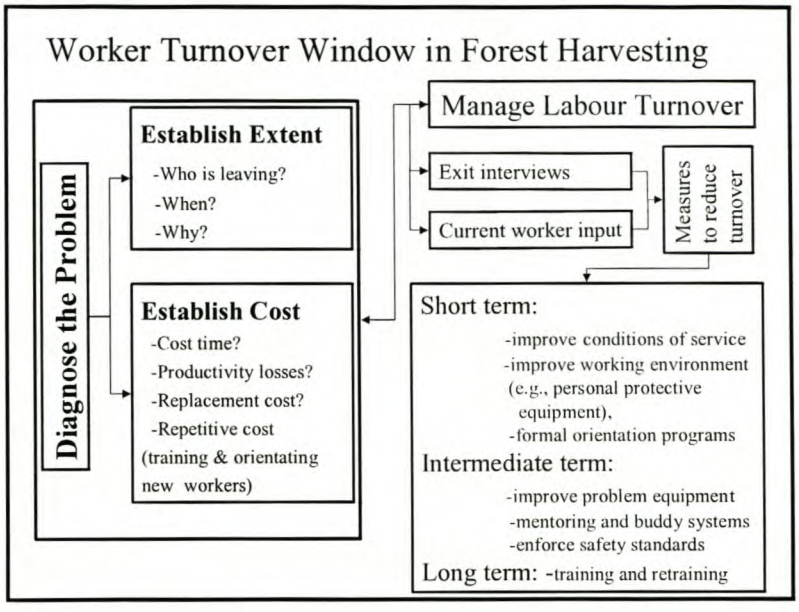

Figure 5: Labour turnover window showing the key elements for diagnosing and managing labour turnover in forest harvesting.

In Canada, as early as 1947, labour turnover had become a matter of financial concern in all woods operations (Hamilton, 1953; Pepler, 1947). Therefore, means and ways of addressing labour turnover had to be developed. Amongst the recommendations then were: the extension and expansion of training programs; engagement of machinery (mechanisation); taking care of the well-being of the worker (conditions of employment); reviewing entry qualifications for forestry work (worker selection); and work incentives (i.e., better accommodation, better meals, recreation and other measures to make forest work attractive).

According to Kirk *et al.* (1997), a high workforce turnover (i.e., when workers move between crews or out of the industry) creates problems for the forest industry, because the skills and benefits of their training are lost. In addition, a high turnover could act as a deterrent to employers in investing in training. Therefore, a high turnover of skilled workers in a industry with few or no formal training opportunities means that workers are put under stress as they have to meet production requirements under uncertain conditions.

According to Smith and Wilson (1983) the tendency to lose experienced workers has obvious ramifications on productivity, cost, ease of employee replacement and staff

morale. In situations of high workforce turnover, new harvesting crew members have to be trained in a production situation. They (new employees) try to progress through their learning curves whilst striving to achieve maximum production as quickly as possible. This is not conducive to quality training, high production, safety and the retention of the workers. It actually worsens the situation, resulting in compromised safety, loss of earnings, increased stress, inconsistent wood-flow and quality and low overall production. According to Kirk *et al.* (1997) the frustrations and stresses associated with learning a new task while meeting production targets frequently results in the workers leaving or returning to less stressful sectors of the industry. This exerts more pressure on the remaining crew members who have to work harder.

It should be born in mind that labour turnover is a complex phenomena. It is affected by a variety of forces internal and external to the industry. Often two types of turnover are mentioned: voluntary and involuntary (Dearden, 1989). The former, is often referred to as "natural turnover"; it includes voluntary resignations (quits) and retirement due to age or bad health and or HIV/AIDS. It is the least predictable due to the limited control the industry has over it. Involuntary termination includes redundancies and dismissals (e.g., dismissal on disciplinary grounds).

The following methods can be used to analyse labour turnover (Dearden, 1989):

- analysis of the industrial relations in an organisation and the individual employee characteristics. The problem with this approach is that it is difficult to test empirically.
- empirical analysis method: the empirical analysis method builds upon the following variables; the labour market conditions (labour supply and demand), relative wage and season models, working conditions, job characteristics and worker characteristics. In the literature, the following conclusions have been reached from data analysed using this model: labour turnover rate is negatively related to wages, unionisation, age of employee, unemployment and organisation size; and positively related to the proportion of the workers who are women and new employee recruitment (Smith and Wilson, 1983; Gaskin, 1988; Dearden, 1989).
- estimate turnover from discharges, redundancies and retirement. Industries will face a higher rate of turnover as labour market conditions deteriorate.

According to Smith and Wilson (1983), most labour turnover measures can be expressed in terms of "leavers" and "stayers". They can be put in the following major categories: volumetric measures (e.g., the rate of labour turnover); length-of-service measures; and cohort measures.

(a) Labour turnover rate: The labour turnover rate is defined as the number of separations in an organisation during a specified period compared to the number of people employed over the some time (i.e., the volume of turnover).

$$LTO = S_i / N_i \times 100 \quad \text{or}$$

$$LTO = (S_i - T_i - Te_i) / N_i \times 100$$

Where;

LTO	=	*labour turnover*
S_i	=	*number of separations during a specified period (i)*
N_i	=	*the average number of people employed during a period (i)*
T_i	=	*is the number of transfers during period (i)*
Te_i	=	*number of people who were employed on a temporary basis leaving the organisation during period (i)*

Transfers are subtracted from S as they are not included as turnover. The discharge and quit rates are examples of other volume measures where the number of discharges and quits simply replaces S in the formula.

The LTO rate has the following shortcomings:

- the rate has no precise meaning thus it gives differing interpretations of organisation effectiveness (Smith and Wilson, 1993). For example, a LTO rate for a employer of 100 % could indicate that the entire workforce has turned over once during the period, half the workers had turned over twice and the other half remained stable, or a quarter had turned over four times.
- the rate does not reflect the influence of other important variables influencing organisational stability (e.g., the length of service). Thus, it gives a misleading picture (Smith and Wilson, 1993). Research has shown that short service employees will have higher turnover rates than long-service employees, therefore, allowance has to be made for this variable in order to gain an impression of the

extent to which the rate of turnover has been influenced by the length of service within an organisation.

(b) Length of services measure: This measure shows where labour turnover is occurring by using the median length of service (MLOS) during the specified time in the length of service continuum (Smith and Wilson, 1993). The MLOS indicates where (by length of service) turnover is occurring. The median is used because of the asymmetrical tendency distribution of quits.

According to Smith and Wilson (1993), the length of service measure has the following disadvantages:

- it can be sensitive to small deviations in data. It is compounded when calculating the median for a small organisation or a small contractor unlike larger organisations with a large number of quits
- it fails to show how much turnover is taking place although it indicates where it occurs by the length of service
- a few long service leavers can skew the median value

(c) Cohort measures: Turnover studies using cohort measures analyse specific sub-populations (cohorts) as they change over time. As an example, all new entrants to an organisation (cohort) at a specific time would be followed through their employment cycle. Turnover measures would be calculated with reference to this cohort.

$$\textit{Survival rate:} \quad \frac{\textit{No. of cohort members who remain during a period}}{\textit{No. new members in cohort}} \times 100$$

$$\textit{Wastage rate:} \quad \frac{\textit{No. of new cohort members who leave during a period}}{\textit{No. new members in cohort}} \times 100$$

The time required to define a cohort of new members will be determined by the length time it takes to get a large number of new members to provide stable statistics. As a rule of thumb, a cohort population should not be below 100 in order to give stable statistics (Smith and Wilson, 1993).

Most of the measures for turnover fail to measure adequately the concept for which they are intended. Which measure to use depends on the available data. According to Smith and Wilson (1993), the turnover process should not be measured by a single measure since there is no single measure capable of comprehensively describing it. Any method(s) used should as far as possible locate the problem in meaningful terms: i.e., it must be diagnostic and should be confined to the parameters of the desired object.

2.3 The workforce situation in forest harvesting: education and training

Although there has been tremendous interest internationally in specific harvesting machines and systems, less effort has been directed towards the source of productivity of the machine: i.e., the human operator (Garland, 1990). According to Garland (1990), about 64 % of forest harvesting production performance variation is attributed to human operators. In South Africa, there has been a surprising rush towards mechanisation and trying new machines while disregarding the importance of the workforce. Training is the key to improved manual and mechanised operations. However, according to ILO (1991) the benefit of training will only be realised if adequate working conditions are provided.

New workers, especially new machine operators typically result in high equipment repairs and maintenance costs (Kirk *et al.,* 1997) The longer the learning curve for a worker the greater would be the cost to the employer, due to failure to attaining optimal levels of production. Training can have an impact on reducing the length of a worker's learning curve through refining working techniques and promoting full machine utilisation. The learning curve theory postulates that the time required to give a certain fixed output will be continuously reduced at a constant rate for some time while a worker or animal learns, until eventually a "working plateau" is reached beyond which essentially no further improvement can be made without additional investments in equipment, training, or the work environment. The learning curve theory helps to assess worker performance, plan production flow, select workers, plan and predict cash flow, calculate additional costs incurred by the new workers and calculate wood flow into the mill/market (Kirk *et al.,* 1997).

There is a great need for well-trained workers because all forest operations are potentially dangerous. In addition, formally trained workers have the lowest turnover (Gibson, 1994). Therefore, any industry should invest in training and education to ensure a stable and highly skilled workforce.

One of the worst misconceptions in the industry is that training is a "magic pill", "one shot affair" or a "quick fix" (Garland, 1990). Rather, training should be built into the tactical and strategic framework of the industry. Many organisations realise that training is a strategic issue, however, they are not willing to commit the necessary resources or develop the necessary infrastructure.

Also linked to education and training is worker selection in order to match the employee to the task. According to Kirk *et al.* (1997), forest employee selection in forest harvesting requires more attention. Forestry needs formal selection programmes that would improve the chances of employing only suitable candidates and reduce the costs of "false-starters" or "non–performers". The potential financial losses of poor operators through increased repairs, lost production and high maintenance can be extensive. Garland (1990) recommends that machine operators for forestry work should be selected on some of the following criteria: the level of experience with similar machinery; some machine operating skills assessment; and/or hiring only experienced operators.

2.4 The workforce situation in forest harvesting: OHS

Although significant progress has been made through improved safety features on harvesting machines and PPE, forestry remains one of the most hazardous industrial sectors in most countries (ILO, 1998). Forest harvesting is especially hazardous and constitutes between 38 % and 90 % of the accidents in forestry (ILO, 1981; ILO, 1991; Poschen, 1993). It is inherently characterized by natural hazards (e.g., bees and snakes), outdoor conditions (characterised by steep and rugged terrain, dense vegetation and extremes of climate) and material risks (i.e., falling trees, rolling logs, high noise levels, heavy work loads, heavy moving equipment and high speed saws) that can be detrimental to the health and safety of forest workers. According to Poschen (1993) and Reisinger *et al.,* (1994), these physical and environmental

hazards are difficult to control. Furthermore, inadequate and or absence of work site welfare facilities, food, drink and appropriate clothing worsen the situation and contribute to the high injuries in forest harvesting.

According to ILO (1991), clear distinctions can be made between developing and developed countries: i.e., there is high ignorance and indifference regarding OHS in developing countries, scarce information on the subject, and limited basic regulations and/or implementation thereof. On the other hand, developed countries with mechanised operations have fewer accidents but a significantly higher percent of workers who suffer from occupational health complaints. Industrialised countries put more emphasis on training and accident preventive measures. In general, between the two, there is now greater awareness than before that accidents and risks require continuous attention (ILO, 1991). However, health and safety issues are still not key focus areas in some countries (Poschen, 1993).

Figure 6 shows a holistic approach to health and safety; it links health and safety to the human focus in an organisation and the regulatory and strategy framework. It shows some key elements in health and safety, these are; measuring, human capital and regulatory and strategy framework.

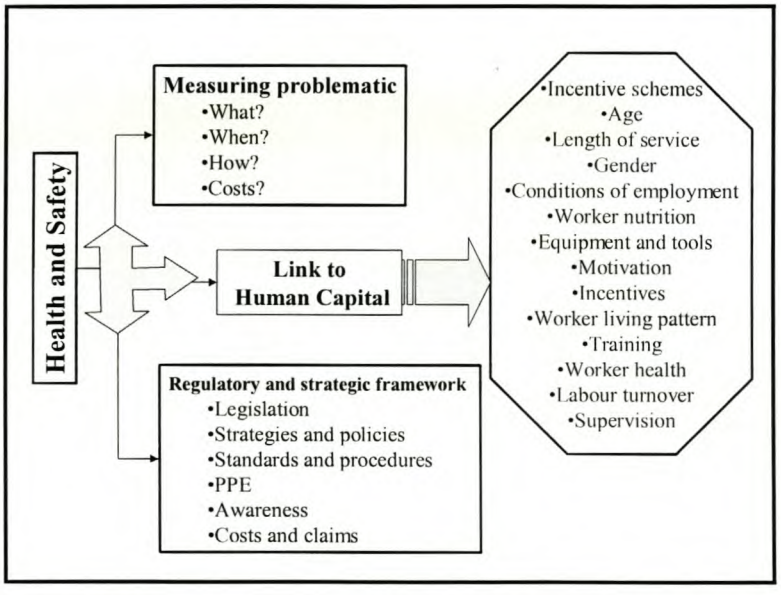

Figure 6: Health and safety and its link to human capital and the regulatory framework in forest harvesting; a holistic approach.

2.4.1 Measuring health and safety

It is difficult to compare statistics on OHS because there are differences in definitions, classifications, regulations and reporting systems. The ILO (1991) confirms this statement. So how does one measure health and safety? The following methods can be used to provide an understanding of OHS in an industry: recall interviews; health and safety indicators; and statistics (e.g., Lost Time Injury Frequency Rates –LTIFR, and number of fatal accidents per million m^3 of timber harvested) (ILO, 1988; Klen, 1988).

According to ILO (1991), recall interviews are not reliable as they do not provide a balanced and complete assessment of the situation. COFHE (2000) cited the following fundamental problems associated with LTIFR (a statistical measure), as a sole measure of occupational health and safety:

- it is a negative measure of OHS performance
- it is subject to variation in reporting and often it is more a reflection of reporting and claiming behaviour than changes in OHS performance
- LTIFR does not provide information on how OHS is managed in an organisation
- it does not measure occupational diseases with a long latency period, for example, back problems, hearing losses and sight loss
- the low frequency of accidents and lost time injuries means events such as fatalities and lost time injuries are subject to random variation.

Although it is difficult to compare accident severity in forestry, the following ratios can be used to measure accident severity:

- workdays lost in relation to the days worked
- the number of days lost per accident
- ratio of the fatalities in relation to working time
- ratio of fatalities in relation to workers at risk
- ratio of fatalities in relation to volume of work (i.e., number of fatal accidents per million m^3 of timber harvested).

2.4.2 Safety awareness, - legislation, rules and regulations

In South Africa, considerable work is being done to define OHS practices, and to make forest harvesting safe. Proper operational practices, good risk and safety management, work supervision, training, tripartite commitment (amongst employees, employers and the government), regulation and policy are some commendable interventions to make forest work safer. In South Africa, the following legislation, rules, regulations and standards have been set, and are periodically aligned with improved technical standards, new technology, social-economic developments and world trends to attain the goal of safer forestry work:

(a) Legislation:

The OHS Act of 1993: the South African OHS Act of 1993 seeks to create a tripartite alliance amongst workers, government and employers were each person is equally responsible for their own safety and that of others. All parties should identify, minimize and eliminate all actual and potential work related hazards

(b) Industry standards and guidelines:

- The FESA Harvesting Code of Practice of 1997, revised and upgraded to The Harvesting Guidelines in 2000. The guidelines are not legally binding, but they are recommended to all FESA members and non-members (FESA, 1997; FESA 2000a)
- The FESA Chainsaw Operators Manual (FESA, 2000b)
- The FESA Cable Yarding handbook (FESA, 1999)
- A FESA forest engineering safety handbook is currently being planned. The proposed document will cover all requirements for safety in forest engineering, training and PPE.

(c) Other standards:

- Specific company standards; e.g., the Mondi Forest Engineering Self-Assessment Handbook and Sappi Induction Safety Standards.
- National Occupational Safety Association (NOSA) standards
- FS&F audits
- International guidelines and standards. For example, the ILO (1998) Safety and Health Code of Practices, which aims at protecting workers from forestry work

hazards and to prevent or reduce the incidence of occupational diseases and injuries and the New Zealand forest code of practice (LIRO, 1993).

- As of March 2000, only certified chainsaw trousers should be used by FESA members and contractors (Anon, 2000). (According to Anon. (2000), the FESA chainsaw trousers standards are based on the European Standards (EN 381-1 1993: Protective clothing for users of hand-held chainsaws –Part 1: Testing rig of resistance to cutting by a chainsaw, EN 381-2 1995: Protective clothing for users of hand-held chainsaws–Part 2: Testing method for leg protectors, and EN 381-5 1995: protective clothing for users of hand-held chainsaws –Part 5: Requirements of leg protectors) and have been approved and adopted by the South African Bureau of Standards).

All these documents provide the basic rules for forestry work and aim to improve health and reduce accident rates amongst forestry workers.

2.5 Developments and trends in forest harvesting technology

2.5.1 The technology window

The following elements are reviewed under the technology window: technology life cycle, technology forecasting and strategic management of technology. The latter, reviews technology acquisition, technology change, technology assessment, risk of technology, technology alternatives, technology transfer and new technology development.

2.5.2 Technology progress function

Industries should constantly assess the success of their technology acquisitions and the use thereof (Porter, 1990; Twiss, 1992; Higgins, 1998). In the forestry industry, specifically in forest harvesting, technology has to be continuously assessed to facilitate the proper harvesting of timber. Failure to do this will result in the loss of wood value, degrade the environment, jeopardize future production, erode the technology base and result in excessive costs.

In forest harvesting it is important to assess the technologies that are available and how they may fit into addressing the South African technology needs. This process is

the basis for a technology strategy. Often, there is a misconception that technology refers to advanced technology ("the high-tech syndrome") leading to the belief that technology is synonymous with high technology (de Wet, 2000a). In addition, there is a "technology illiteracy" problem (van Wyk, 1988). Practitioners often fail to demonstrate the ability to think in terms of technology and systems.

It is important to determine the life cycle position of the technologies on which the industry is dependent. Is the industry trying to maintain a position in a wide range of disparate technologies, which cannot be sustained, or is it dependent on aging technology that is almost reaching technological obsolescence? This is best shown by the regular pattern of the progress of technology with time, popularly described as cycles of technologies or the S-curve (Figure 7). All technical systems go through three phases of development: i.e., stage of slow initial growth, stage of fast development and stabilizing and finally the stage of maturation and slow growth.

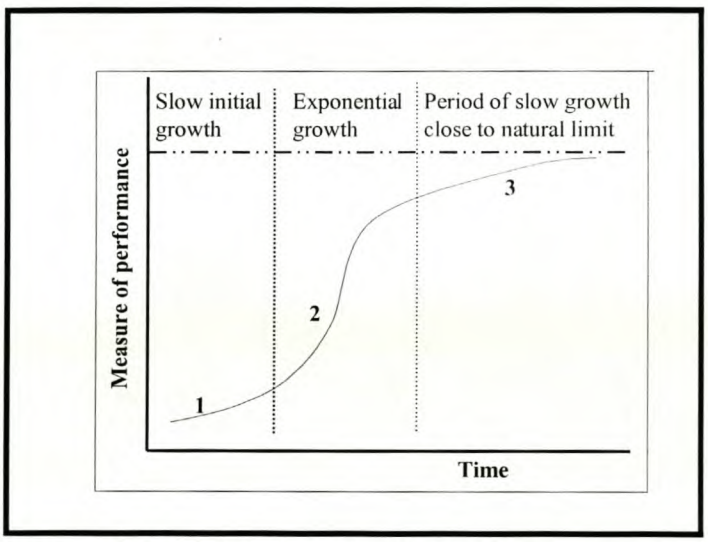

Figure 7: The S-curve; showing the life cycle of technology.

Decision processes for technology investment are complex and even political (Nixon, 1995). However, forest harvesting should be willing to acquire technology and be able to take technology risks since this provides the industry with considerable operational and competitive advantages. According to Orr and Sohal (1999) technology offer a large number of social, political and economic benefits, including improvement in: quality, recovery, inventory control, customer lead times, machine use and efficiency,

staff efficiency and morale, and customer image. However, many organisations find it difficult to invest in technology (Nixon, 1995), because the technology has to be appropriate.

According to Orr and Sohal (1999) and Mignogna (2000), investing in technology is often difficult to justify on the basis of traditional economic analysis methods: i.e., traditional capital budgeting techniques such as discounted payback period, return on investment, net present value and internal rate of return. There is nothing wrong with these methods of analysing the cost of capital and the timing of cash flow; they are just insufficient for evaluating all the pertinent considerations (Mignogna, 2000). For example, they ignore the tangible benefits included in strategic level savings and often it is difficult to quantify some of the technology benefits.

While it is important to recognise that technology innovation inside and outside the forestry industry will change forestry operations, it is equally important to note that the availability of technology is important. According to Guimier (1999), the following technologies will increasingly be applied in forestry operations or equipment: machine control systems, machine vision, training simulators, communications, lightweight components, operator aids and robotics, global positioning systems, computerized decision support systems, environmentally friendly fluids and environmental technologies for soil protection.

2.5.3 Technology colony

According to de Wet (2000a), even though many developing countries gained political independence, they primarily remain "technology colonies". In his model, the level of activity (in monetary value terms) in the developing countries is compared with the level of activity in developed countries and is plotted against the product development life cycle. A technology colony has the following features (de Wet 2000a):

- the primary business activity in the colony is at the manufacturing and trade in final-products-end of the product life cycle. In contrast, there is a continuum of activities in the Industrialised countries.
- there is a large flow of technology from the developed countries into the colony in the form of licensed product designs, processes, subassemblies and final products.

- there is very little activity at the research-end of the life cycle in the colony and a small flow of technology from the local research and development community to local business.

According de Wet (2000a) being a technology colony is not something to be ashamed of nor a disaster, however, remaining one is not a fate to be suffered but an opportunity to be managed.

2.5.4 The forest technical survey

Two forestry technical surveys have been done in South Africa to date (Brink and Warkotsch, 1990; Brink, 1998). The results outline the changes in forest harvesting systems from 1990 to 1998. Also, Grobbelaar and Manyuchi (2000) give a detailed overview of changes that have taken place in debarking technology internationally and in southern Africa.

The past two decades have seen the following changes: an increase in cut-to-length systems in softwoods and a decrease in hardwoods; unchanged use of agriculture tractor and trailer units and animals; a significant gain in the use of Bell-three-wheelers, cable yarders, chutes and grapple skidders; and an introduction of mono-cable systems, harvesters with different heads and a clambunk skidder and the dominance of manual debarking over mechanical log debarking (Brink, 1999; Grobbelaar and Manyuchi 2000; Swaine, 2000; Manyuchi and Engelbrecht, 2001).

Road transport has also undergone significant changes. Amongst them were changes in payload legislation and truck configurations: i.e., a decrease in rigid trucks and a gain in articulated trucks and stinger steer types. Changes in rail transport have been slow (Ackerman, 2001; Brink, 1998, 1999).

Forest roads construction and maintenance has been evolving very slowly. However, forest certification (mainly Forest Stewardship Council, -FSC certification) has stimulated debate and new interest on forest roads. Focus and priorities should be on maintenance and management of the existing networks, and deactivation of excess roads (which ultimately reduces the road density) (Ackerman, 2001). In addition, roads management should be integrated into the rest of the systems in the supply chain.

The use of basic, intermediate and advanced technology has been under review (Grobbelaar, 1999). This has lead to the debate on what is appropriate technology (Figure 8). It is now more important than ever before to predict the future according to the trends of the past and to highlight some of the emerging thinking in technology management in order to establish a platform for developing a technology strategy. In the past, equipment existed in isolation from each other to perform certain functions. Now, the current technology should enable seamless integration of equipment into systems.

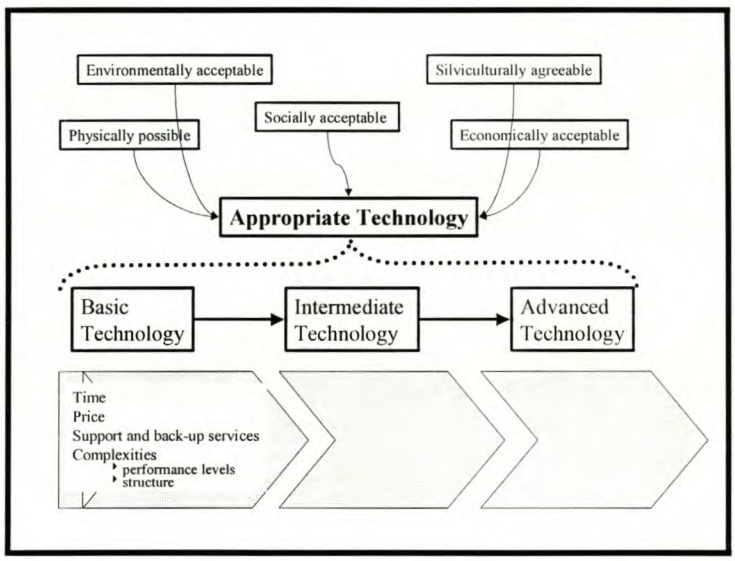

Figure 8: Levels of technology development and the criteria for defining appropriate technology in forest harvesting.

The debate on what is appropriate technology has been gaining much interest. Hence, issues like mechanisation of forest harvesting operations are constantly reviewed. There is a high temptation to mechanise forest harvesting operations in South Africa because of: shortage of workers for forest work, health problems and the impact of HIV/AIDS; people not willing to work in forestry; safety reasons; forestry legislation; the assumption that it is easier to manage one machine and one operator than several employees; increased machine reliability; and harvesting economics. Besides, mechanisation is perceived to offer flexibility. However, mechanisation should be treated with caution because there is evidence to show that mechanisation has not and will not be able to address all these expectations (Kirk *et al.*, 1997).

2.5.5 Technology forecasting

The business world is always changing and the only certainty about the future is that tomorrow's business environment will be different (Sherman, 1982; Twiss, 1992; van Wyk, 1997). Forecasting is a tool used to predict future changes. It has the following primary functions: sensing, interpreting, indicating and predicting the future (Twiss, 1992). According to Sherman (1982), Twiss (1992) and van Wyk (1997), any forecasting has to be based on understanding of market forces because technology is driven by market needs and the complex interaction of societal, task and internal environments (Figure 9).

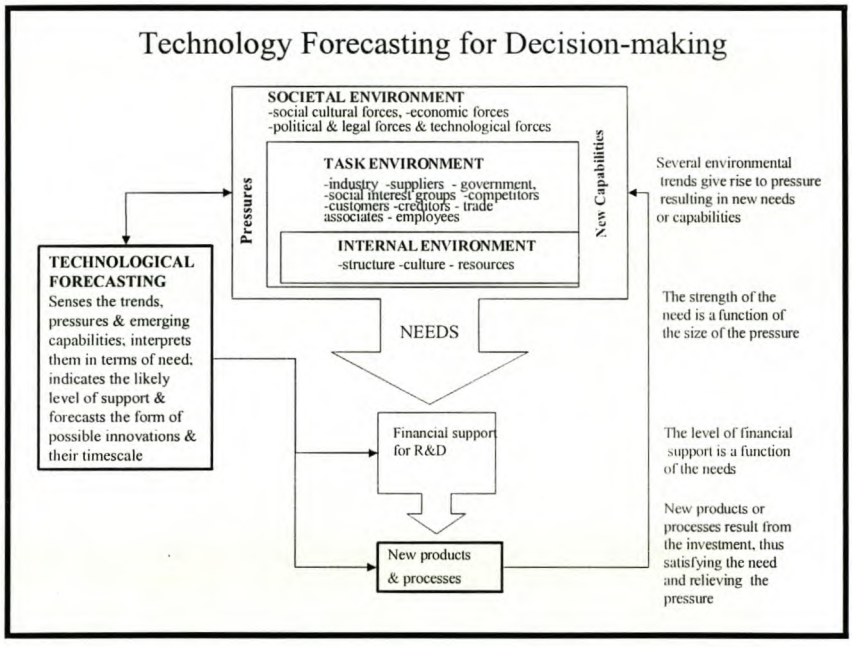

Figure 9: A process for technology forecasting for strategic and tactical decision-making (Twiss, 1992; Jacobs, 1997).

The techniques for technology forecasting can be classified as exploratory or narrative (Twiss, 1992). The exploratory method is based on techniques that look at the trends in the past and the present, and project them into the future. The narrative approach postulates a desired state of events in the future and traces backwards the steps necessary to reach the desired outcome(s) (with probabilities of each outcome). The techniques outlined in Table 4 can be used for technology forecasting.

Table 4: Common techniques for forecasting (de Wet, 1990; Porter, 1990; Twiss, 1992; van Wyk, 1997; Higgins, 1998).

	Technique	Explanation
Qualitative Analysis Methodologies	Relevance trees	A systematic way of determining and evaluating exhaustively all alternate paths to achieving a normative objective or mission from a desired point. The technique works by listing and examining all solutions and functions to get to a desired objective or result point.
	Technology monitoring	Based on noting significant events in a journal and pulling out trends. (e.g., in the journal record: date; events and technological economic data; possible significance and key pointers).
	Impact wheels/cross-impact analysis	Technique to identify, and reflect interrelationships (i.e., enhancing –enabling/provoking, and inhibiting – denigrating/antagonistic) in the forecast.
	Industry descriptions and pattern analysis	Technique is based on a systematic description of the industry "situation analysis". The approach looks for patterns that can be extrapolated into the future.
	Leadership profiling	Technique for evaluating the industry intellectual capacity. The intellectual capacity is used to forecast the future that the leaders would direct their organisations and or the industry
	Demographic and sociological analysis	Technique is based on extrapolating and curve fitting of past demographic and sociological results to predict the future.
	Structured interviews/ expect opinion	Technique uses questionnaires and or interviews to get opinion of selected experts to give factors that could influence the future technology.

Table 4: Common techniques for forecasting; *continued.*

	Technique	Explanation
Qualitative Analysis	Morphological analysis techniques	It is a systematic evaluation of possible combinations of technology possibilities. The technique involves identifying key parameters and functions of a problem and deriving probable solutions of each of them i.e., each function and way of reaching them represents a possible solution. Morphological analysis technique has the ability to suggest future technological advances and identifying hidden and rare technological opportunities.
	Time and interdependence companions	Technique is based on forecasting the future in one field based on developments in another related field. The key to this technique is to identify primary tendencies in one technological field that relates to the field that has to be forecasted. The technique is often used in "meta technologies" (i.e., technology that can transform an economic sector which they are applied).
Quantitative Analysis	Trend extrapolation and impact analysis	Uses mathematical curve fitting techniques to extrapolate past data into the future. The technique could suffer from absence or inadequate data upon which to base the forecast.
	Precursor trends/ analogical prediction – curve matching	Works on identifying a precursor relationship/correlation (two fixes for a point in future) behind which own technology could follow.
	Technology substitution analysis	Based on predicting the rest of the S-Curve (Figure 3) after the new technology reaches 5 % of the dynamics of the substitution.

Table 4. Common techniques for forecasting; *continued.*

	Technique	Explanation
Quantitative Analysis	Delphi surveys method	The technique uses a panel of experts for evaluating the future. Uses questionnaire techniques to anonymously get opinion of selected experts to set targets, identify factors that would influence future technology, set technology time windows, obtain probability estimates and test technology feasibly in stated conditions.
	Scenario developing	Tries to describe a possible future situation based on a wide-ranging environmental analysis. The development of a scenario begins by analysing the current situation and identifying all uncertainties that may affect it and then translate all the uncertainties into a set of different future scenarios.
	Technology balance sheet	Reflection of sources (technologies/capabilities, processes -value addition activities and markets/products) and their application in an organisation in a balance sheet format.
	Practical & theoretical limit testing	Technique is based on mathematical calculations of the future. It endeavours to predict the physical limits of materials under certain conditions. The knowledge gained from these calculations can be used to predict the future in similar situations.
	Financial ratio analysis	The technique uses financial rations to predict the future. The ratios often used include return on equity (ROE) (i.e., ROE = profit margin X asset turnover X financial leverage), payback period, net present value, interest rate of return and benefit cost ratio.
	System dynamic modelling	The techniques involves a rigorous system dynamics-driven analysis of current situation through simulation because often there are no tools or theories to predict the future other than simulation.

3 Research methodology

The research project employs three sources of information: literature review, participatory field survey, and government and industry archives. Industry archives include information obtained from FESA, (FSA, FS&F, Crickmay and Erasmus, Mondi Ltd, Safcol and Sappi Forests.

3.1 Approach

The field survey was the primary source of data for the study. It involved personal interviews with staff of grower companies and harvesting contractors, and forest workers: technical experts from Mondi Ltd, Sappi and Safcol, 18 harvesting contractors -contracted to Mondi Ltd and Sappi, and 190 workers.

Using a participatory survey was deemed appropriate. This is because the foundation theories of this subject are limited and this research is largely exploratory. Also, the potential for a higher response rate was guaranteed since all the workers who could not read or write could participate. The participatory survey gave the opportunity to explain the study objectives, ask questions, establish rapport and complete the checklist. However, this approach has the following drawbacks: participants tend to say what they think you want to hear (Gibson, 1994); and it is time consuming and costly. Similar approaches have been used in New Zealand in studies by Byers and Adams (1993) and Gibson (1994), except that in these cases the participants had to fill in the questionnaires with the researcher giving help where needed.

The participatory interviews were guided by the use of checklists (Appendix A). The checklists served to standardise the data collection process, guide the study and to record the information. The field checklists were pilot tested in the Grabouw area in the Western Cape and adjusted accordingly; 18 workers and three managers/supervisors participated in the pilot study. The pilot checklists had the following problems: they lacked flow in the questions, had repetitive questions, did not have provision for noting field observations and were not structured properly for ease of filling in. The adjusted checklists (Appendix A) were more concise and took into account all the shortcomings of the former.

3.2 Assessment checklist design

Two checklists were developed (Appendix A), one for contractors and the other for workers. The contractor checklist captured the following data: personal details; conditions of employment; contracting relationships; forestry harvesting legislation, policies and standards; management and supervision; health and safety; operations management; harvesting systems; and technology focus. The worker checklist assessed: personal details; working conditions; worker dynamics and health and safety (both questions and observations).

(a) Labour dynamics: the checklist had to be designed in such a way that it measures absenteeism, voluntary resignations, new recruitments, periodic hires (seasonal or temporary recruits), dismissals and length of service. It was designed basing on indicators in the intangible asset monitor (Figure 4) and the human focus. It is clearly understood that labour dynamics measures should be used for the purpose they are intended and often a combination of measures should be used to understand labour dynamics. In the checklist, data for absenteeism, voluntary resignations, new recruits, periodic hires and dismissals for the last month, last 6 months, previous year and the previous 2 years was needed. The assumption made at the time of designing the checklist and after pilot testing it was that contractors and grower companies were keeping records of these indicators, thus, would be in a position to give monthly records. However, during the study it was established that contractors do not keep records of these indicators. Thus, indirect measures of the variables had to be adopted. For example, labour turnover was traced by asking the age of the employee, his/her work history in the industry and the reasons for joining the forestry industry. The contractor was asked to estimate the levels of absenteeism, new recruits, dismissals and voluntary resignations in his/her business. Absenteeism percentage was measured by estimating the number of employees who did not turn up for work per working day relative to the total number of employees. Voluntary resignations, dismissals and new recruits were estimated as the number of employees who resigned, were dismissed or recruited in a month relative to the total number of workers in that period. All these variables put together give an understanding of labour dynamics.

(b) Occupational health and safety: Because of the problem of comparing occupational health and safety statistics between organisations, industries and/or countries as well as limited current and historical data on the subject in the industry, this study adopted an approach which embraces positive performance measures (PPI) alongside a statistical approach and oral interviews as measures of OHS performance. The pros and cons of each of the methods are explained in section 2.4.1.

(c) Training and development: employees were asked who had been involved in their training and the type of training they had undertaken. The contractors had to answer questions about the training providers they used, the type of training, their training budgets for the year 2000 and training constraints they were facing.

(d) Conditions of employment: both the contractor and the employees were asked the same questions about wages, working times and provision of extra work packages. Wages after deductions were recorded. It was deemed appropriate to record this figure because it indicates what the employee can live on and all contractors are likely to make different deductions from their employees.

Both the contractors and the staff from grower companies were asked questions about procedures and standards, contract relationships and technology. These questions are important because they set the framework on which contractor businesses are built. Furthermore, they helped in evaluating the sourcing-decision, determining the factors influencing competitive growth and sustainable development, evaluating the technology in forest harvesting, and setting the scene for technology forecasting. As an example, contractor growth was used as an indicator for growth and development of contractor businesses: this is how it was calculated:

$$\textit{Percent Growth (\%)} = \frac{Y^1 - Y^0}{Y^0} * 100$$

Where;

Y^1 = *Current annual cut (volume) as specified in current years' contract*

Y^0 = *Start (contracting) annual cut (volume), -the volume agreed on in the first year of contracting*

In some cases, both the employers and employees were asked the same questions to cross-check their answers. For example, they were both asked questions about conditions of employment. This was done to check for regularity and to validate the data. After the fieldwork and data capturing, data verification was done through telephone calls to individual contractors, staff of grower companies, members of the forestry associations and some government departments.

The archived data from government sources, grower companies and forestry associations were used as background information to understand both forest harvesting at national level and the general forestry industry in South Africa. It was also used to set a philosophical framework for evaluating the contracting decision in forestry.

3.3 Sample selection

The research project was conducted in KwaZulu Natal, South Africa (Figure 10). KwaZulu Natal Province was chosen as the study area because of its diversity and richness in forestry and for logistical reasons because all the major companies who participated in the study operate in this province.

The contractors who participated in the study per geographical area and per grower company were chosen with the assistance of grower companies. The criteria were contractor size; i.e., contractors harvesting at least 30 000 tonnes annually, and availability during the dates of the interview. Prior to going infield to interview the employees, the contractor provided the researcher with a breakdown of the employees per job category. This helped in stratifying the workforce in order to get a representative sample from each strata. The worker to be interviewed was randomly selected from each group. If the contractor or supervisor handpicked the workers, there were chances of selecting employees who spoke well to strangers and/or the best employees in the job, thus, introducing bias to the data.

The names of the companies and contractors that participated in the research project have not been identified with the data for reasons of confidentiality. The names A, B, C…R have been adopted to maintain contractor anonymity.

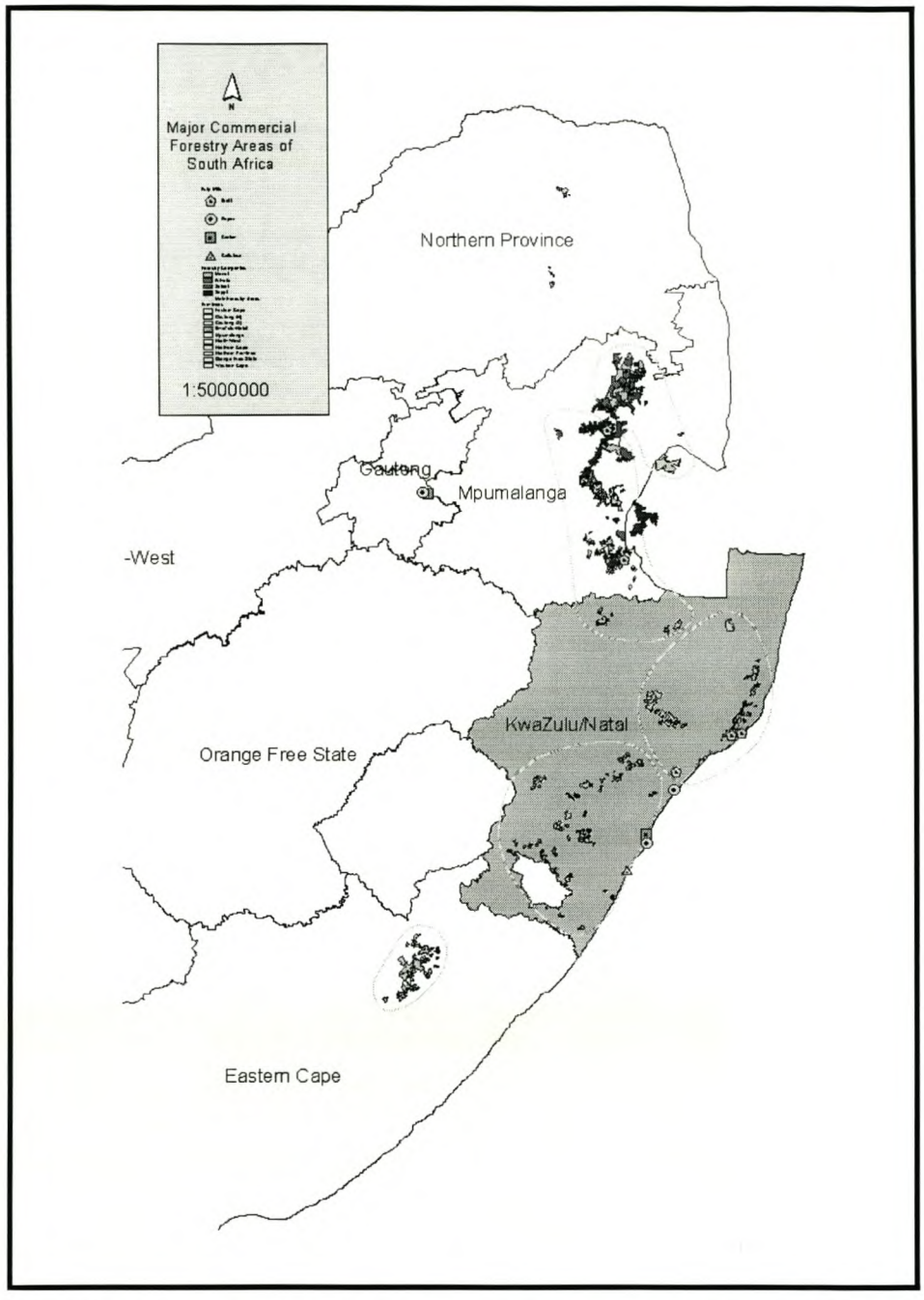

Figure 10: Map showing the study area boundaries and also the major commercial forestry areas of South Africa (*Source:* Mondi Forests -technical department).

3.4 Data analysis techniques

All the data were captured in Microsoft Excel in a single worksheet (Microsoft, 1999a). Two different files were created: one to capture data from the contractors and staff of

the grower companies checklist and the other for the employee checklist. The analysis of the data was done in different worksheets as per section of each checklist.

Microsoft Excel was deemed the ideal tool to use for capturing and analysing the data because of its robust data analysis tools and compatibility with Microsoft Access (Microsoft, 1999b) and Statistica (StatSoft, 2000) databases which were also used in analysing and filtering trends in the data. Microsoft Access is easy to use in filtering trends in categorical data and giving reports. Statistica, was used mainly in filtering data and presenting it in graphical format: e.g. the drawing up of box and whisker plots.

3.5 Frame of reference and limitations

Although the survey was done in KwaZulu Natal, this study contains enough secondary information from forestry associations and grower companies to make sound inferences of forest harvesting in the country. In addition, all the grower companies and contractors in the study have operations throughout the major forestry regions, hence the information and perspectives that they presented to the study was or can be seen as national overviews. In addition, CUP and FS&F have national memberships thus their data portrays national trends too.

The selection criterion of annual harvest of at least 30 000 tonnes per year excluded most emerging contractors from the study, who in most cases do not belong to either CUP or FS&F. The situation and dynamics of this sector of contractors is not understood and there is enough evidence to suggest that the situation in this sector could be different and more complex than what is presented in this study.

4 Results and Discussion

4.1 Contactor profiles and their competitive priorities

Contractor profiles (i.e., demographic characteristics, nature and type of operations, number of years in the contracting business and growth rate), and their competitive priorities are presented in this section.

4.1.1 Demographic characteristics of contractors

Figure 11, shows the population groupings of forest harvesting and transport contractors in the study sample: 83 % of the contractors are White and the reminder (17 %) Black. The distribution can be attributed to the high annual cut threshold (i.e., 30 000 tonnes per year) adopted in this study. Most Black contractor businesses are small, thus many were not included in the study. All the contractors are male. This is not surprising because forestry is traditionally a male dominated profession.

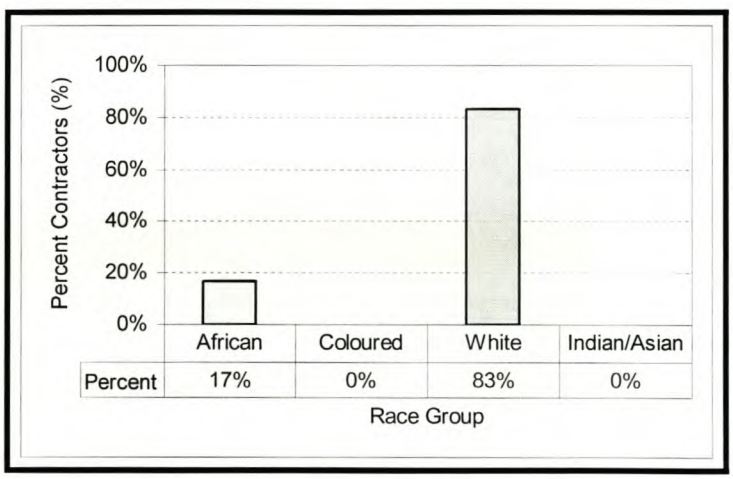

Figure 11: Population groups amongst forest harvesting contractors producing at least 30 000 tonnes/year in South Africa.

4.1.2 Type of operations

About 78 % of the surveyed contractors are involved in stump to depot operations and 22 % in stump to mill operations. This can be attributed to the traditional depot system used in KwaZulu Natal. About 33 % of the contractors are involved in both silviculture

and harvesting. Most contractors tend to start as silviculture contractors and then diversify into harvesting. The reasons for this are to spread the business risk; and because silviculture is less capital intensive it can be used as a springboard to raise capital required to run harvesting operations.

About 22 % of the contractors run felling, debarking and stacking operations only and just 11 % do additional loading. These contractors are characterized by: labour intensive operations; some form of sub-contracting to bigger contractors; and are of smaller size.

4.1.3 Number of companies contractors are working for

Table 5 shows the number of grower companies to which each contractor is providing services. Most contractors are contracted to just one or two grower companies. In most circumstances, grower companies select just one contractor or just the same contractors due to:

- the geographical spread of both the contractors and the grower companies; there is evidence that companies in the same locale work together
- the initial drive for outsourcing; grower companies encouraged their employees to become contractors when the outsourcing process was initiated. Hence, to date, most grower companies still support their own contractors (i.e., former employees)
- contractor size; some contractors have grown bigger and can afford to monopolize certain clients. In fact, the 6 % of the contractors who run operations with five clients are relatively small, and having many clients is the only way they can run a profitable business

Table 5: Number of grower companies for whom the sampled contractors work in South African forestry harvesting contracting businesses.

Contractor with	**Percent of Contractors**
All operations with one company	67 %
All operations with two companies	22 %
All operations with three companies	6 %
All operations with four companies	0 %
All operations with five companies	6 %

4.1.4 Annual volume cut

Figure 12 shows the distribution of contractors by the annual tonnage cut. The majority of the contractors (33 %) is in the 60 – 90 000 tonnes/year category, followed by 22.5 % between 90 – 120 000 tonnes/year and 17 % either in 30 – 60 000 tonnes/year or above 150 000 tonnes/year. The smallest percentage (6 %) are contractors who harvest between 120 – 150 000 tonnes/year or just about 30 000 tonnes/year. Note that about 6 % of the contractors shown in Figure 12 with annual tonnage of less than 30 000 tonnes are very close to the 30 000 tonnes per year threshold, hence they were included in the sample.

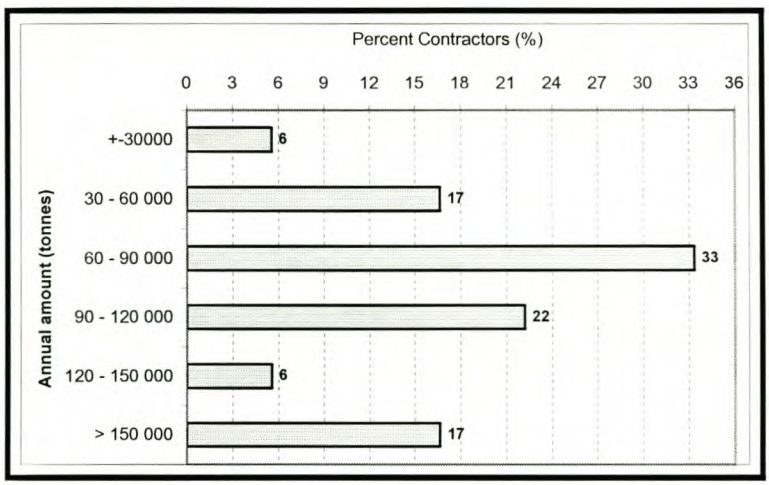

Figure 12: Annual volume cut and the proportion of the surveyed contractors in South African forest harvesting contracting businesses.

Most of the bigger contractors are involved in stump to mill operations because they have the necessary operating capacity. Stump to mill operations ease inventory management, minimizes timber losses and facilitate timely delivery of timber to the mills because all contractors are paid on volumes delivered over the weight-bridge at the mill.

4.1.5 Contracting experience

The length of service in business determines the amount of experience gained by the contractor. Forest harvesting contractors have been contracting for a median of 7.5 years; the majority of the contractors (33 %) have been in business for 3 - 6 years, 28 % for 9 - 12 years and only 11 % for less than three years (Figure 13).

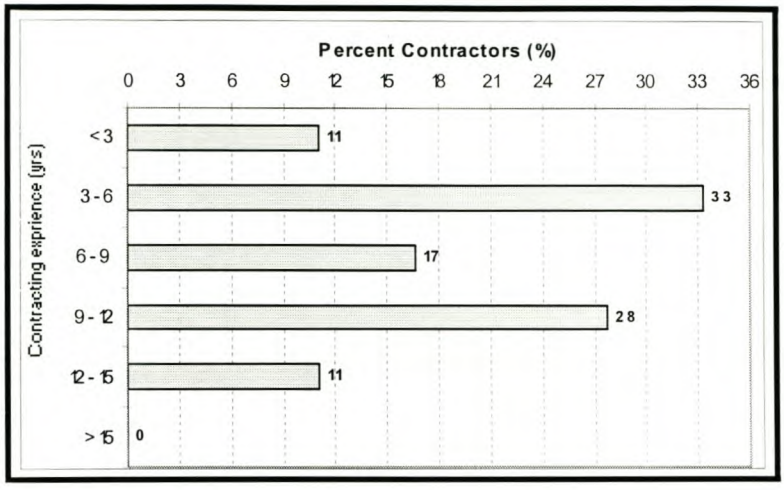

Figure 13: Contracting experience amongst the sampled forest harvesting contractors in South Africa.

4.1.6 Contractor growth

Comparing the starting annual volume cut to the current annual volume gives an indication of contractor growth. On average, contractors have grown 1.78 fold (Figure 14); this is an average growth of 8.1 % per year over a median of 7.5 contracting years (Figure 13).

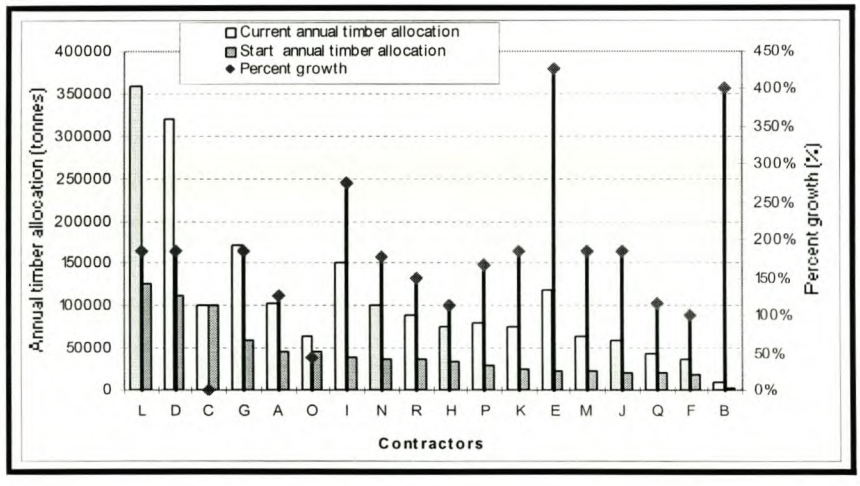

Figure 14: Contractor growth measured by annual volume cut amongst all the sampled contractors in forest harvesting in South Africa.

Contractor businesses in forest harvesting have grown bigger; the trend is likely to continue in future. This is the some conclusion drawn by Klotz (2000) when reviewing contractors in Canada. However, he also concluded that that there was an uneven

power balance between the large grower companies and the contractors which could affect the growth rate of the contractors.

4.1.7 Contractor growth and contracting experience

It was expected that the contractors who have been in the industry the longest have the highest growth rates. However, there is no correlation between the duration in contracting and the contractor growth rate ($r = 0.109$, $\propto = 0.05$) (Figure 15). This could be attributed to other factors which affect growth other than contracting experience.

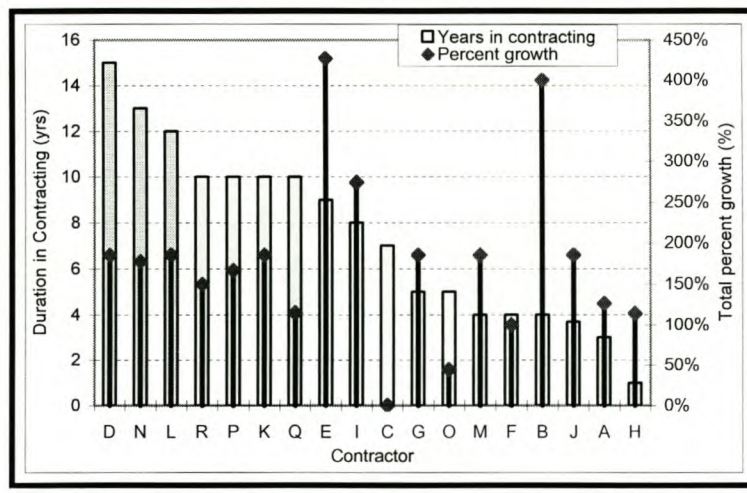

Figure 15: Percent contractor growth and contracting experience amongst the sampled contractors in forest harvesting in South Africa.

4.1.8 Number of employees per contractor

Figure 16 shows the number of employees per contractor. The mean and median number of employees per contractor is 164 and 157.5, respectively. There are more male workers than females; a ratio of 0.55 : 0.45. Forest harvesting is male dominated because of the physically demanding nature of the work, historical reasons, cultural reasons and other work traditions in the industry such as the migrant labour system, which made use of only male workers. About 90 % of the females in forest harvesting are manual log debarkers. Thus, a company with a higher percentage of females tends to run more labour intensive operations: e.g., contractor B, C and P.

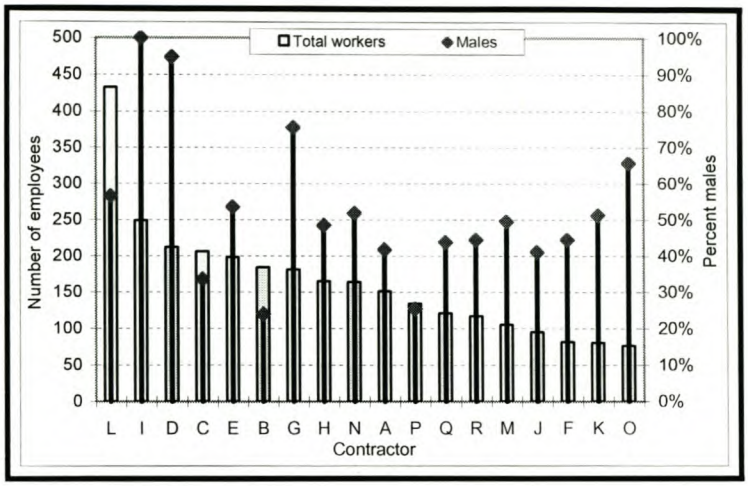

Figure 16: Number of employees and the gender ratio per contractor amongst the sampled forest harvesting contractors in South Africa.

Figure 17 shows the relationship between the number of employees and the size of operations measured by the annual tonnes harvested and/or transported. There is no correlation between the annual tonnes allocated and the number of employees ($r = -0.1096$, $\propto = 0.05$). However, amongst some of the bigger contractors, the tonnage/employee ratio is high which indicates a higher level of mechanisation.

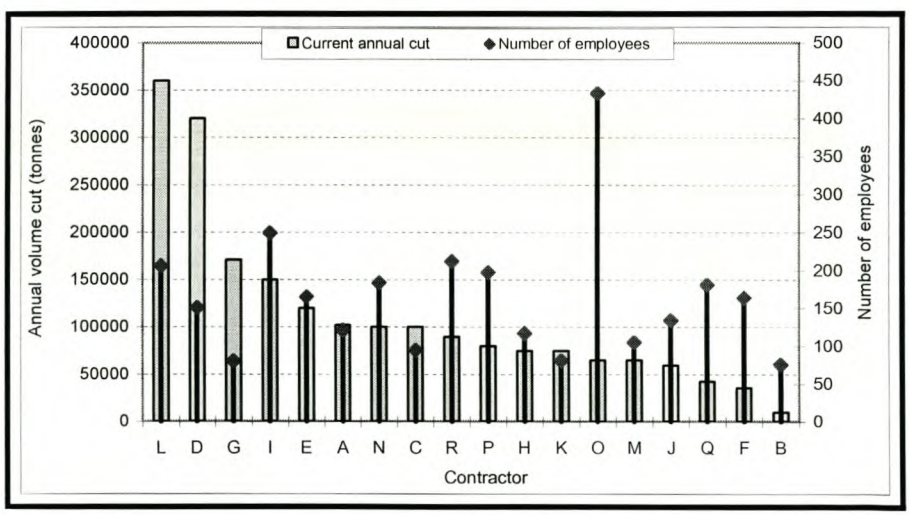

Figure 17: Relationship between the annual tonnes harvested and the number of employees per contractor amongst the sampled forest harvesting contractors.

4.2 Human capital

4.2.1 Worker profiles

Workforce profiles are important when analysing forest harvesting technology. Demographic characteristics of workers, their conditions of employment, training and education, OHS, nutritional heath and worker dynamics are reviewed to understand the people interface (i.e., human capital).

4.2.1.1 Age distribution

The median age of the harvesting workers is 33 years. The age range is 15 to 65 years (Figure 18). Such a distribution shows neither a young nor an aging workforce. However, contractors B, J, K, M and Q and Company SA have elderly workers, and the median age of their employees is at least 36 years (Figure 19).

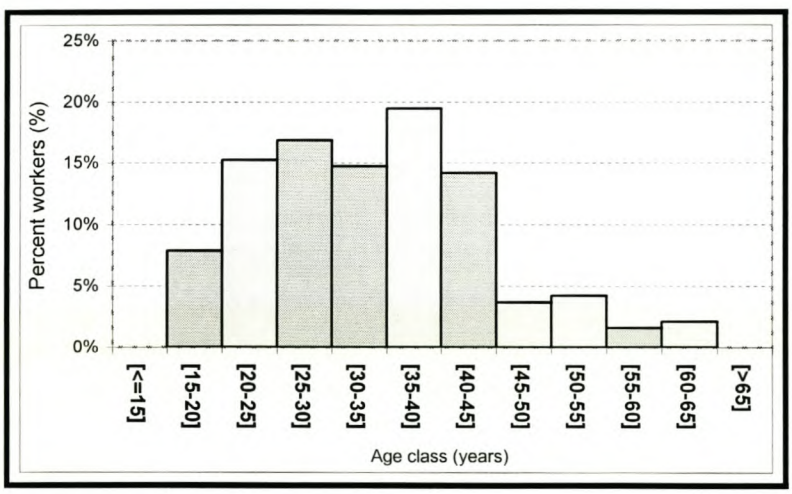

Figure 18: Age class distribution of the sampled forest harvesting workers in South African forest harvesting contractor businesses.

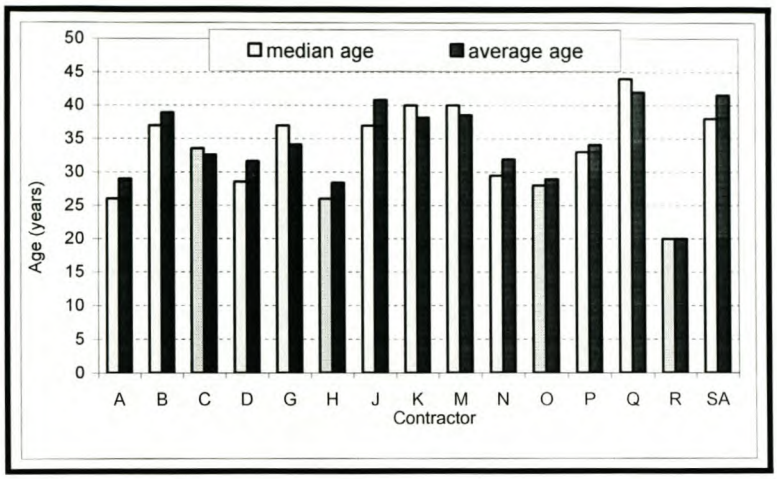

Figure 19: Employee median and average age per contractor/company amongst the sampled forest harvesting contractors in South Africa.

4.2.1.2 Population groups and ethnic groups

White people constitute 1 % of the sampled workers; these are either in supervisory or specialized operator jobs and Blacks 99 % (Africans 99 %, Coloureds 0 % and Indians 0 %). About 90.5 %, 4.5 % and 2 % of the sampled Africans are Zulu, Xistonga (Shangani) and Xhosa, respectively and Sotho's, Setswana's and Swazi's constitute 1 % each.

4.2.1.3 Marital status

About 51 % of the surveyed forest harvesting workers are married, 39 % single, 9 % divorced and 1 % other. The category other includes workers who are cohabiting and any other status that can only be explained in traditional Africa practices.

4.2.1.4 Educational qualifications

About 25 % of the surveyed workers do not have any formal education, while 9 %, 3.5 % and 6 % have at least completed standard 8, 9 and 10, respectively (Figure 20). The median level of having completed schooling is Standard 3. This pattern of low academic qualifications is evenly spread across the contractor businesses.

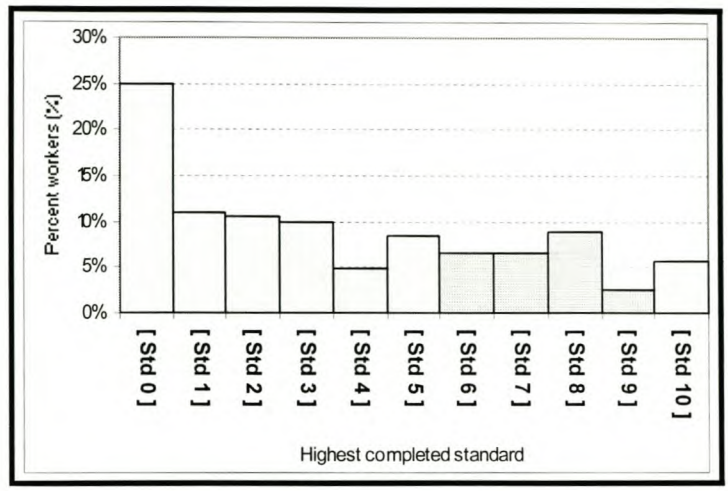

Figure 20: Academic qualifications of the sampled forest harvesting workers in South Africa.

4.2.1.5 Job-gender relations

Figure 21 shows that all machine operators, truck and tractors drivers, chokermen and stackers are male. Females are dominantly in manual log debarking and log marking. There is a high proportion of female log markers because contractors believe females to be more accurate in their task. Leadership positions are skewed towards males in harvesting; 95 % of the Supervisors are male.

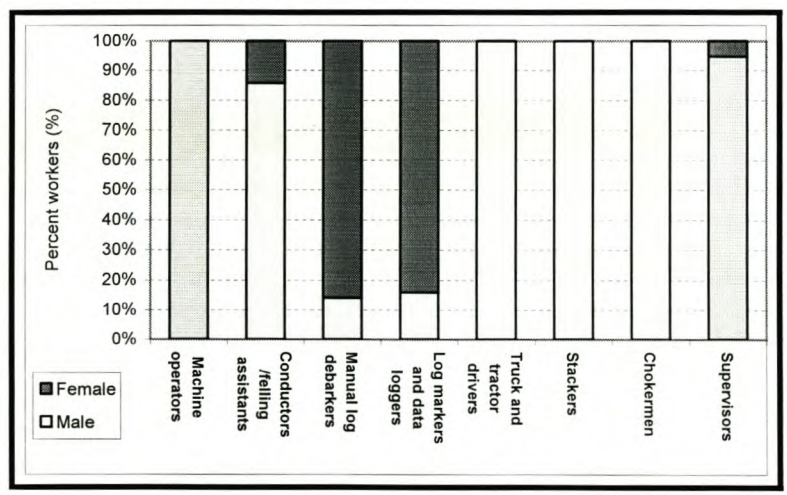

Figure 21: Job category and gender outlook of the forest harvesting workforce amongst the sampled contractor businesses.

Table 6 shows the portion of the forest harvesting workforce in each job category. This is also an indication of the most labour intensive operations in forest harvesting. The

most labour intensive job categories are ranked high in the table, starting with manual log debarkers and ending with first aid assistants. This list of (forest harvesting job categories) is not exhaustive. Hence, the sum of the percent of people in all the job categories in Table 6 does not add to 100 %, the difference between 100 % and the sum of the percent of employees in each job category accounts for the reminder of the other jobs in forest harvesting that are not shown in Table 6. Refer to Appendix B for a brief description of the forest harvesting jobs mentioned in this document.

Table 6: Ranking of the percent of workers in each job category in forest harvesting amongst the sampled forest harvesting contractor businesses.

No	Job	Percent of all workers in forest harvesting	No	Job	Percent of all workers in forest harvesting
1	Manual log debarkers	46.82 %	9	Truck drivers	1.66 %
2	Stackers	18.97 %	10	Chokermen	1.25 %
3	Chainsaw operators	8.91 %	11	Bell logger operators	1.25 %
4	Felling assistants	3.25 %	12	General hands	0.75 %
5	Markers	2.64 %	13	Cleaners	0.61 %
6	Supervisors	2.54 %	14	Clerks	0.37 %
7	Manual debranchers	2.34 %	15	Painters	0.30 %
8	Tractor drivers	1.96 %	16	First aid assistant	0.07 %

4.2.2 Conditions of employment

Conditions of service are the terms of agreement for providing/selling labour (employee) and providing work (employer). The following working conditions are characteristic of the forestry industry in South Africa.

4.2.2.1 Work starting and finishing times and rest breaks

In both summer and winter, most forest harvesting employees' start working once it is light enough to see. The time window is between 04h00 – 06h00 in summer and 05h00 – 06h30 in winter.

There are no scheduled tea or lunch breaks. As a result, some employees just work throughout the day without resting. According to Gibson (1994), it is important that workers have adequate rest breaks to prevent fatigue; fatigued workers are slow and not alert, and are more likely to cause accidents. Work ends when the task has been completed and the time range is from 11h00 to 17h00.

4.2.2.2 Wages

In forestry, most of the workers are in the lower income groups of R20 - R30 per day (Figure 22).

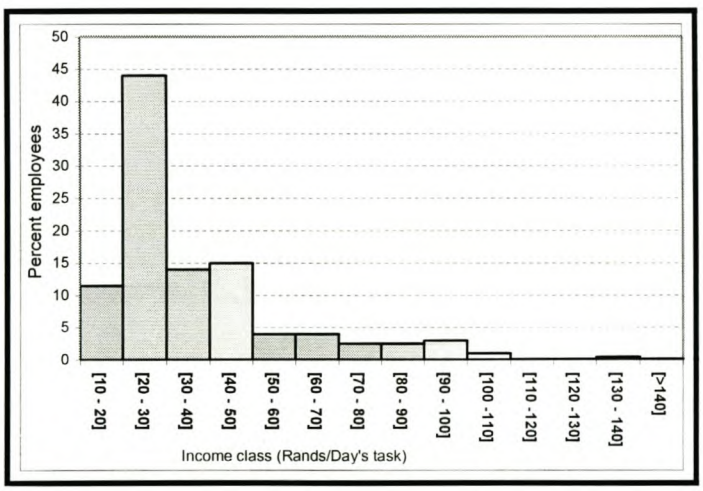

Figure 22: "Take home" daily wage for the sampled forest harvesting workers in South Africa.

Figure 23, shows that supervisors and certain machine operators are paid more when compared to general manual workers. In general, wage earnings in forestry harvesting are skewed distributed (Figures 22, 23 and 24). There are some employees who earn higher wages than the rest of the forestry workers.

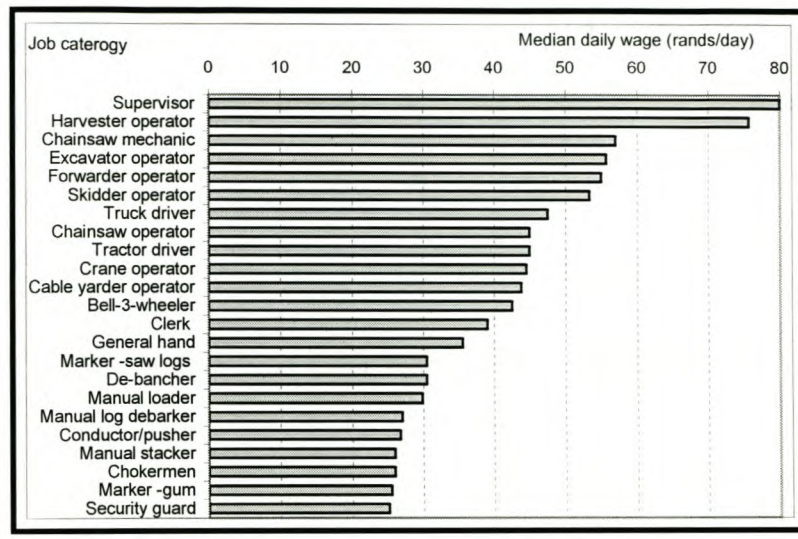

Figure 23: Ranked daily median wage per job category in forest harvesting as indicated by the sampled contractors and forest harvesting workers.

Figure 24, shows that there is a big wage gap between workers in Safcol and contractors; 50 % of the workers are within the R50 – R80 per day bracket at Safcol, whereas amongst the contractors they are between R24 - R38 per day.

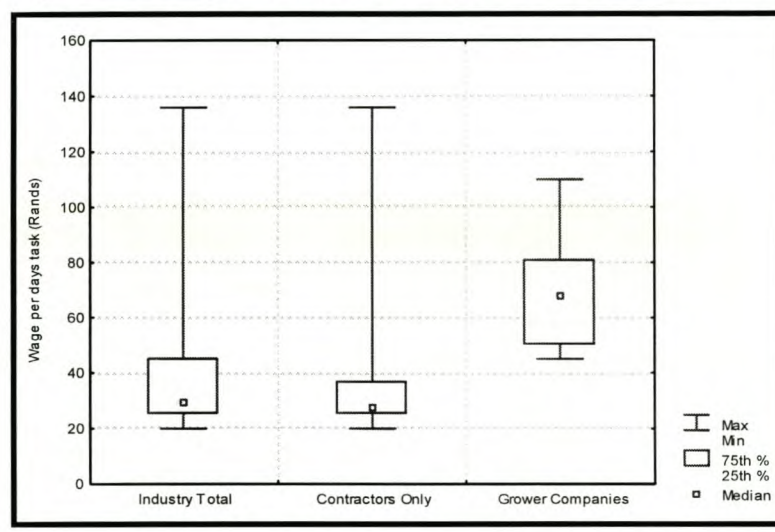

Figure 24: Box and whisker plot showing the wages paid by the grower companies, contractors and the average for the industry (contractors and grower companies combined) for forest harvesting workers in South Africa.

Figure 25 shows that there is no correlation between contractor size and employee daily wage ($r = -0.247$, $\propto = 0.05$) and all contractors pay different rates to their

employees: i.e., workers doing the some job in different contractor businesses are remunerated differently. However, the slight differences in levels of mechanisation amongst the contractors also contribute to the wage differences i.e., more mechanised contractors would pay slightly higher wages because machine operators get higher wages (Figure 23).

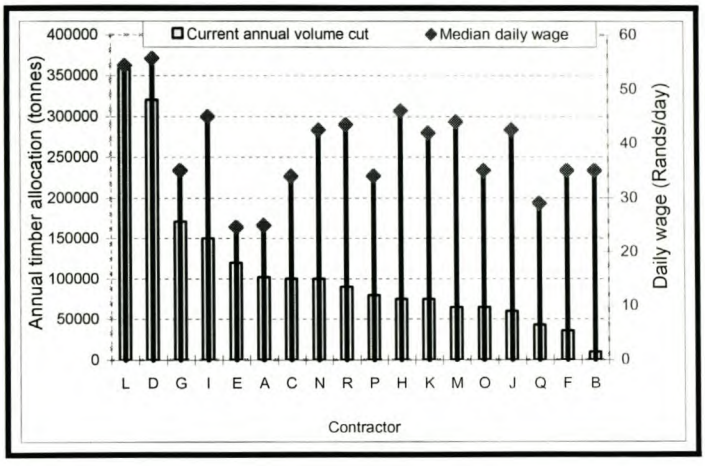

Figure 25: Illustration of the variation in the median daily wages from one contractor to the other amongst the sampled forest harvesting contactors in South Africa.

4.2.2.3 Procedures for remunerating employees

All contractors use a daily rate that is based on task system for remunerating workers and an additional 6 % of the contractors use both a daily rate and a monthly rate. The daily rate is used for all the lower skilled workers and the monthly rate is used for workers in supervisory positions and specialized machine operators (Table 7).

Table 7: Frequency and basis for wage payment amongst the sampled forest harvesting contractors.

Payments frequency	**Percent Contractors**	**Basis for payment**	**Percent Contractors**
Daily	6 %	Monthly rate	22 %
Fortnightly	0 %	Hourly rate	0 %
Weekly	0 %	Daily rate/Task	100 %
Monthly	100 %	Other	0 %
Other	0 %		

4.2.2.4 Incentive schemes

Increased cash payments can be used to motivate and thus can encourage workers to be more productive over the short-term. However, this is unlikely to ensure worker stability in the industry (de Laborde, 1984). Worker stability results from job satisfaction and fringe benefits correctly introduced. According to de Laborde (1984 and 1994), incentive schemes decrease overhead costs in the organisation by increasing productivity. In the study area, 66 % of the forest harvesting contractors have some work incentive scheme in place while 34 % do not.

The reasons for and against work incentive schemes are shown in Table 8; 44 % of the contractors who do not use incentive schemes believe that work incentive schemes are difficult to administer. However, according to de Laborde (1984), administration difficulties can be minimized by using simple methods: e.g., a simple step system with three rates. Another 14 % of the contractors believe that incentive schemes could pose a safety hazard, especially where workers try to exceed work targets. The ILO (1991) confirm these findings, the task system leads to higher rates of accidents because of the drive by the workforce to meet production targets.

Table 8: Reasons for and against work incentive schemes according to the contractors who use and do not use them.

		REASONS	Percent of contractors
Reasons FOR and AGAINST work incentives	FOR	Positive way to achieve production targets	69 %
		Good way to reward individual hard work	31 %
	AGAINST	Difficult to administer	44 %
		Have the risk for compromising safety	14 %
		Salary increases work out better	14 %
		Do not work	14 %
		Employees over-work themselves to achieve and exceed targets	14 %

4.2.2.5 Provision of food rations and worker nutrition

In most developing countries the composition, quality, quantity and the distribution of the food during the day is of concern amongst forest workers (ILO, 1991). In order to

attain high levels of productivity and to keep a good state of health, nutrition must be in balance with the workload. All grower companies in South Africa recognised this in the past and subsequently started feeding schemes and/or providing food rations. However, with outsourcing, this has changed and now 32 % of the contractors stated that they provide food rations and 68 % do not. The reasons for and against providing food rations are shown in Table 9.

Table 9: Reasons as cited by the sampled forest harvesting contractors for and against providing food rations to employees by contractors giving and not giving them.

		REASONS	Percent of contractors
Reasons FOR and AGAINST providing food rations	FOR	Helps in improving productivity	71.4 %
		Money is often spend on none food stuff	14.3 %
		Often work site is too far from homes	14.3 %
	AGAINST	Workers prefer food of own choice	41.6 %
		Ration allowance is built into the wage	25.0 %
		Food ration is shared with the rest of the family	16.7 %
		Issuing of rations is difficult to administer	16.7 %

There is a correlation between food intake and productivity (ILO, 1991). Thus, it is imperative to analyse existing diets of forest workers and improve them where necessary. Table 10, shows the most common food items in hampers given to workers and their nutritional value per 100 g of food. The most common food item is beans and mealie meal.

Experiences elsewhere have shown that some companies over-price the food rations of even poor quality food and bill it against workers wages (ILO, 1991). Not surprisingly, this dissatisfies the workers, hence, in some cases the response that workers are not interested; "they prefer food of their own choice". It is also important to encourage workers to grow their own food crops, and such provision should be made if necessary.

Table 10: Composition of the food hampers (food rations) issued to employees by the sampled forest harvesting contractors in South Africa.

Food	**Percent of hampers containing food item**	**Range nutritional value kilocal/100g (kilojoul/100g) (Source, Langenhoven *et al.*, 1991)**
Beans	83 %	127 - 338 (533 -1415)
Mealie meal	64 %	51 - 381 (217 - 1595)
Salt	50 %	0 (0)
Sugar	50 %	373 - 385 (1561 – 1612)
Cooking oil	37 %	884 (3699)
Soup	37 %	7 - 337 (28 - 1412)
Cooking fat	18 %	904 (3770)
Curry	18 %	325 (1360)
Eggs	18 %	152 - 195 (428 - 819)
Rice	18 %	129 (539)
Soya means	18 %	173 - 416 (725 - 1742)
Tinned fish	18 %	153 – 170 (542 – 744)

4.2.2.6 Workers' committees, union affiliation and work strikes

About 57 % of the contractors stated that they experienced work stoppages due to strikes between 1995 and 1999 and only 20 % between 1999 and 2000. About 28 %, 11 %, and 6 % of the contractors cited the following disputes as the reasons for strikes; wages, task related, poor quality of work and political violence in the area, respectively. However, all the contractors stated that work stoppages due to labour strikes had declined significantly to almost insignificant levels.

On a national scale, there has been a decline in the number of strikes by workers (Figure, 26). According to Andrew Levy and Associates (2001), the year 2000 had the lowest record because most unions in the prominent industries are tied up in longer-term wage agreements. The unions have been more compromising and settlements have been reached without disrupting work. Wage disputes account for the highest cause of most strikes, followed by work grievances (e.g., productivity frameworks, and perceived or real discriminatory practices), dismissal and disciplinary action, lack of

performance recognition at work, and finally restructuring; (i.e., retrenchments and privatisations).

According to Andrew Levy and Associates (2001) the retrenchments, restructuring and outsourcing taking place have been acting as brakes on strikes. The indicators are that the overall trend is down and strike actions will decrease in the medium term.

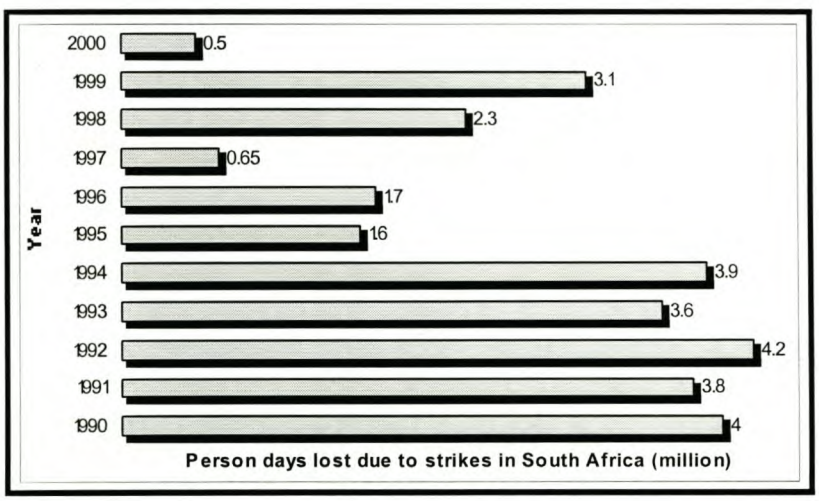

Figure 26: The number of person-days per year lost due to shop floor strike action in South Africa from 1990 to 2000 (Andrew Levy and Associates, 2001).

These results are not surprising because the number of forest harvesting workers affiliated to unions has declined from complete unionisation (before outsourcing) to almost none presently: i.e., only 22 % of the surveyed contractors stated that their workers were affiliated to a trade union. Instead, workers committees have become more popular; 90 % of the contractors stated that their employees had a workers' committee in place. It is interesting to note that workers' committees have grown popular as alternatives to unions. However, 10 % of the contractors who do not have workers' committees in place are of concern. It is increasingly important to note that a vibrant workers' committee is a good vehicle for discussing work related problems, promoting working ethics and improving productivity and safety.

4.2.3 Worker dynamics

4.2.3.1 Work experience

The variables discussed in this section give an indication of worker stability in forest harvesting contractor businesses. Figures 27 and 28 summarises the findings of how long workers surveyed have been in forestry and other industries.

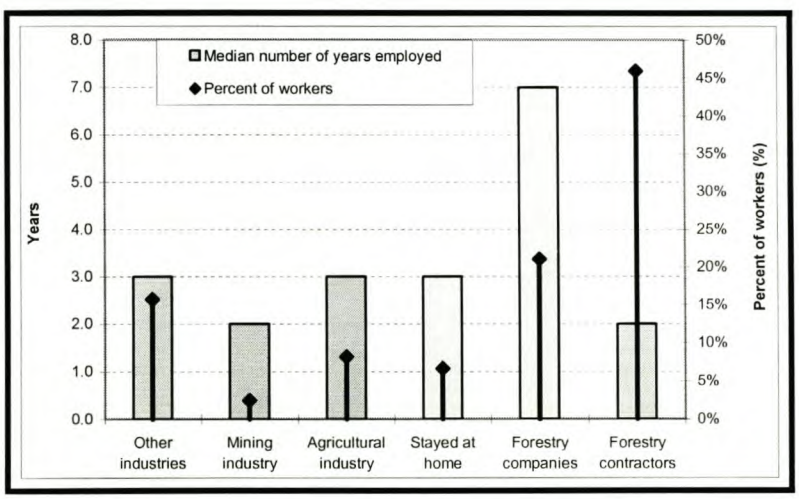

Figure 27: Work experience per industry amongst the sampled forest harvesting employees in South Africa.

About 46 % of the employees have worked for another harvesting contractor other than their current employer, 21 % for a grower company and 16 % in other industries (e.g., roads, fishing and construction) (Figure 27). Some time during their career, 20 % of the workers have taken a break from work and stayed at home for a median time of three years. The reasons cited for staying at home were either health related, personal, or cultural.

Forest employees were more stable with forestry companies than with contractors: i.e., the median number of years with grower companies and contractors is 7 and 2 years, respectively (Figure 27) and the median time spent in the current organisation and in the current job is two years (Figure 28). Contractor K and P and company SA have the most experienced forest harvesting workers (Figure 28). The infancy of outsourcing as a business strategy could skew the results slightly, however, it is important to note that contractors have been in business for an average of 7.5 years (Figure 13).

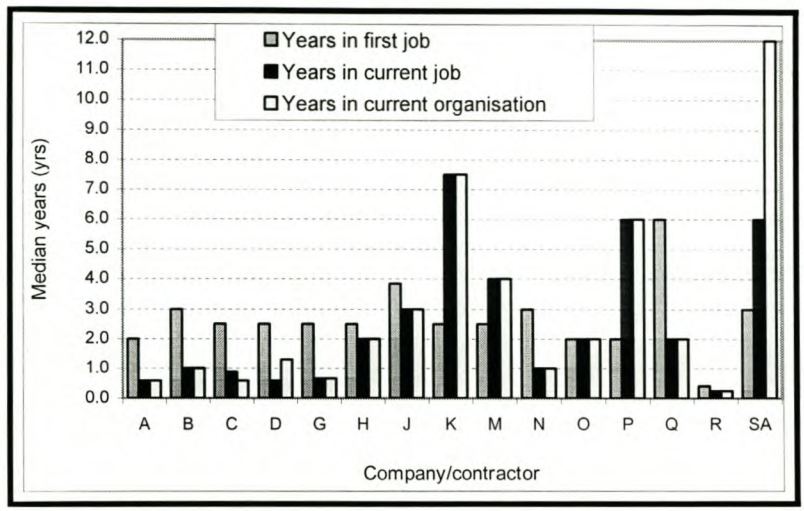

Figure 28: Median years in the first job, current job and current organisation of forest harvesting workers in the sampled forest harvesting contractor businesses.

Figure 29 shows the industry that each of the sampled employees started working for in their first job. Most of the employees started their career either in the forestry industry or other industries.

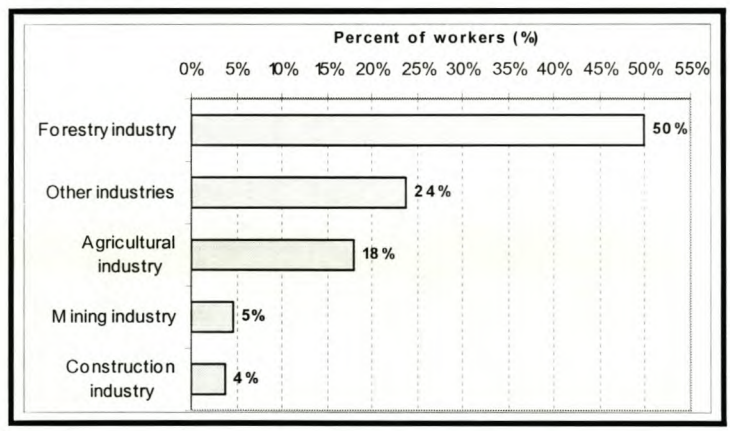

Figure 29: Industries that each of the sampled forest harvesting workers started working for in their first job.

Figure 30 shows the number of companies/organisations for whom each worker currently working in forest harvesting has worked. The higher the number of jobs a person has had, the higher his/her mobility. The majority of the respondents (32 %), have had at least three different jobs in different industries, followed by 31 % who had two jobs.

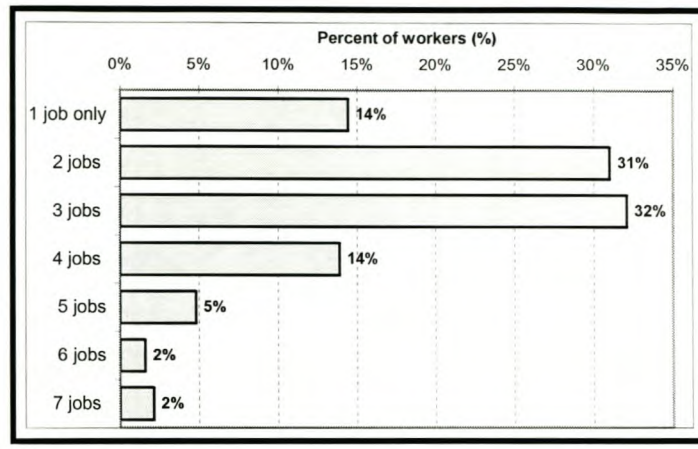

Figure 30: Number of companies/organisations for whom the sampled workers in forest harvesting have worked.

4.2.3.2 Employee reasons for working in forest harvesting

Figure 31 shows the reasons cited by forest harvesting workers for working in forest harvesting. It is evident that the industry is swamped with people who have no other work options: i.e., most of the employees work in forest harvesting because that is the only job they could find.

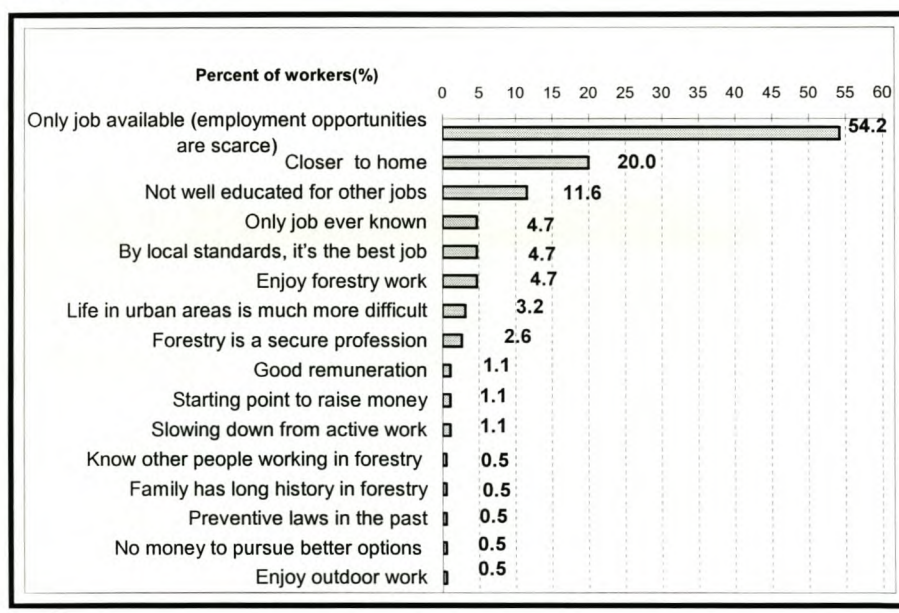

Figure 31: Reasons for working in forest harvesting, responses of the sampled forest harvesting workers in South Africa.

4.2.3.3 Absenteeism, new recruits, dismissals and voluntary resignations

It is important to analyse employee working patterns (dynamics) in forest harvesting, through a review of absenteeism, new recruits (also known as new hires) and resignations. Figure 32 summaries these dynamics amongst the sampled forest harvesting contractor businesses in South Africa. Note, the percentages are based on what contractors estimated to be the percent absenteeism, new recruits, periodic hires and voluntary resignations in their respective organisations. Periodic hires (also known as short term contract employees) are temporary employees often recruited when the contractor has to cut higher volumes of timber at a given time.

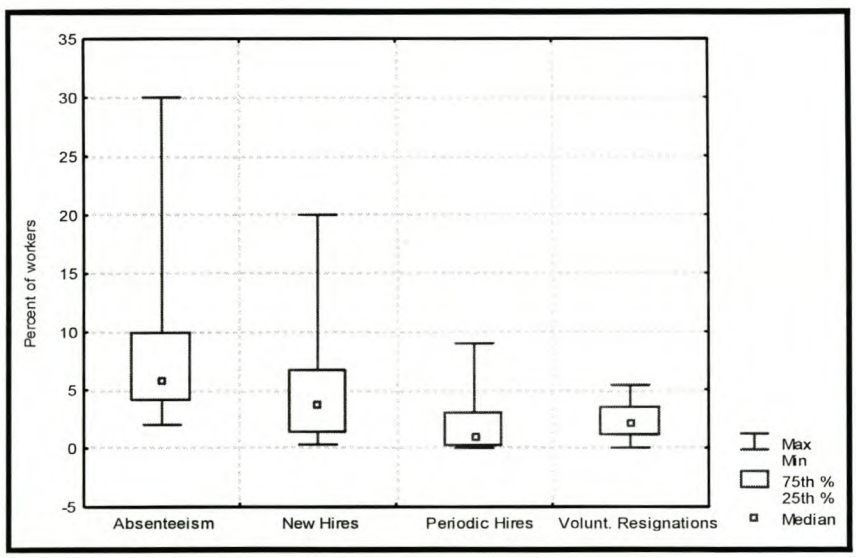

Figure 32: Contractor estimates of percent monthly absenteeism, new recruits, periodic hires and voluntary resignations in forest harvesting contractor businesses.

In South Africa, workforce stability varies amongst the forest harvesting contractors: i.e., certain contractors have a stable workforce and others do not (Table 11). In order of importance, the following factors influence workforce stability: supervision and the management style of the organisation and conditions of employment.

Table 11: Illustration of employee monthly absenteeism, new hires, dismissals, and voluntary resignations per sampled contractor in forest harvesting in South Africa.

		Number of employees	Monthly absenteeism (%)	Monthly new hires (%)	Monthly dismissals (%)	Monthly voluntary resignations (%)
Contractor	L	433	2,00	2,30	3,00	2,00
	I	249	4,00	5,00	0,00	2,00
	D	212	3,50	0,32	0,32	0,01
	C	206	4,00	0,42	3,45	3,50
	E	198	5,00	7,00	3,00	4,00
	B	184	10,00	10,00	9,00	1,00
	G	181	30,00	5,00	1,50	2,50
	H	165	3,00	5,00	0,00	1,00
	N	164	20,00	20,00	1,90	1,00
	A	151	8,00	5,00	2,78	5,40
	P	134	5,00	1,25	0,17	5,00
	Q	121	9,00	2,30	0,00	5,00
	M	105	11,45	6,80	3,40	2,30
	J	95	5,60	0,53	0,12	0,41
	F	81	2,00	0,31	0,00	0,31
	K	80	6,00	2,00	1,73	1,70
	O	76	22,50	7,50	0,33	2,60

4.2.3.4 Workforce recruitment and selection

Table 12 shows the current recruitment and selection practices in forest harvesting. All the contractors recruit workers through word of mouth. Often, this is done through existing employees who pass on the word to family members or members of the immediate communities. Hence, most forestry workers are related and/or come from the same background. About 17 % of the contractors recruit some of their workers at the company gates and 6 % recruit through the local newspapers. These recruitment

methods indicate an abundance of labour supply and indirectly confirm the low literacy levels amongst forest employees.

Table 12: Recruiting methods and selection criteria for forest harvesting workers in South Africa as cited by the sampled forest harvesting contractors.

		Percent of contractors
Employee recruitment methods	Advertise by word of mouth	100 %
	Hire people seeking work at the gate	17 %
	Advertise in the local newspaper	6 %
Employee selection criteria	Prior work experience	100 %
	Should pass probation period	33 %
	Look at the physical attributes	17 %
	Inherited from the grower company	17 %

In this study it was found that the most popular criteria for selecting forest harvesting workers is prior work experience, followed by worker evaluation over a probation period. The probation period could be anything between one week to five weeks depending on the circumstances. The physical attributes of the worker are also an important criteria considered and depends on the nature of the job. If circumstances permit, most physically demanding work is given to muscular people. Some contractors (17 %) inherited most of the workers from grower companies as one of the conditions for rewarding a harvesting contract. As a result, they have had to recruit just a few employees.

A ranking of how contractors choose machine operators is shown in Figure 33. Note that all the contractors use one or more of these criteria hence, the sum of the percentages is greater than 100 %. Promotion by seniority is the most popular approach (61 %). It is a motivational approach. Besides, it provides a career path to crew members. Although, psychometric testing of operators is not widely used in forest harvesting in South Africa, it provides interesting opportunities for future machine operator selection in the industry. The tests are useful in screening the right candidate, who will not be bored with the repetitive nature of the work. According to Kirk *et al.* (1997) formal worker selection (and training) programmes would reduce equipment

down-time repairs and maintenance costs incurred by trainee operators, since formal selection improves the chances that only suitable candidates are employed.

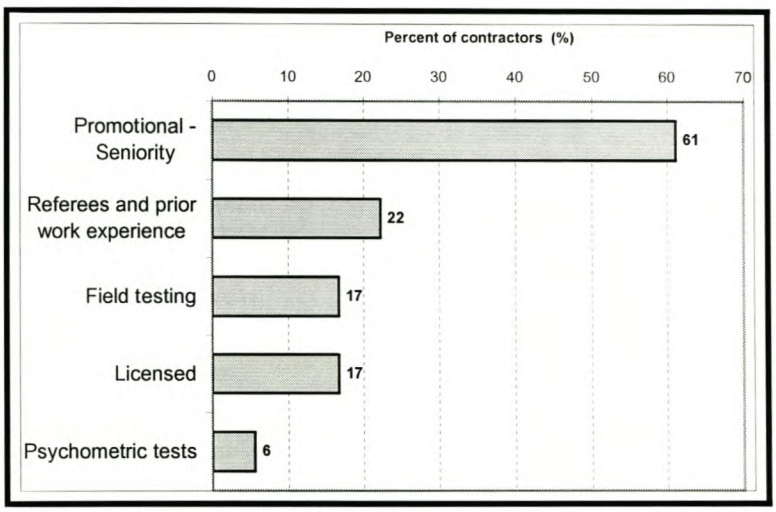

Figure 33: Criteria used by the sampled harvesting contractors to select machine operators for forest harvesting work.

4.2.4 Education and training

4.2.4.1 Training providers

Most workers in the industry received informal or formal training from their previous employer, others have received no training whatsoever, and a small percentage of the employers provide a formal training program. Each contractor uses one or more training providers (Figure 34): 50 % of the surveyed contractors stated that their machine operators are trained by machine suppliers; 44 % are trained in-house; and 45 % use training institutions like Skills for Africa and DH Logging. Note that, some contractors use more than one training provider hence, the sum of the percentages is greater than 100 %.

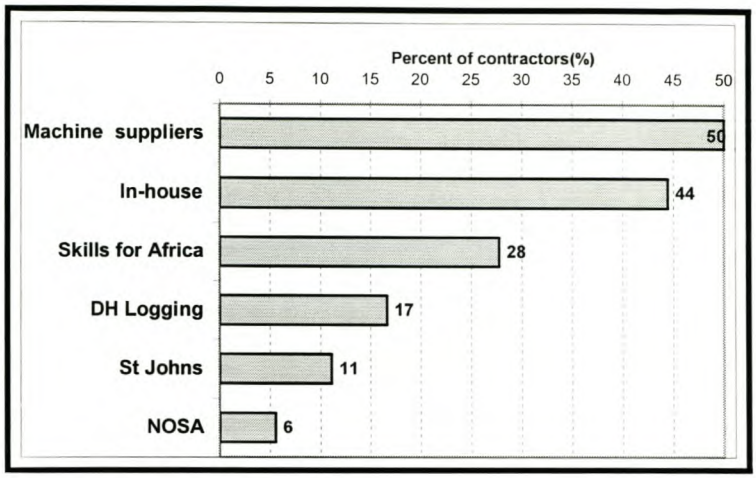

Figure 34: Organisations used by the sampled contractors to train forest harvesting employees in South Africa.

Figure 35, shows the response by survey participants to the question, "who has been involved in your professional training?": 52 % of the workers stated that they have been trained by their supervisors; 20 % by grower companies (before they outsourced); 17 % by fellow workers; and 20 % self-trained. Note, some workers have been trained by more that one person or organisations hence, the sum of the percentages of their trainers will add to above 100 %.

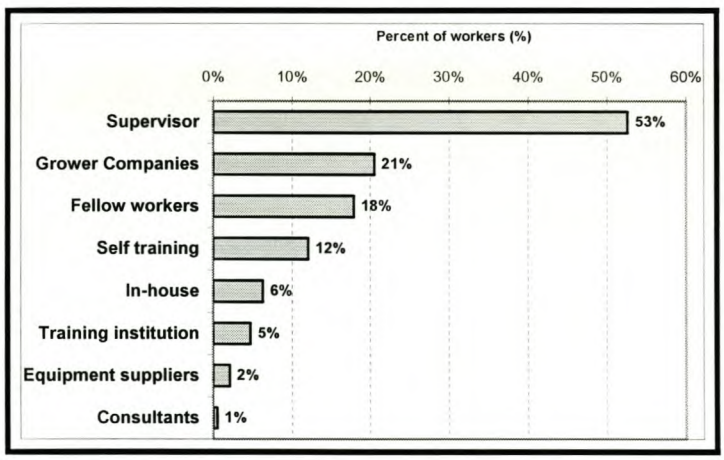

Figure 35: Responses of the surveyed forest harvesting workers on who has been involved in training them.

Institutions like the Skills for Africa, the Skills Academy and DH logging are involved in training of forest workers. Academic institutions have not been able to contribute to

workforce skills development at the lower level in the industry; there is potential for them to get involved through providing extension and basic technology transfer and setting unit standards for the forestry industry.

4.2.4.2 Nature of training

Figure 36 shows the types of training, ranked by popularity amongst employers, that workers currently undergo in the industry. Note, some contractors give more that one type of training hence, the sum of the percentages is greater than 100 %. Work induction is the most popular type; it covers use and maintenance of tools, production requirements and the use of personal protective equipment. Fire fighting, AIDS awareness, technical proficiency and OHS are also very popular. Technical proficiency covers aspects of quality and improved handling of machines and tools.

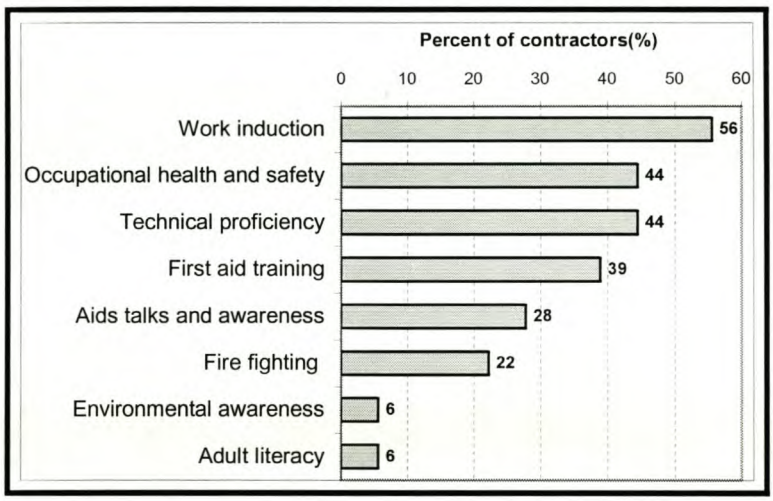

Figure 36: Type of training organised by contractors for forest harvesting employees; response of the surveyed contractors.

Garland (1990), recommends the following types of training for all machine operators: harvesting business, maintenance and control functions, fundamental machine functions, limits of the machines, production behaviour and special techniques, silviculture and site impact, and crew productivity (Table 13). This type of training is recommended for the South African forestry industry.

Table 13: Training recommendations for machine operators in forest harvesting; the concepts and objectives (Garland, 1990).

Training	Objective
Whole concept	Enable workers to know their position in the organisation, the general objectives of the organisation and how their particular jobs fit into the rest of the organisation.
Maintenance and control functions	Enable operators to properly maintain equipment and to become familiar with control functions (i.e., according to the machine manufactures recommendations).
Fundamental functions	Enable harvesting operators to develop skills on a series of fundamental functions (e.g., motor skills, depth perception and ultimately the mental judgments needed in the fuller task of the job).
Limits of machines	To avoid the operator working the machine beyond its limits, this is often the major cause of most repair and maintenance problems. Machine limits should be related to the operating conditions (i.e., terrain, stand characteristics and silvicultural prescriptions).
Production behaviours and special techniques	To increase production and develop techniques that help in solving operational problems –trouble shooting (i.e., these are mental processing and judgments used often by excellent operators). The techniques are often (or should be) passed own by experts, more experienced workers or acquired by trial and error.
Silviculture and site impact	To minimize environmental impacts and conform to silviculture standards. The training varies across the machine operating conditions.
Crew productivity	Combine individual skills such that machines work together and other functions are balanced.

The type of training, design and scheduling of training should be at the pace of the workers (Garland, 1990). Traditionally, training approaches have been based on "a sink or swim" approach; this is based on what the trainers could simulate or put together. The challenge for the contractors is to combine the outcomes-based standards, the capabilities of the individual and the needs of the organisation.

4.2.4.3 Constraints to training

The harvesting contractors interviewed in this study cited the constraints to training presented in Figure 37. It is important to note that scapegoat reasons are often cited for not training. Generically, most organisations view training as an unjustified expense and the training budget is cut first in difficult times. This requires a paradigm shift to develop the needed changes at the operational level.

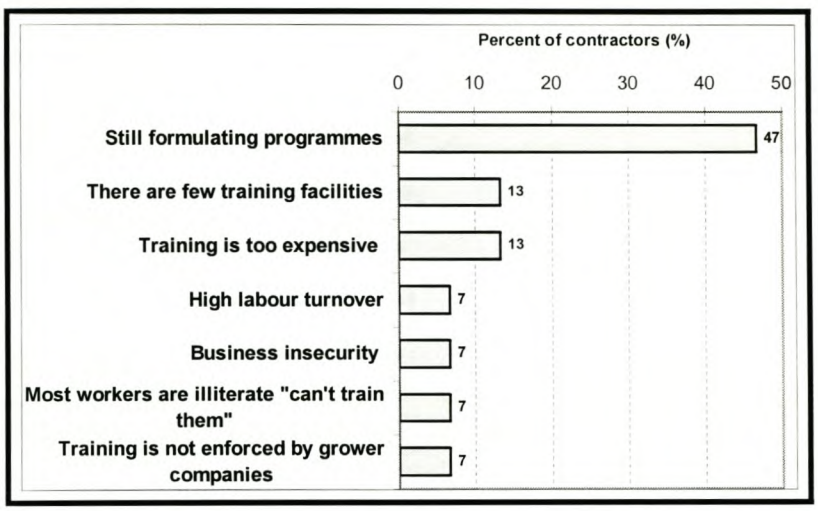

Figure 37: Current constraints to workforce training in forest harvesting as viewed by the sampled forest harvesting contactors in South Africa.

4.2.4.4 Training budgets

Only 29 % of the interviewed contractors have a training budget and a training programme in place (Figure 38). The weighted average training cost per employee per year is R144.44 for the contractors who have a training budget in place, and R41.40 amongst all the contractors surveyed in the study.

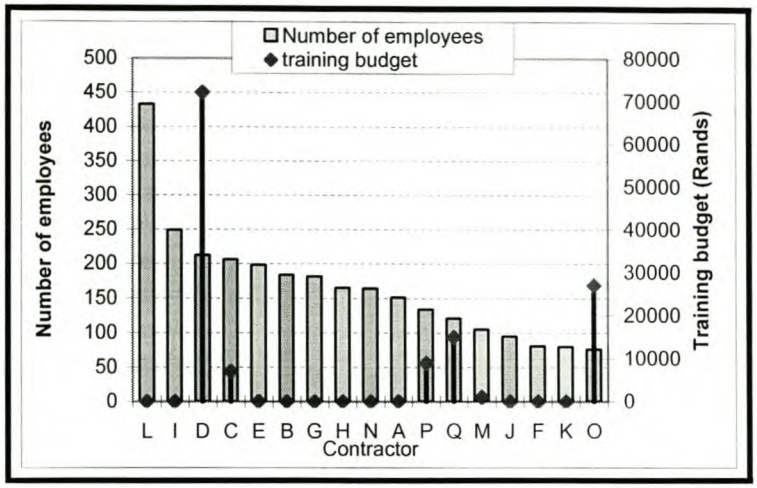

Figure 38: Workforce annual training budget and the number of employees per contractor; responses of the surveyed forest harvesting contractors.

From the results above, it is clear that the magnitude of the gains from worker training (and selection and placement) is not realised and is undocumented. According to Garland (1990), these gains are like the negative hypothesis of safety: i.e., it is difficult to show how the accident that never happened was avoided. Sketchy information shows where gains might be made or losses avoided. For example, well trained workers are most likely to remain in the industry and continue to raise their skills and knowledge levels (Forest Industries Training, 2000a and b; Gibson, 1994).

Most developed countries realised that the need to train forest workers only increases with increasing constraints and operational demands in forestry, and with increasing complexity of forestry equipment (Guimier, 1999). This lead to the development of special institutions (e.g., forest machine schools to educate operators and workers), additional short courses to upgrade training, more instructors and new education methods (Harstela, 1999). Unfortunately in South Africa, most forestry training centres and training departments of grower companies have closed.

The skills development levy institutionalised by the South Africa Government has been catalytic in simulating discussion on training and committing needed resources. However, as is evident in this study, more resources and infrastructure still has to be put in place to realise the targets set by the Government and to measure the overall success of skills development programme in the forestry industry.

4.2.5 Status quo and trends in occupational health and safety

Gibson (1994) distinguishes between safety hardware and safety software. The former covers PPE and the work environment, and the later covers OHS legislation, standards and procedures. The forestry harvesting work environment is noisy, hot, cold, dusty, muddy, weedy and has snakes and nasty insects (e.g., bees) dangers. This makes forest work extremely difficulty and increases the chances of accidents.

4.2.5.1 Occupational diseases

Occupational diseases play a major role in forestry because of the nature of operations, the exposure of workers to dangerous chemicals and the difficult working environments. They result from continuous exposure of workers to unfavourable working conditions and become apparent after a lapse of time. According to ILO (1991) monotonous or strenuous movements, and improper working positions are the most frequent causes of occupational health complaints. The most common complaints are musco-skeletal complaints and hearing impairment caused by noise.

Table 14 shows the most common musco-skeletal problems resulting from work in forest engineering as cited by the sampled forest harvesting workforce. Note that there were no medical tests done to verify these results and detailed discussions on all occupation ailments identified in this study will be left to in-depth studies on the subject by medical professionals.

Table 14: Types of occupational ailments amongst forest harvesting workers according to the interviewed workers.

Complaint	**Percent of workers**	
	Yes	**No**
Back-problems	15.8 %	84.2 %
Sight problems	1.1 %	98.9 %
Hearing problems	0.5 %	99.5 %
Problems with fingers	0.5 %	99.5 %

Back problems could range from spinal problems to muscular problems. In forest harvesting, back problems can be attributed to the nature of the equipment used and

the type of work. Manual workers suffer frequently from back pain while machine operators have neck and shoulder pain. Musculo-skeletal complaints found in forestry mainly affect the lower back because of the physically demanding heavy work and unfavourable working positions (ILO, 1991). Manual loading of timber on to trucks, stacking of logs, log peeling and operating the chainsaw demand bending which exerts strain on the back. Some machines (e.g., the Bell-three-wheeler, haulers and the agricultural tractor) provide very little support to the back. It is common to see worn out overalls as supports on seats of these machines because workers would be trying to improve their sitting positions and add some comfort.

Back problems increase with age and exposure to strenuous work. However, 59 % of the workers who had back problems had less than 5 years of working experience in forestry, followed by 14 % and 27 % who had between 5 – 10 years and 10 – 20 years, respectively (Table 15).

Table 15: Percent of respondents (by age, experience and gender) with back complaints employed in forest harvesting contractor businesses.

Years of forestry work	**Age in years**					
	Under 20	**20 – 25**	**25 – 30**	**30 – 40**	**+ 40**	**Total**
Above 30	0 %	0 %	0 %	0 %	0 %	**0 %**
20 – 30	0 %	0 %	0 %	0 %	0 %	**0 %**
10 – 20	0 % (0:0)	0 % (0:0)	0 % (0:0)	27.28 % (0.17 : 0.83)	0 % (0:0)	**27.28 %**
5 – 10	0 % (0:0)	0 % (0:0)	0 % (0:0)	9.10 % (0 : 1)	4.5 % (0 : 1)	**13.6 %**
Under 5	0 % (0:0)	22.74 % (0.8 : 0.2)	9.10 % (0.5 : 0.5)	27.28 % (0.33 : 0.66)	0 % (0:0)	**59.12 %**
Total	**0 %**	**22.74 %**	**9.10 %**	**63.66 %**	**4.5 %**	**100**

Figure in brackets is the ratio of females to males. The percent is the proportion of the workers who indicated that they had back problems.

These results could mean that back problems are more prevalent than this work shows because workers with back problems may tend to leave forest harvesting and therefore would not be adequately represented in this survey. The ILO (1991) cites back

problems as the main reason why forest workers retire early and/or look for other employment. Note: The detailed analysis of age, experience and gender of the workforce with back problems (Table 15) is based on 16 % of the interviewed employees who stated that they had pack problems. This is a small sample size and the results should be seen as based on a small sample. Additional work needs be done to get a bigger sample size and to keep historical data.

According to the ILO (1991), audiometric investigations done in many countries show that hearing impairment is common amongst forest workers. This can be attributed to high noise levels (above 85 dB(A)) that workers are exposed to for long periods. In this study, 0.5 % of the surveyed workers said that they had work-induced hearing problems (Table 14). Most people do not think they have lost hearing even though they have (ILO, 1991). The FESA ergonomics working group has done much work to improve the ergonomics of most machines and to reduce the noise levels to acceptable levels (FESA, 1998).

Table 14 shows that 0.5 % of the surveyed workers said that they had problem fingers. Problematic fingers could be partially linked to the existence of vibration-induced disturbance of blood circulation, discoloured palms and numbness caused by not using gloves. According to the ILO (1991), problem fingers are common amongst chainsaw operators however, in most countries, it has declined since the late 80's.

The severity of the occupational diseases was measured by assessing whether the worker had sought and received medical help and/or stayed at home for some period because of the problem. About 2 % of the workforce stayed at home because of occupational ailments and 10 % received the required medical assistance. However, it is important to note that most forestry workers use traditional healers for medical related problems and would not necessarily go for conventional medical treatment.

4.2.5.2 Analysis of occupational accident risks - accident frequency

Out of the surveyed workers, 10 % had had at least one accident in their forestry working career. They listed a number of factors as the major causes of the accidents

(Figure 39). Some employees' cited more than one cause of an injury hence, the sum of the percentages is greater than 100 %.

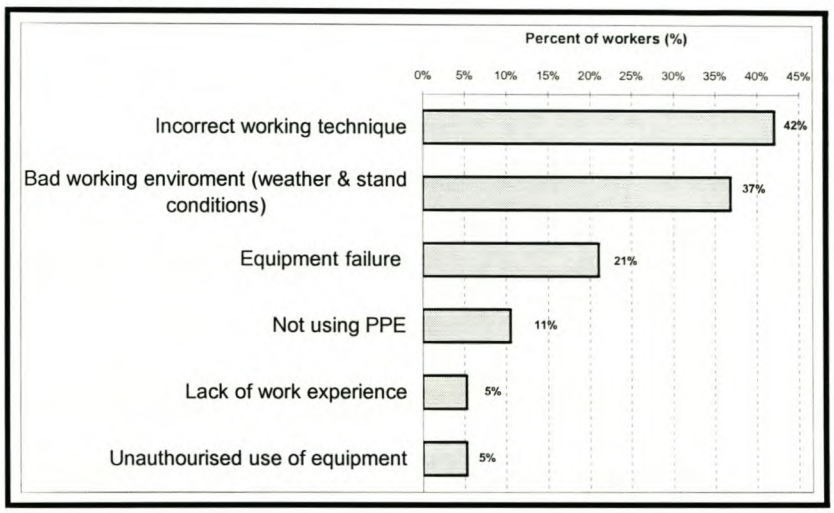

Figure 39: Causes of accidents in forest harvesting according to the surveyed workers in forest harvesting contractor businesses.

4.2.5.3 Analysis of occupational accident risks – accidents per job

Amongst the people who experienced an injury in their career in forest harvesting, manual log debarkers were the worst affected (38 %), followed by truck and tractors drivers (18 %), and chainsaw operators (16 %) (Figure 40).

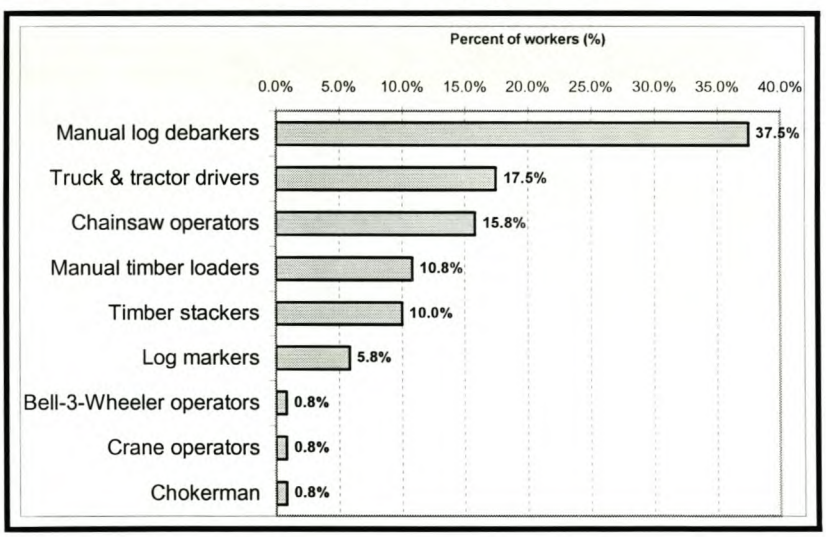

Figure 40: Statistics of injuries amongst forest harvesting workers per job category according to the surveyed workforce in forest harvesting.

These results show that women are at greater risk in forest harvesting, since the majority of manual log debarkers are female. Poschen (1993) also confirms that felling and crosscutting activities are amongst the most prone jobs to accidents in forest harvesting.

4.2.5.4 Analysis of occupational accident risks – equipment and tools

Figure 41 shows the equipment and tools that cause injuries in forest harvesting according to the workforce. The injuries associated with trucks and tractor and trailer units occur when hauling timber and during labour transport, thus injuries associated with these machines could be high because of large numbers of people involved.

Labour transport is a big risk factor to forest harvesting because of the poor state of some of the vehicles used to transport employees, overloading and in some cases over-speeding. These results confirm the findings in the literature that manual and motor-manual harvesting is more dangerous than mechanised harvesting (ILO, 1991; Poschen 1993; Kirk 1995).

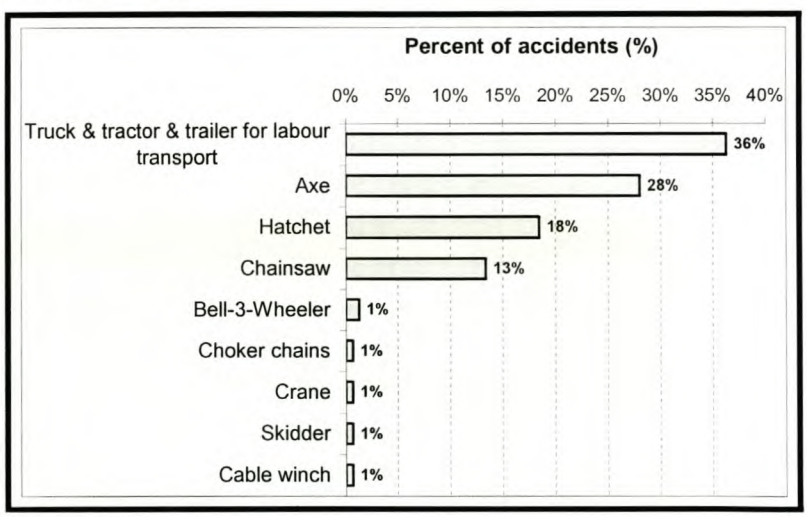

Figure 41: Machines and equipment causing accidents in forest harvesting, according to interviewed workers in forest harvesting contractor businesses.

4.2.5.5 Analysis of occupational accident risks - types of injuries

Data on the type and location of injury provide sound information needed to ensure adequate first-aid provisions, the required PPE, the effectiveness of PPE and type of

preventative measures needed (ILO, 1991; Slappendel *at al.,* 1993). Table 16 shows the location of injuries amongst the forestry workforce (this information is based on OHS data received from grower companies). From the data it is evident that there are three distinct sets of body locations at risk:

- Set A: the hand and wrist, the lower leg, and foot and ankle are the most affected parts (14 % of the accidents occurred on the feet and ankle, 18 % on the lower leg and 21 % on the hand and wrist).
- Set B: the arm (8 %), trunk and abdomen (7 %), eyes (8 %) head and neck (7%), and thigh (9 %).
- Set C: the back and face, 4 % of the accidents occurred on both.

Table 16 also shows a cross tabulation of the types of injuries and the body location. The most common type of injury is cuts and abrasions, on all body parts (40 %), followed by strain and sprains (28 %). Strain and sprains do not affect the upper body. All body parts are affected by at least three types of injuries and the most affected parts are the hand and wrist, and foot and ankle (affected by at least six injury types). The least common injuries are burns and amputations, 2 % and 0.5 %, respectively.

Table 16: Percent of injuries by type of injury and body part amongst forest harvesting workers in South Africa.

Body part	Type of injury								
	Cut & abrasions	Contusions	Strains & sprains	Fracture	Foreign body	Burns	Splinter	Amputation	Percent of total injuries
Hand & wrist	1.78	1.47	5.39	0.00	0.49	0.49	1.47	0.49	**20.59**
Lower leg	8.33	1.47	5.88	0.98	0.98	0.00	0.00	0.00	**17.65**
Feet and ankle	5.88	1.96	4.90	0.00	0.49	0.49	0.49	0.00	**14.22**
Thigh	4.41	0.49	3.43	0.49	0.00	0.00	0.00	0.00	**8.82**
Arm	3.92	0.00	1.96	1.47	0.00	0.49	0.49	0.00	**8.33**
Eyes	1.47	0.00	0.00	0.00	5.39	0.49	0.49	0.00	**7.84**
Truck & abdomen	1.96	1.96	3.43	0.00	0.00	0.00	0.00	0.00	**7.35**
Head and neck	0.98	1.47	0.00	0.00	4.90	0.00	0.00	0.00	**7.35**
Face	1.47	0.49	0.00	0.00	1.96	0.00	0.00	0.00	**3.92**
Back	0.49	0.49	2.94	0.00	0.00	0.00	0.00	0.00	**3.92**
Percent of total injuries	**39.71**	**9.80**	**27.94**	**2.94**	**14.22**	**1.96**	**2.94**	**0.49**	**100**

4.2.5.6 Analysis of occupational accident risks – injured worker age

According to the ILO (1991), forest workers between the age of 30 and 50 years of age tend to have proportionally fewer accidents than younger and older workers. Of the 10 % of the harvesting workers in this survey who stated that they had an accident at some time during their harvesting career, 42 % were between 30 and 40 years, 26 % were older than 40 years, 16 % were between 20 and 25 years, 11 % were under the age of 20 years and 5 % between 25 and 30 years (Table 17). The workers who had the greatest number of injuries had less than five years of working experience.

Note: The detailed analysis of age, experience and gender of the workforce who had work injuries (Table 17) is based on 10 % of the interviewed employees, who mentioned that they had work injuries. This is a small sample size and the results should be seen as based on a small sample. Additional work needs be done to get a bigger sample size and to keep records.

Table 17: Relation between employees who had work injuries and their age, experience and gender amongst the interviewed workers in forest harvesting in South Africa.

Years of forestry work	**Age in years**					
	Under 20	**20 - 25**	**25 – 30**	**30 – 40**	**Over 40**	**Total**
+30	0 %	0 %	0 %	0 %	0 %	**0 %**
20 – 30	0 % (0:0)	0 % (0:0)	0 % (0:0)	0 % (0:0)	11 % (0.5 : 0.5)	**11 %**
10 – 20	0 % (0:0)	0 % (0:0)	0 % (0:0)	21 % (0.25 : 0.75)	16 % (0.33 : 0.66)	**37 %**
5 – 10	0 % (0:0)	0 % (0:0)	0 % (0:0)	10.5 % (0.5 : 0.5)	0 % (0:0)	**10.5 %**
Under 5	11 % (0.5 : 0.5)	16 % (0.5 : 0.5)	5 % (0: 1)	10.5 % (0.5 : 0.5)	0 % (0:0)	**42.5 %**
Total	**11 %**	**16 %**	**5 %**	**42 %**	**26 %**	**100**

Figure in brackets is the ratio of females to males. The percent is the proportion of the workers who indicated that they had a injury at work.

4.2.5.7 Analysis of occupational accident risks – time of accident

Figure 42 shows the injury distribution amongst workers from August 1999 to July 2000 (this information is based on OHS data received from grower companies). The number of injuries decreased as the year progressed from August to December and increased dramatically in January. The sharp increase in January could be due to the Christmas break and the wet weather. It would be expected that the risk of injuries increase in summer when it is hotter and wetter, and lower in winter when it is drier. However, more data is needed to analyse these seasonal variations.

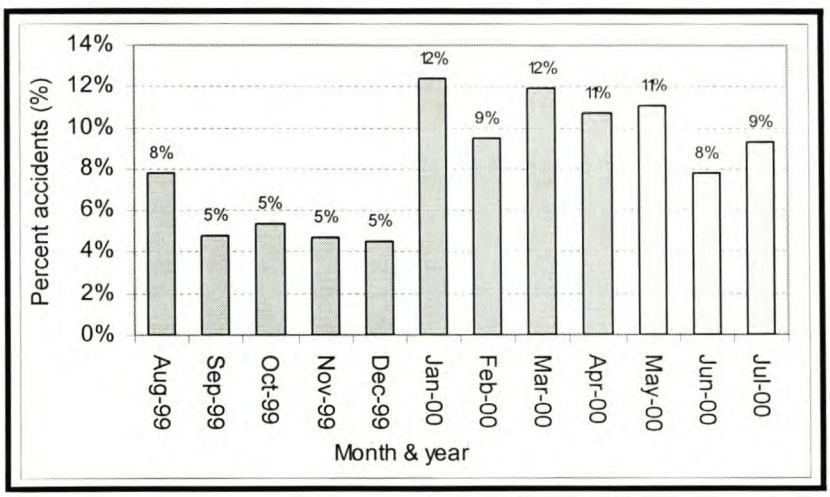

Figure 42: Work injury frequency per month from 1999 to 2000 of the forest harvesting workforce in South Africa.

Accident reports should at least contain the time of the accident, the date, the month and a description of the accident. This information should be used to decide on the times to initiate safety campaigns and when to conduct toolbox talks (Manyuchi and Engelbrecht, 2001). According to Manyuchi and Engelbrecht (2001), toolbox talks are production discussions held between management and the workforce before the start or end of a work shift. Often, they are aimed at discussing environmental issues, production targets and any issues related to informing and equipping the workforce and management with best practices necessary to keep accidents and incidents to a minimum. The later includes the right use of PPE, inspecting tools and equipment to ensure that they conform to stipulated standards; improving working techniques and working methods; detecting and communicating safety problems; and reporting and learning from near-misses and accidents. There was no data to analyse trends in the time of the day of the injury, the variation of the accidents according to the day of the

week and the time of month. However, according to ILO (1991), most accidents occur mid-to-late morning and early-to-mid afternoon, separated by lunchtime. The trend would be different in South Africa due to the work task system used and the lack of scheduled breaks. It is expected that the accident and incident frequency would increase with the length of the hours worked, decrease after Monday and increase towards the weekend and after payday for the following reasons: long hours of work result in fatigue and loss of concentration; and weekends and paydays are often associated with festivities and alcohol consumption amongst workers. This topic needs to be studied further.

4.2.5.8 Personal protective equipment (PPE)

Risks to the worker can be averted by protecting dangerous parts of machines and tools, by using safe working methods and techniques, and by separating the worker from the source of danger (ILO, 1991). If these measures fail to provide enough protection, PPE are recommended. Injury statistics show which jobs, tools and machines are dangerous and which parts of the body have to be protected (Figures 40 and 41, and Table 16). The use of PPE was also discussed with the workforce and assessed (Table 18 and 19). The worker either has (Yes), does not have (No) or does not need (Not needed) PPE for the specific job.

Table 18: Evaluation of the use of PPE in forest harvesting amongst the surveyed workforce in South African forest harvesting contractor businesses.

Personal protective equipment	**Percent of workers**		
	Yes	**Not needed**	**No**
Overall/work suit	64.7 %	2.6 %	32.6 %
Gloves	67.9 %	15.3 %	16.8 %
Ear muffs or ear plugs	15.8 %	74.2 %	10 %
Leg protectors	25.8 %	67.4 %	6.8 %
Hard hat (helmet)	90.5 %	4.2 %	5.3 %
Helmet with visor or safety glasses	15.8 %	82.6 %	1.6 %
Safety boots	99.5 %	0 %	0.5 %
Chainsaw operators trousers	15.8 %	83.7 %	0.5 %

These results (Tables 18 and 19) raise three issues of concern:

- the workers who are not issued with PPE by the contractors. There are between 2 % and 33 % of the workers who do not have hard hats, earmuffs or ear plugs, leg protectors, gloves, helmet with visor or safety glasses, chainsaw operators trousers or overalls.
- those who are not using their PPE (Table 19). Between 1 % and 4.1 % of the workers are not using their helmets, leg protectors, safety boots, chainsaw operator trousers or overalls. This could be due to any of the following reasons: lack of an appreciation of the safety practices at work; lack of supervision; discomfort caused by PPE (i.e., too heavy and too hot); forgetting them at home or only having one pair which has to dry overnight after a rainy day at work.
- the conditions and size of PPE; some of the PPE used by workers are in a worn-out state and in some circumstances dirty. According to Poschen (1993), there is a lack of appropriately designed PPE for women. Observations of female harvesting employees in this study confirm this finding.

Table 19: Illustration of the extent of employees who have PPE but not using it amongst the surveyed forest harvesting workforce in South Africa.

Personal protective equipment	**Percent of employees**
Overall or work-suit	4.1 %
Chainsaw operators trousers	3.3 %
Leg protectors	2 %
Helmet	0.6 %
Safety boots	0.5 %
Ear muffs or ear plugs	0 %
Gloves	0 %
Helmet with visor or safety glasses	0 %

Table 20 shows the issuing pattern of PPE adopted by the contractors in forest harvesting. According to the OHS Act (1993), employers are expected to provide PPE to their employees. Whist there is a 100 % (Yes) response to this practice (Table 20), there are some irregularities on the issuing frequency and patterns.

Table 20: The response of the surveyed forest harvesting contractors to general practices on employee PPE.

OHS attribute	Percent of contractors	
	YES	NO
Issue protective clothing to the employees	100 %	0 %
Give regular training on the uses of PPE	100 %	0 %
PPE is used by the workforce as intended	100 %	0 %
Use of PPE amongst the workforce is mandatory	100 %	0 %

The contractors have a number of differing basis for issuing PPE (i.e., some of the contractors use more than one of these basis): 61 % of the contractors issue PPE on needs basis; 44 % annually; 33 % bi-annually; and for 22 %, the employee pays 50 % of the cost and the employee the remainder ("50/50"). The "50/50" basis means that if the PPE wears out before the issue date, the employee has to contribute to the cost of the PPE; the contribution is a certain percentage deemed necessary by the contractor. The latter "50/50" approach is illegal. According to the OHS Act (1993), all employers should provide the appropriate PPE to their employees.

4.2.5.9 Work safety organisation

Safety awareness and having the proper documentation is one of the indicators of good OHS practices. Safety awareness is high amongst both the contractors and the workers (Table 21 and 22).

Table 21: Responses of the sampled forest harvesting contractors to OHS practices in forest harvesting in South Africa.

OHS attribute	Percent of contractors	
	YES	NO
Causes and preventative measures of accidents are discussed	100 %	0 %
OHS training is part of the induction training	100 %	0 %
Hold toolbox talks	100 %	0 %
OHS representatives in place	100 %	0 %
Section 16.2 appointee in place	100 %	0 %
Have a copy of the OHS act	100 %	0 %

All the contractors have a copy of the OHS Act, they confirmed that the use of PPE is mandatory and they all give "tool box talks". However, only 90 % of the contractors agree that PPE are used as intended. All contractors have a 16.2 appointee as required by the OHS Act (1993). A 16.2 appointee is someone who is responsible for all safety matters in the organisation. Often the appointee is the contractor himself or someone senior in the organisation, while some contractors have a dedicated safety officer to look after safety issues of the organisation.

All workers attend toolbox talks, they all know their crew safety representative and they have all been trained and provided some information on OHS in their current organisation (Table 22).

Table 22: Responses of the interviewed forest harvesting workforce to OHS practices in South African forest harvesting contractor businesses.

Attribute	**Percent of workers**	
	Yes	**No**
Trained and provided info on OHS	100 %	0 %
Had an injury or accident in forestry work	10 %	90 %
Attend all toolbox talks	100 %	0 %
Know the crew safety representative	100 %	0 %

4.2.5.10 Costs of accidents and incidents in forest harvesting

There are no standard models for calculating work accidents and incidents (near misses cost) in the industry. However, there is agreement that accidents and incidents have a direct and an indirect cost. On average, R23 590 593 worth of compensation claims annually, are paid by the South African Department of Labour (Figure 43) to employees who get injured in the timber contractor operations. (These are real values calculated using forestry price indexes (FPI) with base year 2000. Source FPI, Statistics SA, 2001).

Appendix C shows a proposed costing model to highlight essential components necessary to analyse the real cost of accidents and incidents in forest harvesting.

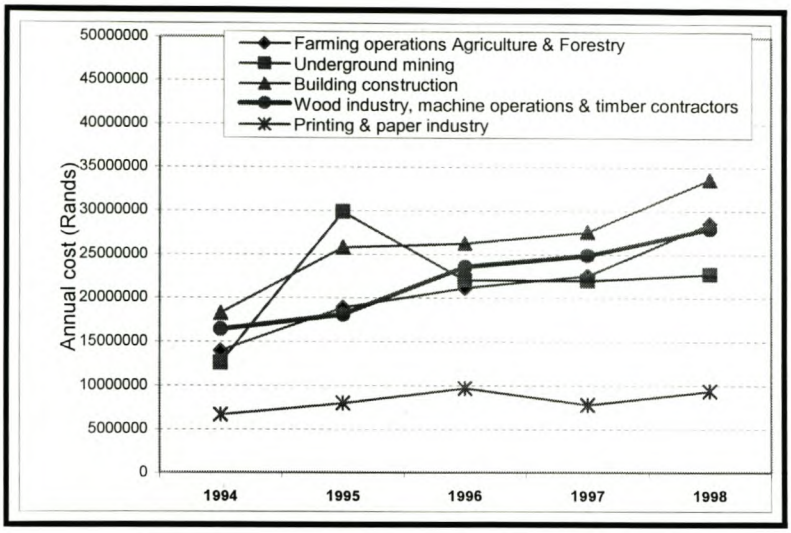

Figure 43: Real compensation claims paid by the Department of Labour for selected industries expressed in 2000 values. (Source: Department of Labour, 2000).

The results on the workforce situation in forest harvesting in South Africa have promoted the drawing of a "smart-safe-work" programme (Table 23) (Grandjean, 1990; FAO, 1992; Kirk and Parker, 1992; Manyuchi and Engelbrecht, 2001; Poschen, 1993; Apud and Valdes, 1995; Kirk, 1995; Kirk *et al.,* 1996; Kirk *et al.,* 1996). The primary aim of the programme is to make forestry work much safer. Furthermore, Figure 6 showed that any safety intervention requires a holistic approach. According to Poschen (1993), with any form of safety intervention, safety starts with management of the organisation. Safety should form an integral part of production planning and the work organisation (ILO, 1981; ILO, 1991; OHS Act, 1993).

Table 23: Important interventions to make forest harvesting work safer - "smart-safe-work programme": a recommendation.

Situation in forest harvesting	Intervention	Intervention recommendation
Most accident/incidents causalities are new employees & less experienced workers	Training	Minimum training requirements required for all forest harvesting employees
		Certification systems to test competence
		Use of mobile training units and training on site
Framework, regulation and control	Regulations and law	Occupation health and safety act
		Application of codes of practice
		Safety audit system or safety inspections to test compliance
		Self-assessment programmes
Occupation health problems prevalent amongst the forest harvesting workforce	Work organisation	Job rotation
		Overlapping shift schedules,
		Team work and safety incentives
		Toolbox talks
Accidents high amongst unfit, dehydrated & malnourished workers	Worker nutrition, dehydration and fitness	Provision of meals and food at work.
		Provision of water and energy supplements
		Awareness programmes on good living patterns, nutrition and fluid consumption
		Introduction of work fitness programmes
Unprotected workers are more prone to accidents	PPE	Use the correct PPE
		Monitor the use of PPE
		Issue comfortable and fitting PPE

4.3 The technology in forest harvesting and its forecast

What are some of the factors affecting decisions concerning systems and methods of wood harvesting? The contractors and technical staff of grower companies were asked questions on technology and systems to evaluate their understanding of harvesting/transport systems, their technology focus and to determine factors influencing technology in the industry. Figure 44 shows the ranking of what they

believe to be the major factors influencing the current and future technology in forest harvesting.

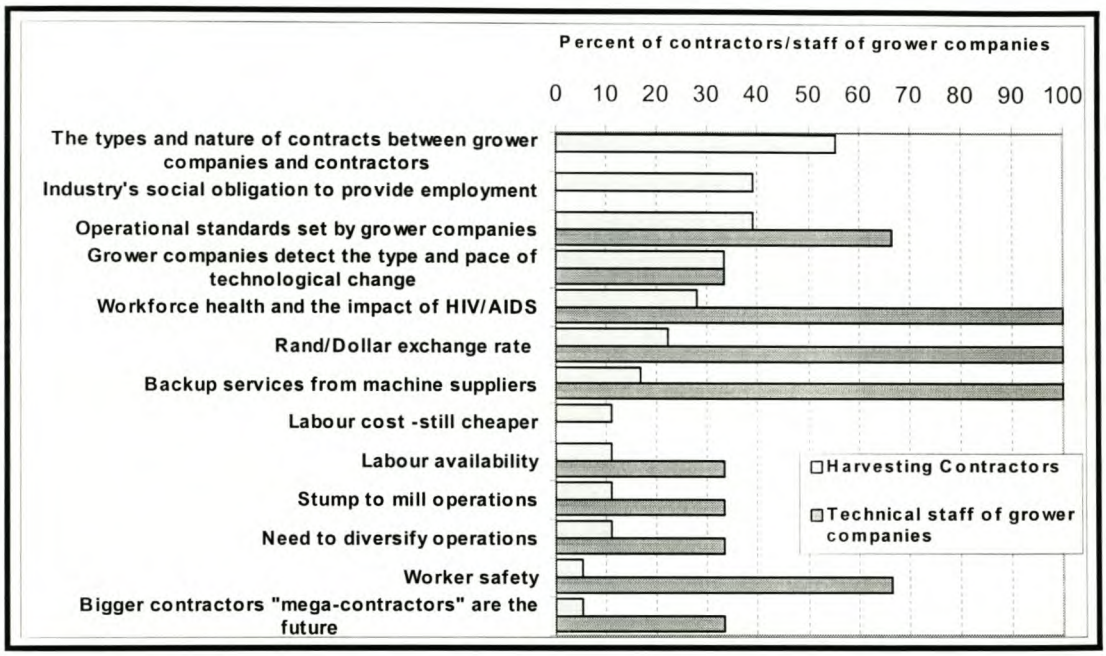

Figure 44: Factors influencing the current and future technology in forest harvesting in South Africa: contractor and grower company technical staff opinion.

Contractors and technical experts from grower companies have differing views on what are the factors influencing current and future forest harvesting technology. This could be due to the following reasons:

- differences in planning horizons between the grower companies who have long term horizons of their business and contractors tend to roll from year to year often associated with the length of their contracts;
- differences in exposure to strategic issues; and
- the growing operational knowledge gap between the contactors and the staff of grower companies (Figure 3).

Contractors believe that the future technology depends on the nature of contracts they have with grower companies and that they have a moral obligation to provide employment to local communities. Thus, their operations have to be labour intensive. Whereas, staff from grower companies believe that worker health due to the HIV/AIDS epidemic, the Rand exchange rate with major currencies and backup from machine

suppliers will have a greater influence on the future technology. These points will be discussed individually below.

According to the contractors the nature of contracts (volumes to cut, contract period length and the type of operations) allows the grower companies to stop production due to mill shutdowns or other reasons. According to Riddle (1995) a contractor with higher capital commitments will not be able to survive shutdowns. In addition, flexibility in a mechanised operation is reduced if production has to be decreased. However, grower companies would urge that this was one of the reasons for outsourcing; contractors can be started and stopped as mill timber requirements fluctuate.

Time-scale is a major factor in technology (Porter, 1990; Twiss, 1992). Most of the contracts between contractors and grower companies are one year long and in exceptional cases three years long. This short time frame does not allow for strategic planning by contractors. It also makes it difficult for contractors to apply for loans from financing institutions because they often require greater security in the form of long-term work contracts. This exerts pressure for immediate financial returns, leading to short-term orientations amongst contractors.

Availability or scarcity of labour for forest harvesting work associated with worker health and HIV/AIDS, is regarded as one the most important factors influencing technology changes in forest harvesting in South Africa by staff of grower companies. The extent and impact of this on forest harvesting is not fully understood. More studies should be done to understand it.

About 40 % of the contractors believe that they have a moral obligation to provide employment. This is significant because South Africa has a high unemployment rate. The highest unemployment is in rural areas where most forestry operations are based. If a narrow definition (the narrow definition of unemployment includes people who are not working and actively seeking work) of unemployment is used, South Africa has an unemployment rate of 23 % and if the broader definition is used (including discouraged job seekers), the unemployment rate is about 38 % (Klasen and Woolard, 2000). Therefore, its important that the forest industry engage and support the national

imperatives as specified by the South Africa Government, to create employment and to eradicate poverty.

Quality of work (measured by fibre recovery, residual stand impact and soil compaction), productivity and workers' safety are some of the standards set by grower companies. Contractors realise these factors as variables that will influence their current and future technology. This implies that contractors will be forced to seek innovative and best technologies to provide quality services. In addition, integration/diversification of operations is also an important consideration for technology focus. Presently, most contractors are involved in stump area operations or just haulage. Most contractors envisage integrating stump area operations with short- and long-hauling, for economic and logistic reasons.

5 Conclusion and recommendations

5.1 Conclusion

A framework for analysing workforce dynamics was presented and tested in forest harvesting in South Africa. The workforce in forest harvesting is stable. However, the concerns in forest harvesting are: high instability in some individual contractor businesses; and the contractors who are not measuring and monitoring it. As a result, it is difficult to ascertain with certainty the cost of labour turnover and other labour dynamics in forest harvesting. This study established that: the forest workforce was much more stable with private grower companies than presently with contractors; labour turnover rates depend primarily on the conditions of employment offered by the contractor with better conditions resulting in lower rates; and labour volatility is highest amongst manual log debarkers and stackers. Manual log debarkers and stackers constitute 66 % of the workforce in forest harvesting and are amongst the lowest paid jobs earning an average of R27.50 and R26.00 per day, respectively.

These findings should be of concern to decision makers in forest harvesting. Efforts should be made to put appropriate immediate, short and long term measures in place to reduce labour turnover and absenteeism and to manage them. The labour turnover model in Figure 5 is recommended to achieve these objectives. This would include developing measuring and monitoring systems; cohort measures -to measure survival and wastage rates, in conjunction with the method that was used in this study - interviews with current employees and exit interviews.

There is no doubt that the forestry industry has to take worker training and skills development more seriously. It relies on supervisors and fellow workers to provide training. The current weighted average training investment per employee is only R41.40 per year. Training should be recognised as an investment in human capital. The industry needs to overcome the training constraints cited by the harvesting contractors. In addition, it has to formulate training objectives and build them into programmes. It is recommended that the contractors and grower companies fully engage potential training partners (e.g., forestry associations, academic institutions, the government, machine suppliers and consultants) and commit the necessary

material resources to meet these training objectives. Performance checks and feedback systems have to be developed, and the results communicated back to the partners.

There are no coherent worker selection programmes in forest harvesting in South Africa. However, all the contractors stated that they would employ candidates with prior worker experience, whilst some give a probation period and others use field tests for worker selection. The financial losses faced by contractors because of choosing inappropriate workers, and thus increased equipment repairs and maintenance costs and production losses, are potentially significant. It is recommended that contractors develop functional production databases to track the performance of machine operators and incorporate them into business decision models for tactical and strategic planning.

This study found that the axe, hatchet and the chainsaw are still associated with a high number of injuries in forest harvesting and that injury age range in years of the workforce depends on the age distribution of the workers. In addition, the levels of work experience of the workers, the nature of work, level of education and the exposure of the workers to danger could influence these results. There seems to be high awareness and knowledge of occupational health and safety amongst forest harvesting contractors and employees. However, injury statistics are still high with the average annual compensation claims being about R23 600 000. The use of PPE and issuing pattern of PPE does not confirm high commitment to safety. The issuing of PPE is still viewed as a cost by most contractors, hence the ad-hoc and illegal approaches.

There is a technology literacy problem in forest harvesting in South Africa. Furthermore, the short-term contracts and orientation between grower companies, contractors and machine suppliers are technologically costly because all partners are looking for short-term gains. It is recommended to have long-term close relationships. Efficient operations, particularly in mechanised operations, will only develop if guarantees of continuity of work are offered and backup services are good. However, it is encouraging to see that contractor volume allocations have increased at an average rate of 8.1 % per year over 7.4 years.

This study's hypothesis was that it is the people and the technology that will influence the competitiveness and sustainability of forest harvesting in South Africa. If the current profiles of workforce and technology are used as the focal point, the following scenarios can be developed: "Techno Scen" (highly competitive and mechanised businesses); and "Bantu Scen" (highly competitive and labour-intensive semi-mechanised businesses). (Bantu is a Nguni word, which means people). The terminology "scenario" here is used in the sense that they are presumed outcomes of how the future might unfold.

The important precursors for the "Techno Scen" are higher workforce academic qualifications; more specialized training; better salary and improved conditions of employment; increased technology literacy; longer term contracts amongst grower companies, contractors and machine suppliers; and solid contractor business structures and for the "Bantu Scen" are: improved academic qualifications; training and retraining; improved conditions of employment; increased technology literacy; longer term harvesting contracts; and sustainable and equitable contractor business.

Mechanising forest harvesting operations ("Techno Scen") in South Africa would mean laying off all the lower paying jobs in forest harvesting (manual log debarking, manual stacking, felling assistants, clerical work, general hands, chokermen and log marking). This means cutting off about 78 to 90 % of the current South African forest harvesting workforce. It could reduce most of the accidents in forest operations that occur during felling and delimbing because 40 % of the accidents occur in manual log debarking and felling with a chainsaw. However, it might induce problems of a differing nature. This would include machine operator exposure to high noise levels, boredom due to repetitive work, longer learning curves, and shoulder and back injuries. At industry and national level, this would increase unemployment and poverty and other related social-economic problems.

The underlying variable in the "Bantu Scen" scenario is the national imperative to create employment and to reduce poverty. The current workforce in forest harvesting needs to be effectively managed and developed in order to realise the Bantu scenario. However, HIV/AIDS could offset this scenario pushing it towards the "Techno Scen".

The AIDS pandemic could be managed through improved conditions of employment, fitness programmes, nutrition and AIDS awareness programmes.
It has been demonstrated that competitive growth and sustainable development in forest harvesting will depend on how technology and human capital are exploited and managed. The value in people (human capital) needs to be nourished. One of the objectives of the study was to seek and provide a systematic methodology for measuring and analysing the people and the technology in forest harvesting. It was ascertained that measuring the contractor/grower company interface to establish the worker and contractor profiles and forecasting the technology using the research framework presented in Figure 1, provides a better understanding of the subject. It provides a holistic outlook of all the important facets that should be considered in making strategic decisions in forest harvesting.

The information gained from analysing the profiles of the workforce and technology should aid in decision-making, remove uncertainties and help in building a sustainable competitive advantage in forest harvesting. However, a number of preconditions have to be met first regardless of the scenario followed ("Techno Scen" or "Bantu Scen"), amongst them: a reduction in wage disparities; a change in the nature and length of harvesting contracts; contractor and employee skills development; improvement in employee conditions of employment; increased job security; better management of the human and technology interfaces; and an increase in contractor and staff of grower companies technology literacy.

5.2 Recommendations for future work in forest harvesting

This study could not answer all the questions that were asked in the research. Therefore, the following additional research projects are recommended.

(a) The human focus model and the intangible asset monitor (Figure 4) presents valuable measures for human capital. Most of the indicators presented in this model were used to assess the workforce. The results were presented and discussed. For future work, the profiles of contractors and staff of grower companies should be studied using this model. The following additional individual competences not covered in the

model should also be measured: the portion of professionals, leverage effect, profit and value added per employee, and profit and value added per professional.

(b) Forest harvesting workers could be in a poor state of health, undernourished or dehydrated. Poor nutrition and dehydration results in early onset of fatigue, reduced concentration, reduced coordination and poor decision making ability, which increases the risk of accidents and health disorders. Few contractors provide supplementary food rations to improve worker nutrition. The food rations are relatively low in nutritional content. On the other hand, South Africa is trying to move away from paternalistic employment methods. Employers are recommended to pay cash to the workforce not kind money. The wages for forest harvesting employees are very low, thus little money would be available to buy food. It is recommended that worker nutrition and dehydration be studied as soon as possible. The study should quantify the net workforce energy and fluid balance by comparing intakes to expenditure.

(c) It appears that outsourcing in the forestry industry has not been a critically thought out process. Grower companies did not systematically think over certain key issues which now stand as major risks in the industry: lack of availability and development of skills as a result of closure of major training centres; technology acquisition and exploitation; contractor selection and development and sustainability of contactor businesses.

- The scope of this project was limited to medium and large contractor enterprises in forest harvesting. It is recommended that a study that includes emerging contractors be done. There is enough evidence to suggest that these contractors have a more challenging workforce and technology situation that what was presented here.
- It was shown that forest harvesting contractors are growing in size and chances are good that the trend will continue in future. However, there is still need for a better understanding of partnering, equity and what it means to be professional amongst the contractors and the grower companies. Additional work in this regard should include criteria like: business processes and economies of scale, business development, balance of power between the large forestry companies and the contractors, quality of products, efficiency, costs and rates.

(d) & (e) It is difficult to compare OHS statistics amongst the grower companies and the contractors. It is even more difficult when comparing with other industries and other countries. It is recommended that forest harvesting through FESA, draw up a health and safety monitoring system to capture accident statistics. The system should include injury statistics linked to body location, causal tools and equipment, and time (season, month, day of the week and hour of the day) and accident severity (near misses, lost time (how long), and death). It should include health and safety indicators, recall interviews and personal information (e.g., personal background, training and educational qualifications and mobility patterns) to give a holistic understanding of the subject. This information should be communicated across the industry and awareness programmes built and implemented.

In addition, the industry needs to look at new safety initiatives. Commendable are programmes in New Zealand by Forest Industries Training on the influence of the use of alcohol and drugs amongst workers (Forest industries Training 2000b).

(f) There are other factors that can influence the competitive advantage of forest harvesting in South Africa specifically the impact of HIV/AIDS and certification. These factors need to be investigated and their impact modelled.

(g) There is little basic or applied research in forest harvesting amongst the contractors and the grower companies in the country: i.e., developing new equipment and systems, progressively testing and monitoring technology, and communicating and exchanging technology. Any research that has been done has been ad hoc. It seems that forest harvesting in South Africa is trying to maintain a wide range of disparate and inappropriate technologies, which cannot be sustained, and it is depending on aging technology that is almost reaching technological obsolescence. More research work needs to be directed towards the basic and intermediate technology category (as shown in the appropriate technology model for South Africa). This, together with results from work on advanced technology, would help the industry in understanding technology for South Africa: i.e., often referred to as local solutions in some circumstances.

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7 Appendices

7.1 Appendix A: Field Assessment Checklist

Technology and Contractor/Worker Profiles in Forest Engineering; KwaZulu Natal, (South Africa)

Assessment Checklist

July 2000

Killian Tendai Manyuchi
Faculty of Agricultural and Forestry Sciences (Forest Engineering)
University of Stellenbosch

Date:

Name of contractor:

Location (current operations):

Physical address:

1 PERSONAL DETAILS					[WORKER]
1.1 Gender:					1.4 Where do you come from?:
1.2 Race group:	African	Coloured	Indian/Asian	White	1.5 What is your age (or date of birth)?:
1.3 What is your ethnic group?:					1.6 What is your marital status?:
1.7 What is your current job:					how log have you been on this job?:
1.8 How long have you been working for this organization?:					
1.9 What was your first job (note when, where)?:					
1.10 What is your employment history (*note industry, duration, geographical location and reasons for changing*)?:					
1.11 Why did you join forestry?:					

2 CONDITIONS OF EMPLYOMENT	Yes	No
2.1 Do you stay in: company accommodation//own house//other *(specify)?:*		
2.2 What mode of transport do you use to get to work site?:		
2.3 What is your monthly income (*take home*) (*or specify other work benefits*)?:		

3. EDUCATION AND TRAINING			
3.1 What's your highest completed school qualification?:			
3.2 Have you ever received any first aid training (*note specifics*)?:	Yes	No	
3.3 Have you ever received any training from: Fellow Workers **{Yes / No}**; Supervisor(s) **{Yes / No}**; Self-training **{Yes / No}**; Machine supplies **Yes/No}** ..... Consultants **{Yes / No}**..... teaching institutions **{Yes / No}**.....Contactors **{Yes / No}**..... Training Department (in-house) **{Yes / No}**, Other..... *(specify, nature, duration and refresher training*):			

4 HEALTH AND SAFETY							Not needed	Yes	No
4.1 Have you ever had any serious accident at work (in forestry)?									
4.2 What happened?:									
4.3 As a result of your work, do you suffer from any physical problems e.g., back problems, sight, hearing *(specify)*?:									
4.4 Do you ever stay off work due this problem?:									
4.5 Do you get medical assistance for the problem?:									
4.6 Were you ever trained or provided with information on safety at worksites *(specify)*?:									
4.7 Do you know your safety representative?:									
4.8 Do you attend health and safety meetings/talks, how often?:									
4.9 Do you receive protective clothing from your organization (*specify*)?:									
4.10 Personal protective equipment	Not IU	Not ND	Yes	No	Personal protective equipment	Not IU	Not ND	Yes	No
Overalls/work-suit					Leg protectors				
Chainsaw operator trousers					Ear muffs or ear plugs				
Helmet with visor or safety glasses					Helmet				
Gloves									
Safety boots									
Key: Not IU –not in use, Not ND –not needed									
5 GENERAL									
5.1 Is their a workers committee in this organization?:									
5.2 Which workers union do you belong to is it active?:									

1 GENERAL BACKGROUND									[CONTRACTOR]
1.1 Race group:	African	Coloured	Indian/Asian	White	1.2 Gender?:	F	M	1.3 Age?:	
1.4 What contracting operations are you currently involved in (*note if harvesting only or intergrated*)?:									
1.5 How long have you been a contractor, what is your contracting history (*note: duration, nature of operation, geographical location*)?:									
1.4 What is your annual volume cut *(note units)?:*									
1.5 How many crews do you have					how many employees do you have?:				
1.6 What is your educational qualifications?:	Forestry Degree			Forestry Diploma		Other (*specify*)?:			
1.7 What is your work history:?									

2. CONDITIONS OF EMPLOYMENT					
2.1 How often do you pay your employees?:	Monthly	Fortnightly	Weekly	Daily	Other *(specify)*
2.2 What is your basis for your employee payment:?	Monthly rate	Hourly rate	Tasks based rate	Other *(specify)*	
2.3 Do you make use of incentive schemes (*specify*)?:	Yes	No			
2.4 How much do you pay your employees *(-by worker category)?:*					
2.5 What arrangements do you have for employee accommodation?:					

2.6 What time do you *(note season)*	Start Work	Finish Work	Break for lunch	Other scheduled breaks

2.7 Do you provide transport to and from work site for your employees (*specify mode*)?:	Yes	No
2.8 Do you provide rations to your employees (*specify what &arrangements)?:*	Yes	No
2.9 Do your employees have a workers committee in place?:	Yes	No
2.10 Are your employees affiliated to any workers union (*specify)*?:	Yes	No
2.11 Have you had any work stoppage/strikes in the past year (*specify)*?:	Yes	No

3 HEALTH AND SAFETY	Not needed	Yes	No
3.1 Do you have a copy of the OSH act?:			
3.2 Do you have a section 16.(2) appointee (OSH Act)?:			
3.3 Do your employees have occupational health and safety representatives (or H&S committee)?:			
3.4 Do you perform safety /"tool box" talks with your crews?:			
3.5 Is the use of personal protective equipment (PPE) mandatory			
3.6 Do you think that personal protective equipment are used as intended?:			
3.7 During induction do you give training on basic health and safety awareness?:			
3.8 Do you give regular training and explanation on the use of personal protective equipment *(specify frequency)?:*			
3.9 What arrangements do you have for employees protective equipment *(specify, frequency and cost)*?:			
3.10 Do you discuss causes, preventative measures all accidents and incidents?:			
3.11 Do you have accident/incident records/ stats?:			
4 TRAINING			
4.1 Do you personally train your employees, who else helps you with the training?:			
4.2 What is your annual training budget and expenditure?:			
4.3 Do you have training programmes for your employees *(specify)?:*			

3 HEALTH AND SAFETY	Not needed	Yes	No
3.1 Do you have a copy of the OSH act?:			
3.2 Do you have a section 16.(2) appointee (OSH Act)?:			
3.3 Do your employees have occupational health and safety representatives (or H&S committee)?:			
3.4 Do you perform safety /"tool box" talks with your crews?:			
3.5 Is the use of personal protective equipment (PPE) mandatory			
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3.7 During induction do you give training on basic health and safety awareness?:			
3.8 Do you give regular training and explanation on the use of personal protective equipment *(specify frequency)?:*			
3.9 What arrangements do you have for employees protective equipment *(specify, frequency and cost)*?:			
3.10 Do you discuss causes, preventative measures all accidents and incidents?:			
3.11 Do you have accident/incident records/ stats?:			
4 TRAINING			
4.1 Do you personally train your employees, who else helps you with the training?:			
4.2 What is your annual training budget and expenditure?:			
4.3 Do you have training programmes for your employees *(specify)?:*			

5 PLACEMENTS AND QUITS

5.1 How do you recruit your workers?:

5.2 How do you select your machine operators?:

5.3 How many * have you had for the given periods.	*	Absentees	New hires	Dismissals	Voluntary resignations	Retrenchments	Deaths	Accidents
	Last month							
	Last 6 months							
	Last 12 months							
	Last 24 months							

6. OTHER

6.1 Harvesting systems and technology focus

6.2 Working team profiles: age distribution, distribution of seniority, crew size, job description, gender

6.3 Accident and incident statistics

6.4 Management structure

7.2 Appendix B: Description of each job in the forest harvesting as referred to in this document.

No	Job	Description
1	Chainsaw mechanic	Employee who maintains and services chainsaws and the day to day maintenance and service done by the chainsaw operator.
2	Chokermen	Employee who sets choker chains and chokers logs infield or de-chokes logs at the landing using a cable skidder or cable yarder extraction system.
3	Cleaner	Employee who does general house keeping work at the worksite i.e., removing logs and big debris from roads, cleaning oil spills and cleaning the villages.
4	Clerk	Employee whose duties are to count, capture and report on production to the manager or supervisor. Additional duties often include monitoring of quality, communication and keeping attendance registers.
5	Conductor/pusher	Employee who assists the chainsaw operator (using a pushing stick) in directional felling of trees.
6	Depot cleaner	Employee in charge of removing bark or branch debris from logs piles at the depot.
7	First aid assistant	Employee training to administer first aid at work in case of an injury.
8	General hand/casual	Employee who does general work in a crew based on need. The duties range from sitting in for a absent crew member and house keeping at work site.
9	Manual loader	Employee whose duties are to manually load logs onto trucks or tractor trailer units.
10	Manual log debarkers	Employee who manually removes bark from logs or trees.
11	Marker	Employee who tallies and marks logs into product classes for cross-cutting by a chainsaw operator.
12	Mono-cable crew	Member of a team in working with a mono-cable for extracting timber
13	Operator	Qualified and authorized employee who operates a specified machine e.g., chainsaw, harvester, skidder, excavator, cable yarder etc.
14	Painter	Employee who applies paint on log ends to distinguish them between source and the market.
14	Security guard	Employee in charge of safe guarding timber or equipment to prevent theft.
16	Stacker	Employee who manual sorts and stacks timber in desired product piles.
17	Supervisor	Employee who is in charge of a harvesting crew or gang. His/her functions are to look after production, qualify of work and safety.

7.3 Appendix C: Recommended elements for analysing direct and indirect costs of accidents in forest harvesting.

Direct Costs		**Rands**	**Rands**
1	Compensation cost and medical expenses	**	
2	Transport cost and rescue services	**	
3	Cost of accident investigation, reporting and legal actions	**	
Sub-total – direct costs			***
Indirect Costs			
4	Cost of replacing equipment involved in accidents	**	
5	Cost of recovering damaged equipment	**	
6	Wages of employees in crew	**	
7	Cost for corrective actions that caused the accident	**	
8	Cost of production and function losses (downtime)	**	
9	Cost of loss of skills, experience and training	**	
10	Increased insurance rates	**	
11	Loss of crew moral and poor public image	**	
12	Cost of relief	**	
13	Other	**	
Sub-total – indirect costs			***
Total cost			***