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Bethlehem, Lael Irene

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Evaluating the concept of 'racial Fordism' : a case study of the South African paper industry

Lael Irene Bethlehem

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A dissertation submitted to the Faculty of Arts at the University of the Witwatersrand, Johannesburg for the degree of Master of Arts.

Johannesburg 1994

Abstract

This study seeks to evaluate Stephen Gelb's notion of racial Fordism as a theory of industrialisation in South Africa. The central concern of this study is to assess whether racial Fordism provides a useful basis for understanding the development of industry. The validity of racial Fordism is analysed through a discussion of the conceptual strength of the theory, as well as through the application of the concept to a case study.

A review of the literature on Fordism shows that Gelb's concept is based on Alain Lipietz's version of regulation theory, and especially his theory of Global Fordism. Gelb's work is based on a reading of Lipietz and rests on the assumption that South Africa's path of industrialisation is similar to the experience of Western economies such as the USA, whose path of development can be described as Fordism. Although Gelb qualifies the theory to take account of the specifics of the South African experience, he argues that the defining features of South African industrialisation can be understood in terms of the theory of Fordism.

In response, I argue that in addition to certain conceptual problems with the notion of racial Fordism, the concept is of limited value in explaining the development of the pulp and paper industry which serves as a case study for this dissertation. The evidence provided by the case study suggests that the theory of racial Fordism is insensitive to a number of key factors including the importance of the raw material base, the determinants of productivity, the role of the competitive regime and the linkages between manufacturing and other economic sectors. In addition, racial Fordism provides an inadequate analysis of the nature of the domestic consumption market, the impact of racial domination on production and the role of the state. All of these factors are important in explaining the development of the pulp and paper sector. Their absence in the theory of racial Fordism suggests that the concept has important limitations.

Given the limitations of racial Fordism I argue that alternative conceptualisations need to be considered. In this light, Alice Amsden's notion of 'late industrialisation' is examined. I conclude that this concept provides a useful basis from which to approach an analysis of the process of industrialisation in South Africa.

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INVESTIGATION INTO THE REQUIREMENTS FOR AN INTEGRATED COMPUTER-AIDED ENGINEERING ENVIRONMENT.

Anthony V. Blake

March 1991

A dissertation Submitted to the Faculty of Engineering, University of the Witwatersrand, Johannesburg for the Degree of Master of Science (Engineering)

Johannesburg 1991

ABSTRACT

Integration of islands of Computer Assisted Functions is becoming increasingly important in many organisations and is being driven by the need for Data Sharing and the reduction in Duplication of Effort in order to achieve an increasingly competitive edge. Technology is increasingly providing the means of taking the "Integrated Organisation" out of the realms of an "Idealistic Dream World" into the harsh environment of Reality.

The concept of Integrated Computer Aided Engineering (CAE) is discussed, and then some Critical success factors to achieve some degree of success are discussed:

- Non-technical issues, such as Management Involvement and the need for change in Organisational Culture, are placed in perspective,
- Possible "Models" and functions acting on these Models are explored in some detail and
- Real-world issues influencing the development of large integrated software projects are examined.

The contents of this report are based firstly on experience gained in developing and implementing the first phase of a large CAE environment for the Power Station Electrical Engineering Department of ESKOM (namely CEEDS[1]); and secondly on further research undertaken for the continued evolution of the CEEDS system into a truly "Integrated Computer Aided Engineering Environment".

A pragmatic approach has been adopted and some comments and observations may seem unduly cynical. This is because the "Real World" shows no mercy towards the intrusion of "innocent bright ideas, hoards of momentumless talk and floundering amateurs". This is demonstrated by a failure rate of at least 75% in attempts to introduce CAE into organisations and an even higher failure rate for technologies such as expert systems **[MGT 01]**.

It has been attempted to make the study of general applicability. Illustrative examples and arguments are based on a large organisation's environment and the CEEDS project.

(1) CEEDS is an acronym for: Centralised Electrical Engineering Database Scheme.

Declaration:

I declare that this dissertation is my own, unaided work. It is being submitted for the degree of Master of Science (Engineering) at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

A Blake

Dated this 8th day of March, 1991.

To my wife, Irma

Acknowledgments

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Final special thanks going to my wife for her patience during these trying times.

Conventions

- Indications of a reference to a paper or book, as listed in the chapter on **"References and further reading"** (R), are indicated in bold within square brackets "[]". For example **[MGT01]** is a reference to the paper listed as MGT01.
- References to other chapters or section within the main report are indicated by giving the chapter or section heading within quotes, in bold print and followed by the chapter/section number in parenthesis. For example, **"Job design"** (3.5.1) refers to section 3.5.1 in chapter 3.
- Appendixes are numbered as follows:
    - The first letter is an "A" to indicate an appendix;
    - The second number refers to the chapter in the main report that has the most bearing on the contents of the appendix;
    - Thereafter appendixes are numbered sequentially.

  For example, **Appendix A4.3** is the third appendix bearing relevance to chapter 4.
- Figures are numbered similar to appendixes, only that the number of the main section within a chapter is used and not only the chapter number. For example, Figure F4.3.02 refers to a drawing used in section 4.3. The figure number is prefixed with an "F" for figures used in the main report and with "FA" for figures used in an appendix.

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1 Introduction

An **Integrated Computer Aided Engineering ENVIRONMENT** consists of teams of people and the computer tools they use to carry out their specific (probably inter-related) Engineering tasks, in a harmonious, free-flowing manner.

An **Integrated Computer Aided Engineering SYSTEM** consists of the suite of programs and databases that are capable of supporting the engineering function in a cooperative and transparent manner.

This investigation will briefly cover:

- CAE in general, (which sets the scope of this investigation);
- The history of the CEEDS system;
- A proposed Development Approach;
- High level system requirements.

The following will be reviewed in more detail:

- Non-technical Critical Success Factors (the Human aspect);
- Possible Models to support the detailed Engineering process;
- Functionality surrounding the Models[1]; and
- Software and System Development/Implementation aspects.[2]

(1) The chapters on "Models" and "System Functionality" are strongly based on work already completed for the CEEDS project and on work currently underway for the continued enhancement of CEEDS.

(2) Some sections of the "Software Development and Implementation Aspects" are specific to the computer environment on which CEEDS is being implemented and to the development approach (namely in-house development). These sections may not be of general applicability but may be adapted to other environments and disciplines. There is an incredible amount of common ground between very diverse applications at a conceptual level.

2 Integrated Computer Aided Engineering Systems

In this chapter,

- Computer Aided Engineering (CAE) is discussed from an organisational point of view;
- a brief history of the CEEDS system is presented;
- critical success factors are highlighted; and
- a development strategy is proposed.

2.1 General Discussion on CAE

It is felt that fully integrated information systems encompassing all information requirements of a large organisation (for example, Engineering, Marketing, Sales, Personnel, etc.) are still futuristic. The technology exists to build such systems, but organisations are generally unable to cope with such a high degree of integration. Introduction to the concepts of integration need to take place gradually and organisations need to adjust accordingly. One organisational discipline, namely Engineering, will be examined in some detail. Engineering systems can be viewed from a Corporate, Discipline and a Functional level. Corporate and Discipline levels are discussed in this chapter while the Functional level is dealt with in detail in the chapter on "System Functionality" (5). For the purpose of this study, examples are extracted from the point of view of a Power Utility Company (namely ESKOM) and a particular CAE system (CEEDS).

The Engineering division is subdivided into Power Station Engineering, Transmission Engineering and Distribution Engineering. The "operations" functions are similarly grouped. The Engineering division is responsible for the design, construction and modification of facilities. The relevant Operations divisions are responsible for the running and maintenance of these facilities. The Power Station Engineering department and their operations counterpart, "Generation", are chosen for a more detailed analysis. The principles relevant to this "partnership" are similarly applicable to other such partnerships as well as to the interface between functional groups, for example, Power Stations feeding Transmission.

2.1.1 CAE at a corporate level

The following steps describe a typical definition, development and production cycle at corporate level:

1) The Generation Group establishes the requirements for a new power station.

2) Engineering is approached to establish detailed specifications against which various contractors can tender

3) Contracts are awarded and detailed design may begin.

4) Engineering acts as interface coordinator between the various contractors. Engineering also conducts some of the detailed design in-house and can therefore be considered as a contractor.

5) Construction begins and is coordinated by Engineering. The majority of construction is carried out by contractors.

6) Engineering commissions the plant and hands it over to Generation, along with the necessary documentation.

7) Generation operates and maintains the plant for its life time.

8) Major modifications or overhauls (for example, Life Extension programs) of the plant would be managed by Engineering on Generation's behalf.

9) The plant will finally be decommissioned and demolished (or kept as a museum).

The steps presented above are a simplification of the real situation but are useful in defining the scope of activities being considered for inclusion in an Integrated CAE system. Steps 4, 5, 6 and interfaces to 7 are currently considered viable for a detailed investigation.

Areas of activity where it is felt that computerised tools could be beneficial include:

a) Engineering builds up a large amount of data relating to the detailed design of a plant (in the form of drawings, listings, manuals, etc.). Configuration management of this data is critical, especially data relating to various interacting contracts. (For example: one contractor supplies the boiler, another builds the support structure, another supplies the control systems for that boiler and yet another supplies the power to all equipment on the boiler).

b) Engineering is also involved in some internal detailed design (Refer to paragraph "**CAE at an Engineering Discipline Level**" (2.1.2) for an example). Efficient capturing and control of design data is critical. Design optimisation is also important.

c) Commissioning of such large quantities of complex plant (as found on a power station) requires a great deal of information (points (a) and (b) above). Stringent control must be carried out for safety, quality, project planning and progress monitoring purposes.

d) On hand-over of the plant, Generation takes possession of the plant and the necessary documentation. They then have to begin to maintain the plant. This requires information about the plant, the components of the plant, maintenance procedures, diagnostic procedures and availability of spare parts.

Refer to **Figures F2.1.01** and **F2.1.02.**

All these activities require large amounts of data. Much of this data is captured in electronic form either via a CAD system (drawings), simple databases and word processors or via various applications (e.g. design aids, maintenance packages, stores inventory systems etc.) It would seem very desirable to have the data from one system available to other systems that require it, in an electronically transferable state. This is where the ideas of system integration begin to form. There are obviously many levels of "integration" from exchange of flat ASCII files (at a primitive level) to totally transparent, single source data usage (the ultimately desirable situation). There are just as many levels of "Control" over data interchange and integrity.

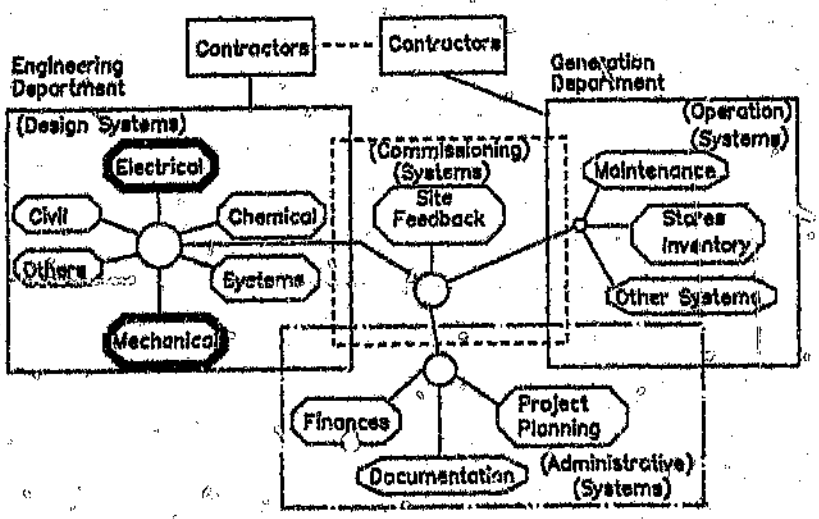


Figure F2.1.01

Very briefly, the ultimate system is one in which:

- all data is stored in only the appropriate places (eliminating unnecessary data duplication and facilitating configuration control);
- this data is accessible by all systems requiring it, in a transparent (yet fully controlled) manner; whether that system be CAD, database, word processors, expert system, etc.

Technology (and standardisation thereof) is heading in the direction where this scenario may be possible. Managers, users and software development staff must just be ready to exploit the technology as it becomes available and must be very wary about being dragged into a single vendor's proposed "solutions".

What would seem to be a sensible approach would be to establish the desirable end goal and start working towards it in achievable incremental steps. This investigation is one such step. The area concentrated on is that of in-house Electrical Design activities, electrical construction and the necessary interfaces to other systems that have an influence on these activities.

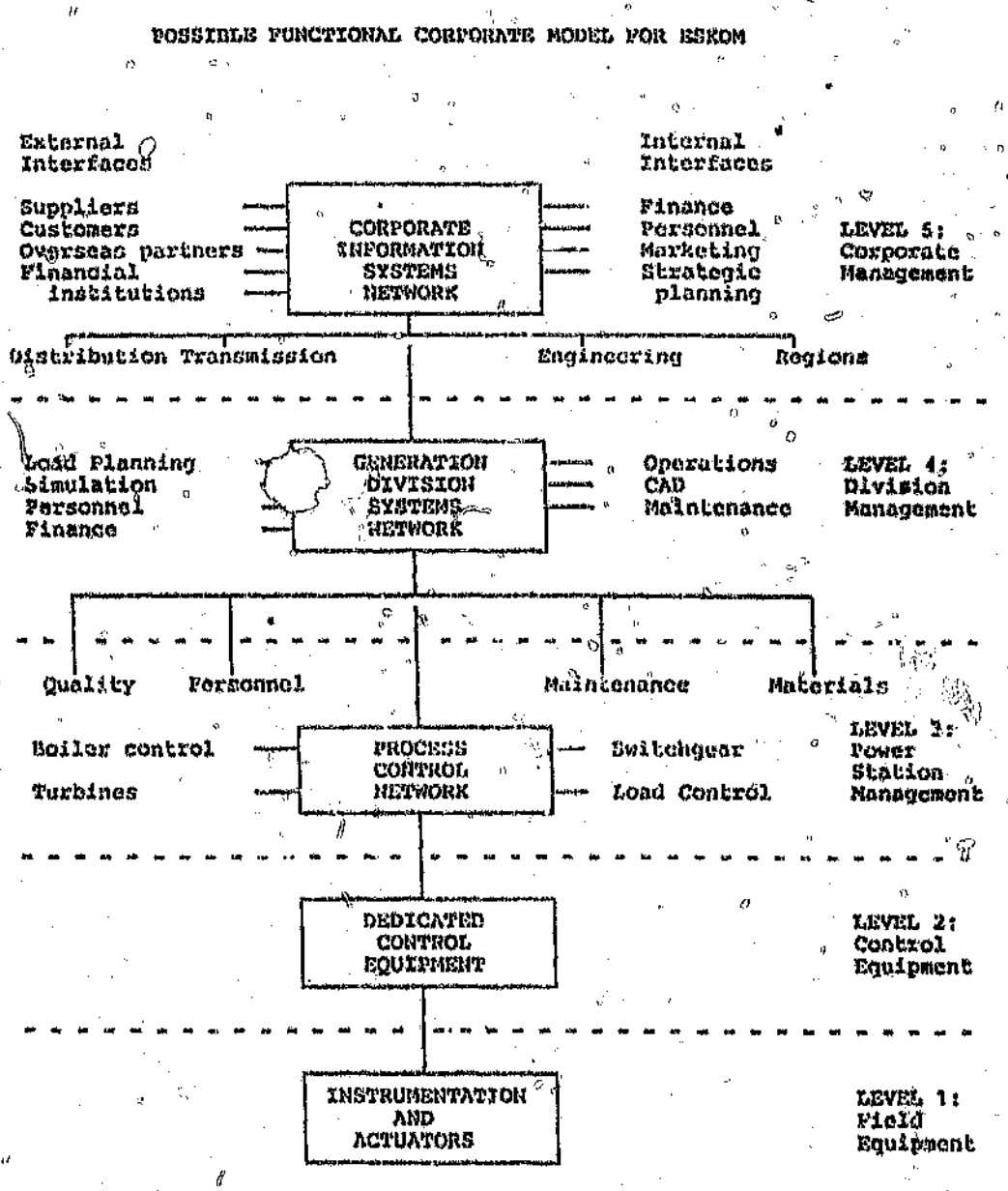
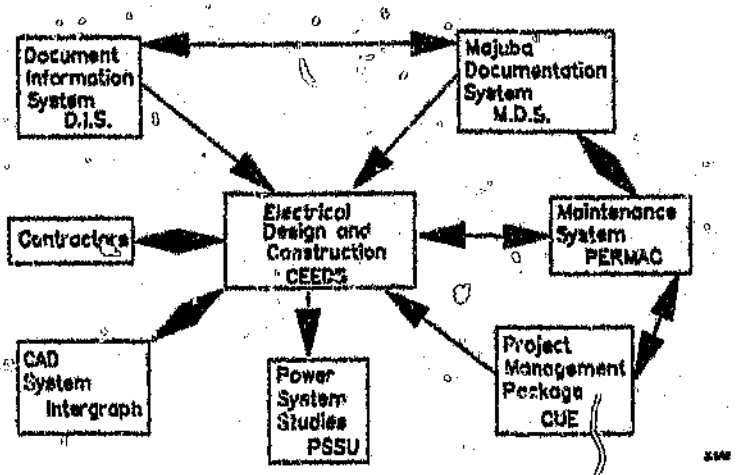


Figure F2.1.02 (Source: ESKOM IT Strategy Workshop)

2.1.2 CAE at an engineering discipline level

The Power Station Electrical Engineering Department (PSEED) is responsible for, amongst many other tasks, the detailed design and management of:

1. The Auxiliary Power Supply system; (which includes switchgear, transformers, emergency supply equipment etc.);
2. Lighting;
3. Certain cabling (e.g. power cables);
4. Cable Support Structures;
5. Certain Control systems.



CAE at a Discipline Level.

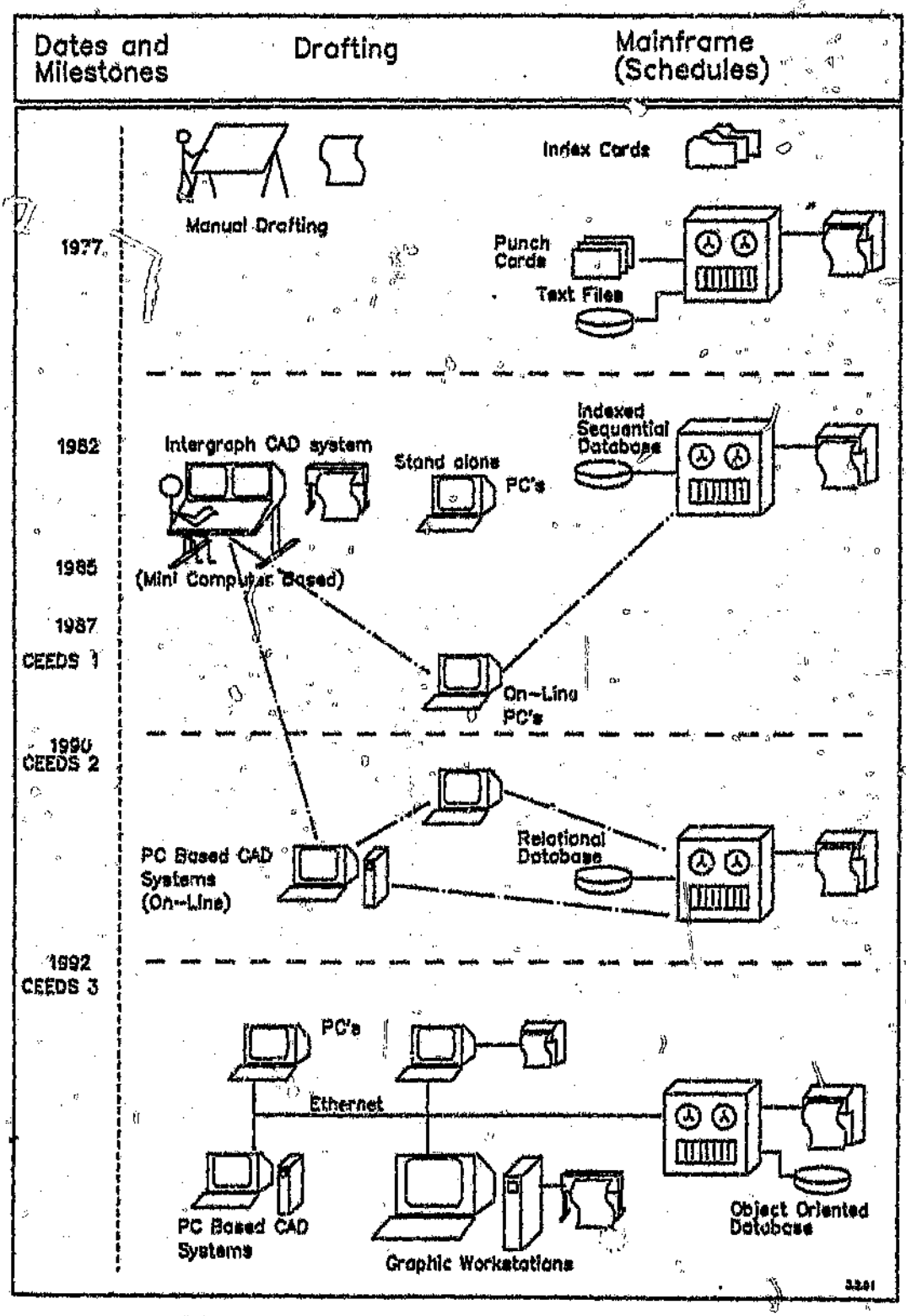
Figure F2.1.03

Equipment requiring power (and their details) must be provided by the various contractors. A supply network is then designed to meet these requirements. Equipment, control and cabling requirements of the supply network are defined and cable support structures are designed to meet the cabling needs. Design documentation is then produced for construction (and maintenance) purposes. During construction, feedback from site is used to measure progress and to control payments to contractors for work done. On plant hand-over, certain design data is loaded into the maintenance package, the Engineering Department then withdraws and Generation begin their task of operating and maintaining the plant.

It is not intended to go into detailed analysis of the system requirements to carry out these tasks. The intention here is to show the interfaces and interactions between the various systems involved, with the purpose of setting the scene for the "System Models" and "System Functionality" sections below. The CEEDS information system serves well as an example. Currently, most electrical Engineering data is resident in CEEDS and/or on the CAD system to fulfil the needs discussed above. **Figure F2.1.03** provides an overview of the CEEDS system and its interactions with other systems.

The following provides more detail to be refered to along with **Figure F2.1.03**:

- **PERMAC** is the Generation Maintenance Package (Purchased Package, MVS Mainframe);
- **CUE** is the Project Management Package used by Engineering (Purchased Package, MVS Mainframe);
- **DIS** is the Engineering Documentation System (Developed in-house, VM Mainframe, Oracle Database);
- **MDS** is the Documentation Configuration Management system being used on Majuba (duplication with DIS due to political reasons) (Developed in-house, VM Mainframe, Oracle Database);
- **CAD** is the Electrical Engineering Computer Aided Drafting System (Purchased Intergraph software, PC's and Vax mini-computer);
- **PSSU** is a Power Network Analysis Package (Purchased Package, PC and Apollo workstation based).



CEEDS History in ESKOM.

Figure F2.2.01

2.2 Brief History of CAE and CEEDS in ESKOM

2.2.1 Setting the scene for CEEDS

Refer to **Figure F2.2.01.** Initially the whole engineering design process was done manually. Drafting was done manually on drawing boards and "schedule" (list) type information was either kept on pre-printed sheets or index cards. A CAD system was introduced in 1982 and most of the manual drafting gradually moved over to the CAD. Some sections, the architects for example, are still doing manual drafting. The CAD system was simply a computerised replacement of drawing boards. Schedule type information was placed on a master overlay and details manually entered. At about the same time, Mainframe computers were also increasingly used for storing certain schedule information. These facilities started off with punch card technology and flat files, moved to on-line editing of flat files, then onto Indexed-Sequential and Hierarchical Indexed-Sequential Databases. There was no automatic correlation between CAD activity and Mainframe data, and in many cases there was no manual correlation either. PC's started to make inroads in about 1982 and some pro-active people started to keep individual schedules, lists etc. This simply compounded the correlation problem and strengthened functional islanding.

In the early days of the Majuba Power Station Project (1986), it was discovered that the "Auxiliary Power Schedule" and the "Cable Schedule" (two important base documents) were on Mainframe and practically everything else was on CAD. It was then that the idea of a set of "Cooperating databases" was established whereby data could be "poured" into the top (The Auxiliary Power Schedule Database), filter into a set of Switchgear and Transformer databases and down into the Cable Schedule Database. Refer to **Figure F2.2.02.**

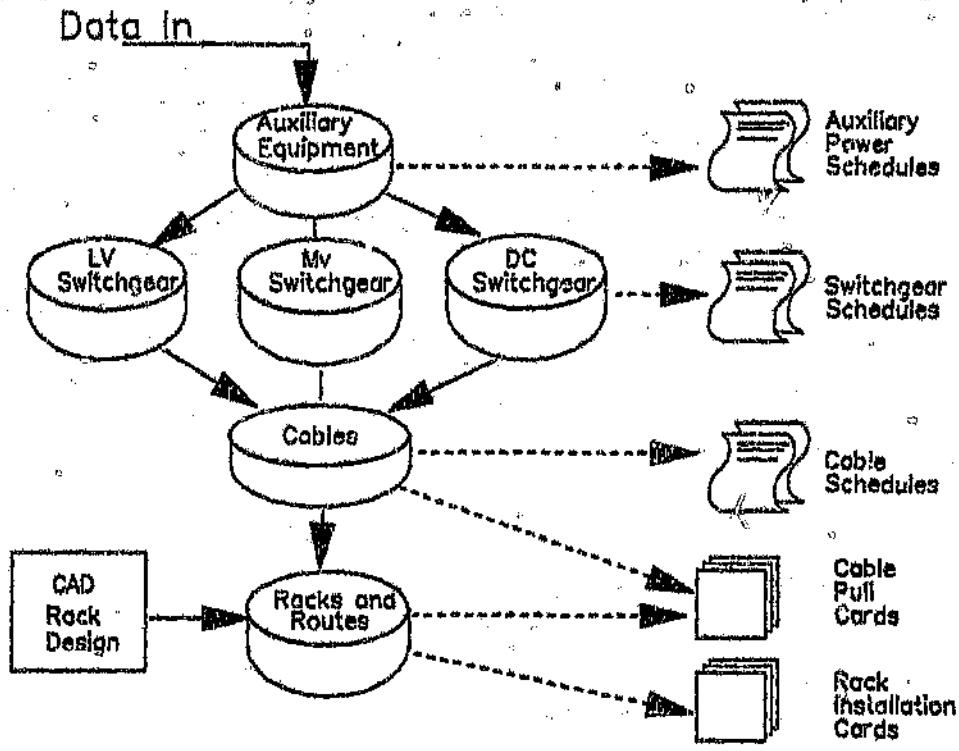


Figure F2.2.02

2.2.2 CEEDS I

Hence CEEDS I was developed on a Cyber 175 using the IPF2 Hierarchical Indexed-Sequential Database system and later Fortran Advanced Access Methods (for increased speed).

Based on the new CEEDS system, ESKOM made a decision to manage the cable contract for Majuba in-house. Previous power station projects contracted out for this function. This provided the necessary incentive to get the system working properly.

Cable Racking design was being done on the CAD system at that time and software for data extraction from CAD had become available (1987). An ambitious addition was made to CEEDS to extract three dimensional (3D) racking information from the CAD system to enable the optimised routing of Cables identified on CEEDS.

The system performed adequately in that it produced an Auxiliary Power Schedule, Cable Schedules, Switchgear Schedules, Rack installation cards and Cable pull cards. One of its major contributions though, was that it had introduced the division to "Integrated Computer Facilities". There was extreme resistance to this new technology as traditional roles were being challenged and the "Black Box" ("Blik Brein") syndrome set in. People felt that they no longer had full autonomy over their activities. Despite such feelings, some degree of acceptance was evident.

CEEDS I had a number of inherent flaws, many of which are contributory factors to system failure. (Refer to Appendix A2.1 for details). At the beginning of 1989, it was decided that the Cyber was to be decommissioned and replaced with an IBM. The Oracle relational database was purchased for the new machine. CEEDS would have to move off the old Cyber and onto the new IBM. This was a prime opportunity to carry out a re-design of the CEEDS system. This lead to the CEEDS II development, much of which is detailed in this report.

2.2.3 CEEDS II

The Software environment and development methodology standards were established first (in the absence of any existing standards). System Requirements analysis began in September 1989, Coding was phased in during April 1990 and the current system was implemented by December 1990.

Current Application characteristics: (Refer to Figure F2.2.03.)

- This system consists of a "physical model" and parts of the cabling "financial model". It has rudimentary cable design process facilities built into the functions that manipulate cables. (Refer to the chapter on "System Models" (4) for details about these models). There is a "link" into the CAD system in order to import Rack designs and the physical locations (x,y,z coordinates) of equipment. External data (equipment and cables captured by contractors on CEEDS PC software) can be imported.

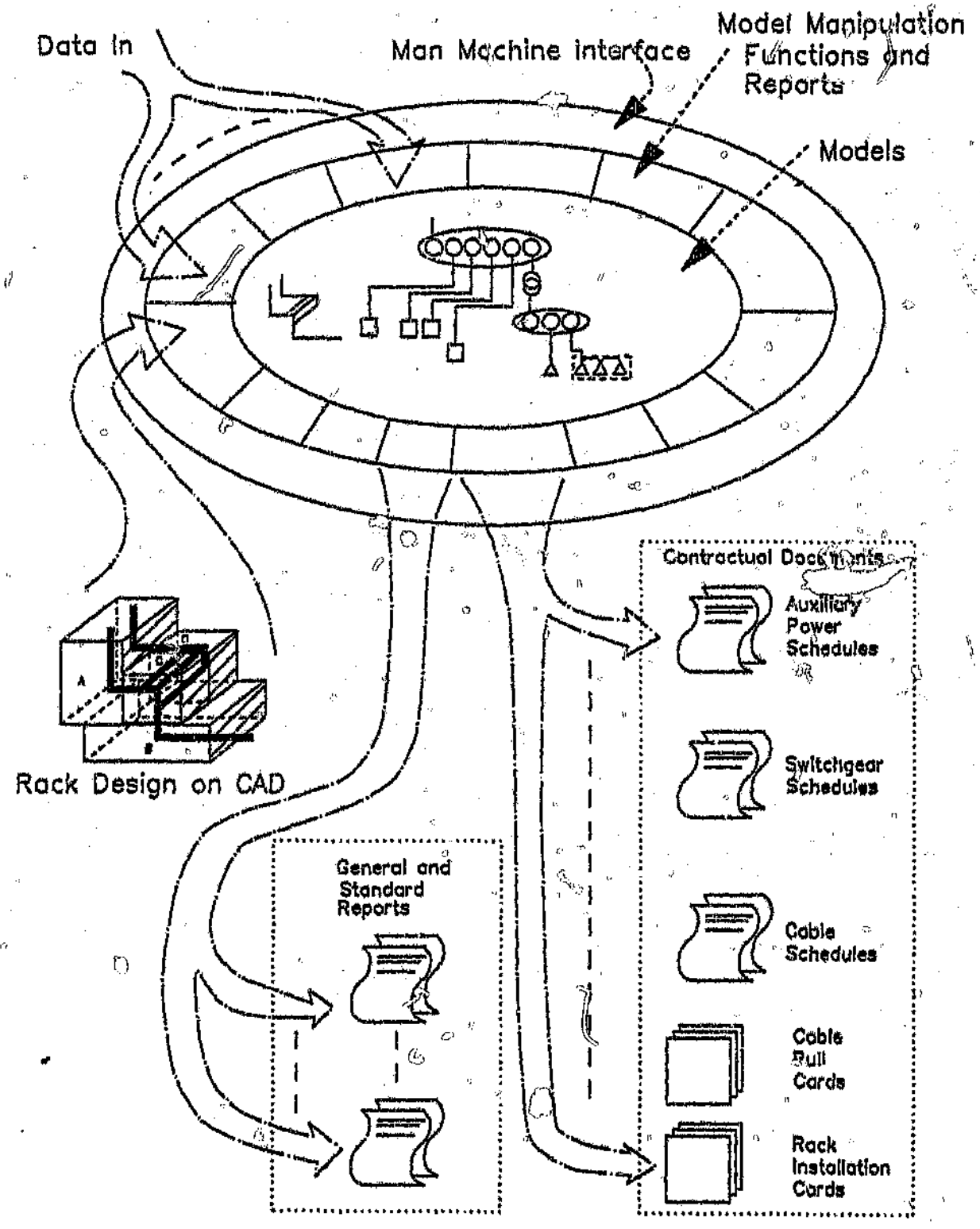


Figure F2.2.03

- There is no automatic access to data in interfacing systems. This is mainly because they are purchased packages and are resident on a different mainframe. Necessary Data transfer is via flat files on a once off or periodic basis. The interface is purely texual, although data in specified format can be exported to programs written for the CAD system so that a graphical representation can be generated.
- Contractual data modification auditing and system activity logging are available.
- Documentation production and configuration management facilities are available (but can do with some enhancement).

The current Software situation:

- The Oracle Relational database manager forms the basis of the system. Most data capture and manipulation takes place using Oracle products such as Structured Query Language (SQL), SQL Forms for screen forms, and a Fortran/SQL Precompiler for more complex data retrieval and manipulation.
- The user interface is totally menu driven and has user specific access to menu options. Flexible query and reporting facilities are available that make it possible to produce almost any desired report and to extract data in any desired format (for exporting to other systems).
- The system has its own set of software configuration management tools integrated into the system. This facilitates limited automatic software documentation production and allows maintenance staff to query the system to determine the scope of change for any required modifications.

The system is still essentially stand alone but has reasonably flexible importing and exporting facilities. Data transfer between CAD and CEEDS is still via flat files. The main restriction has been non-transparent computer environments.

Future activities (briefly):

- The system will migrate to a more suitable computer platform consisting of networked workstations, high performance PC's and the mainframe acting as a database server. The first stage has already begun with the delivery of a suitable workstation that is being coupled to an Ethernet LAN that will eventually have a link into the mainframe system.
- Creating a consistent graphical front end for the models.
- Increasingly transparent interaction with cooperating systems and the establishment of centralised sources of common data.
- Improved Models and Functionality.
- Introduction of Artificial Intelligence (AI) type software for various functions.

One of the main reason for this investigation has been to gain insight into the requirements for these future activities.

2.3 Critical Success Factors

There are a number of factors contributing to the disturbingly high failure rate in trying to implemented systems successfully (or even partially so).

Critical factors can be divided into:

- Non-Technical Factors such as:
  - Skills training;
  - Changes to procedures;
  - Organisational Structure;
  - Company Strategy; and
  - Organisational culture.

  Refer to "**Non-Technical aspects**" (3) for more detail.

- Technological Factors such as:
  - A sound theoretical and consistent foundation (Model) for tools;
  - A sufficiently rich, flexible and reliable Computer Environment; and
  - System maintainability and expendability.

  Refer to "**System Models**" (4),"**System Functionality**" (5) and "**Software and Development /Implementation aspects**" (6) for more detail.

Experience indicates that early failures (the majority) are mainly caused by non-technical issues such as resistance to change and inability to adjust organisationally. Failures further down the line are influenced by both technical and non-technical aspects. The later into the life cycle that faults occur, the more likely it is that inadequate or incorrect maintenance has lead to a "fragile" system. One that can no longer be modified to meet changing requirements. (The "fix one bug, create three more" syndrome).

2.4 High Level Development Strategy

A strategy that will work needs to be established. It is anticipated that there are three major waves of system development that take place within any organisation.

- The first is where individuals or small teams begin to build up their own sets of tools to aid them in their detailed day-to-day activities.
- The second is where these individuals and teams begin to realise that the teams they interact with also have tools and a lot of commonality exists (data and functionality). Some cooperation begins to take place and it is realised that a concerted effort must be made to rationalise the proliferation of small systems.
- The third wave is where such rationalisation has already taken place in relatively large "islands" and a concerted effort must now be made to integrate at a corporate level.

These waves have large overlaps and cannot always be clearly distinguished. Refer to **Figure F2.4.01.** ESKOM in general is currently at the beginning of the second wave, although some development teams are approaching the third wave.

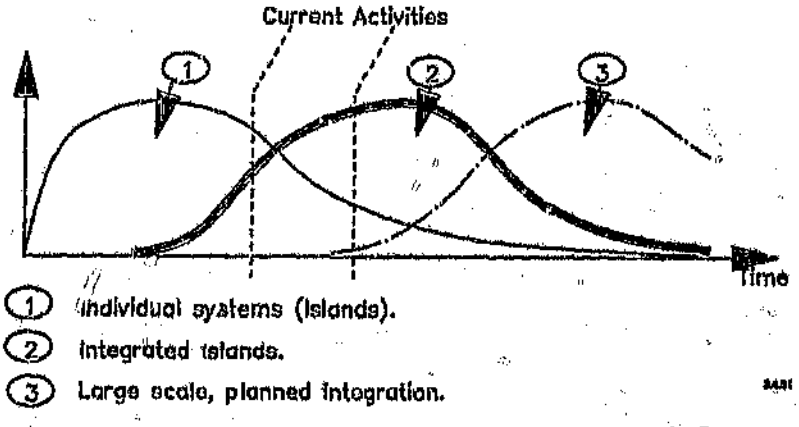


Figure F2.4.01

In the development of any large multi-faceted project that involves and affects many people, a sound strategy must be established if any semblance of success is to be hoped for. It is extremely important to have a very clear end goal in order to avoid the "moving goal post" scenario and the "I'll do it my way" empire building phenomenon.

There are essentially two extreme strategies with a continuum in-between:

1. Initially develop islands of small systems, then attempt to centralise and integrate them (Bottom-Up approach); or

2. Gradually create one large centralised system and then allow de-centralised control (Top-Down approach).

Both of these extremes have glaring flaws that make neither suitable on their own. Using the first approach, it is unrealistic to expect the systems to be sufficiently compatible to allow integration without major re-designs. There is also the danger that once a system suits a particular group's immediate needs, they will be unwilling to cooperate in any activity advocating change to their system. A "Let the other team change their system" attitude could set in.

Using the second approach, it could take so long before the system is usable that individual groups would revert to the first method to meet their own needs.

The recommended strategy is to attempt to use the best of both extremes **[MGT 16]:**

1) Start with a few large islands. For example, each Engineering discipline (Electrical, Mechanical, Civil, etc.) would be an island, Generation another;

2) Establish a global strategy on a centralised basis (to allow for the third wave) and allow the individual islands to sort out their own detail. (Make sure that the organisational body looking after the interests of the centralised facilities has sufficient authority to eventually enforce the use of these facilities by individual islands).

3) Establish which data needs to be centrally accessible and the sources and administration of such data.

4) Establish interface requirements between islands. Islands should be established that have clean interfaces, i.e. there should be as much independence as possible between chosen islands. For example, disciplines should not be broken into further islands, (such as Process control and Electrical systems, or Boiler plant and Turbine plant) because of the high degree of interdependence between such similar activities.

5) Development can then begin individually within each island in such a manner that best suits the requirements of each island. For example, mechanical engineers may have more need of CAD facilities and less need for supporting databases whereas with electrical engineering, it may be the other way around.

There are certain pre-requisite's applicable to the recommended approach:

1) The requirements of the centralised facilities and the interface requirements must be taken into account during development. Initially these facilities can be duplicated or simulated within the individual islands (to facilitate speedier development), but they must eventually be integrated.

2) The integration must be a definite, planned-for activity, not just something that everyone knows must take place at some time or another, but has no immediate importance.

3) Development should be grouped into phases in such a manner that immediate needs can be met within as short a time as necessary. Progressive enhancements can then be made to the system. Some of these enhancements will include the interfaces to centralised facilities and to other islands.

4) A flexible scope should be established and tasks prioritised to suit.

5) In order to allow a system to evolve successfully, the foundations upon which further facilities are built must be very stable. A very clear and stable philosophy must be adhered to when expanding the system. If this is not done, any change to requirements of the core system could cause failure in all dependent systems. What may seem like a simple decision by management to "slightly" change a philosophy could invalidate many man years of system development work. The "System Models" chapter is an attempt at establishing such a foundation for the Power Station Electrical Engineering Discipline.

The question may be asked, "Why not just skip the second wave and progress directly to the third more desirable wave ?". There are a number of reasons:

- Each wave requires a very sound basis upon which to be built. It is usually the preceeding wave that provides such a basis. (Such a basis could be purchased at a price, but the general organisation would lack the necessary culture. This culture, on the other hand, cannot be purchased without a radical staff turnover);
- Organisational culture can very seldom handle revolutionary change, especially in large organistions; and
- The shear lack of people in the organisation experienced in integrated CAE implementations. (This expertise will hopefully be built up during preceeding waves).

It is important to note the following:

- The establishment of centralised functions and inter-island interfaces MUST be de-politicised. Logic and information requirements must be the driving factors and not empire protection or personal ambition.
- All parties that could be participants must be identified and involved in interface discussions. This is mainly to prevent unnecessary duplication of facilities and data. Duplication invariably leads to integrity problems such as having different groups working on the same job using different and often conflicting information.
- Company wide Standards must be established and enforced.
- Phased implementation must not be overlooked because of support needed for old designs using old methods. This has the effect of increasing manpower costs for possibly a long period, during which multiple administrative systems are supported.
- Implementation speed should never exceed the rate of retraining of the users of the systems or the rate at which new administrative procedures can be established.
- It must be decided up-front whether a given system is to support multiple projects or whether a framework is to be developed that could be customised to meet the detailed needs of an individual project. For example, would the system be utilised in the design and construction of a new facilities as well as existing old facilities. The fact that any system tends to be very project-specific must not be under-estimated. If the ability to customize the system is not provided from the beginning, modifying an existing system to meet the requirements of another project could be a prohibitively expensive undertaking. This dependence on the current state of affairs is not only restricted to systems developed for islands but affects the whole integrated system. For example, if on one project it is decided to contract out the facilities management function, and on another project, this function is managed within the company, then the specifications for an island's system as well as most interfaces could be radically different.

Additional factors to be considered by all parties involved in the development of such a system are:

- The REALITIES of such a system must not be overlooked. The complexity of such systems seldom surfaces during initial discussions. Real problems must not be over-simplified and then expectations placed on a system (developed to solve the simplified problem) to solve the Real problem(s);
- The development of such systems takes substantial time and effort;
- The size of such systems must not be under-estimated.

Software developers should pay attention to the following considerations:

- The system being developed is a TOOL for Engineers and Designers, not a theoretical exercise in computer modelling.
- Maintainable and Usable software must be written. Rather cut back on sophistication than creating a massively complex system that "falls over" the first time it is launched into the real world or shatters when it is attempted to tweek something within. Even worse is if the system degrades (or corrupts data) in a manner difficult to detect so that when it is noticed that something is wrong, it's too late.

All of the above factors should not be taken lightly as they are all major contributors to system failure.

3 Non-Technical Aspects

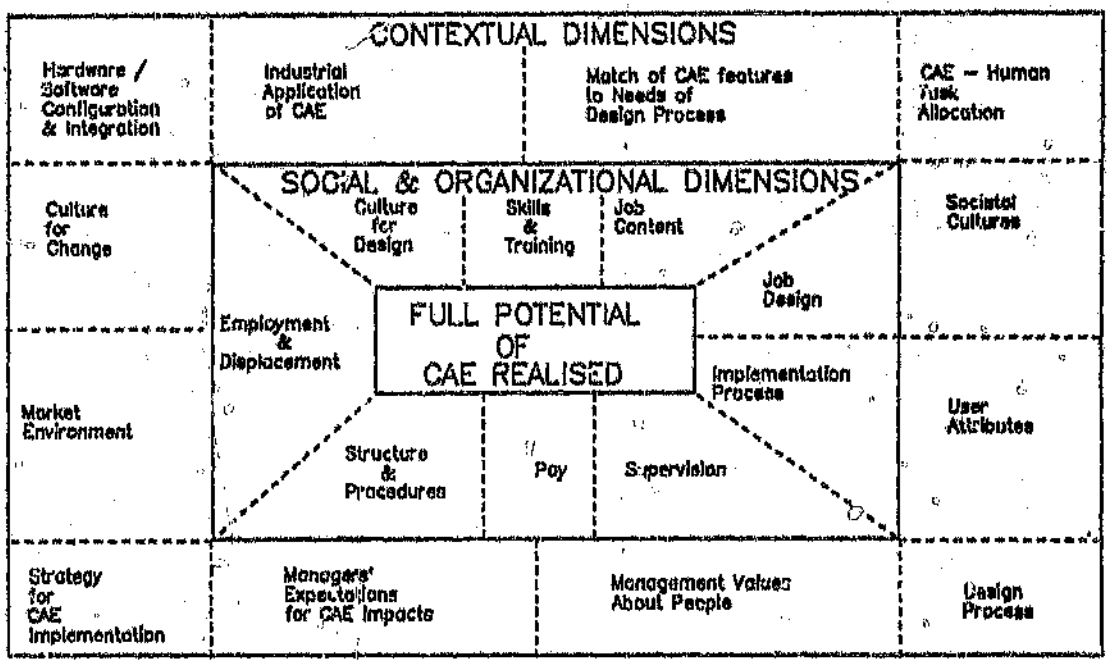
3.1 Introduction

There are a large number of factors which contribute to the success or failure of CAE within an organisation. The majority of these factors are not technical in nature. When management is thinking of introducing CAE systems, they must be aware of these issues as the track record shows very few fully successful implementations [MGT 01]. The vast majority of these systems were doomed to failure, even before the question of specific technology was addressed, simply because of some general misconceptions and myths about the effect of introducing advanced technology into an organisation.

The following factors will be covered in some detail:

- Organisational culture:
  - Structure (e.g. Hierarchical/matrix);
  - Strategy (How and why is CAE introduced);
- Managerial role and commitment;
- Changes to procedures;
- Correct employee attitudes (new culture);
- Skills training; and
- Developers' attitudes.

Refer to Figure F3.1.01



Source: IEEE Transactions on Engineering Management August 1989, Vol. 36, Number 3. 4.1.01

Factors influencing CAE in an Organisation

Figure F3.1.01

3.2 Organisational Aspects

3.2.1 Organisational Culture

Successful implementation of advanced technological systems can only be achieved where social factors such as job content, training, organizational change, etc. are taken into account and planned for in advance to implementation (or at least during implementation).

The introduction of technology will bring about automatic change.

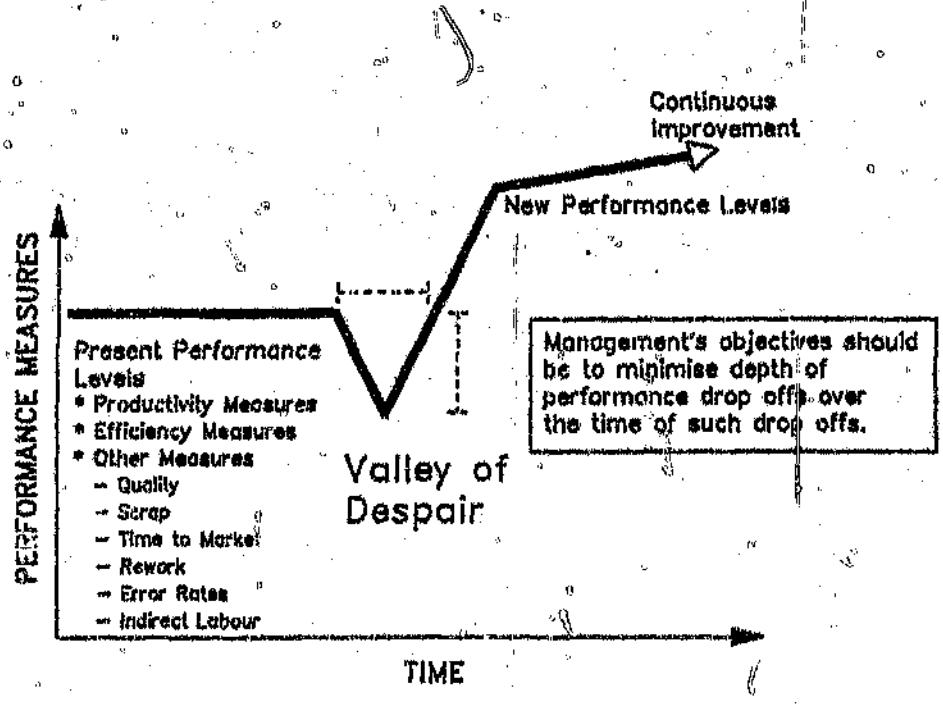
The above statement is one of the major misconceptions about the introduction of technology. "Lets put the system in place and see what happens" soon leads to "What's going wrong?, one would swear we've never done this job before !!". It is the integration of data and functionality, made possible by the introduction of a technologically advanced system, that encourage and promote change. The change itself must be planned for and orchestrated by management **[MGT 03]**. This is not a job that can be delegated down. It has also been shown that more success is achieved in high-trust environments (although there are cases of success in low trust environments) **[MGT 02]**.

3.2.2 Right and wrong reasons for the introduction of CAE

- If the integrated system is designed to simply automate or replace existing practice without using the computers' inherent benefits, it will be an in-effective and expensive exercise for so few benefits. For example, using CAD purely as an electronic drawing board (for producing neater drawings) or using a database simply to produce a specific list (previously done manually) are only the tip of the iceberg regarding the inherent benefits of using computer technology. Computer technology can create tools, but to gain maximum benefits it must form an integral part of a company's culture. Tools should not be thought of as "machine systems" but as "Person-machine systems", an integrated partnership between person and computer.
- If the system is regarded purely as a capital-for-labour replacement i.e. in the hope of reducing staff, failure is inevitable. This is a favorite ploy of vendors who advocate the potential of incredible productivity increases, which in turn can be equated to a corresponding reduction in staff to carry out the current work load. In many cases trends indicate just the opposite **[MGT 08]**. Roles change but people aren't replaced. An actual increase in labour is inevitable if the new system is mismanaged and if parallel old system(s) are maintained for too long. Trends also indicate that operator and management training is seldom adequate to achieve anywhere near the productivity gains claimed by vendors. **[Most references under MGT highlight the training problem].**
- Successful implementations have been driven by using new technology as a strategic weapon, to reduce design cycle times, design more effectively, reduce information conflict and integrity problems, improve product quality, rationalise operations, etc.

3.2.3 Productivity and quality

- CAE has the potential to increase productivity and service / product quality. This can be achieved by skillful use of the inherent benefits of CAE.
- One of the main benefits is reduced cycle time. A change in design detail can be managed far more quickly using CAE than using manual methods. Design integrity also remains intact with a good CAE system. A design can therefore go through far more refinements than previously and thereby improving quality. Case studies have shown that reduced iteration time can often pay for the investment in technology **[MGT 01]**.
- Time saving due to the concurrent nature of design, made possible by CAE, is another benefit. (One designer doesn't have to wait for the completion of one activity before starting another, Refer to "**Design Philosophies, Procedures, Operations and Administration**" (3.4) below).
- Productivity gains will inevitably go through an initial "valley of despair". Refer to**Figure F3.2.01.** This is mainly due to unfamiliarity with the system and with new procedures surrounding the system. Management must not overreact and revert back to old methods or try other changes too soon. Such "over steering" simply leads to confusion and loss of direction. The length and depth of this "valley" are very dependant on training (too many people in training leads to sharp drops in productivity while insufficient training prolongs the period of reduced productivity).



Performance Change Curve.

Figure F3.2.01

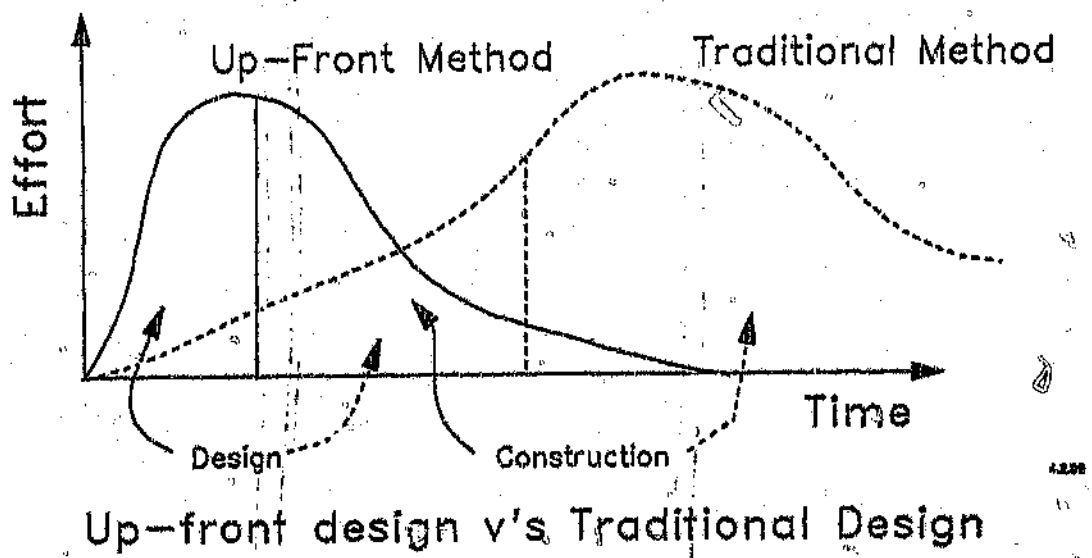


Figure F3.2.02

- Experience has shown that a higher quality of preliminary design is required to best suit computer tools. Refer to**Figure F3.2.02.** A major benefit is that design errors are trapped during the design phase and not left to be sorted out during construction. Errors are far cheaper to correct during design than after equipment has arrived on site and found to be incompatible with related equipment. Moving a line on a CAD to indicate a cable being moved from one termination to another is obviously far cheaper than having to uncouple and discard an incorrect cable and then pull and terminate the new cable on site. "Get it right first time" attitudes should be encouraged.

3.2.4 Differences in the nature of work which affect implementation success.

- Electronics industries (especially Integrated Circuit (IC) and Printed Circuit Board (PCB) production) have some extremely successful CAE systems. Design is highly automated, manufacture is fed directly from design and testing is almost totally automated. There is obviously a very close link between the electronics industry and CAE technology, so it seems logical that this industry would make maximum use of CAE.
- More traditional disciplines, such as heavy current, must work harder to change. The industry operates within a highly regulated environment, and work is usually tender-based. The groups setting up specifications, doing the design and manufacturing the equipment are usually far removed and often belong to different companies. This is in total contradiction to the electronics industry. It is difficult to rationalise products into families for multiple use, for example, modularised switchgear components that can be combined into various "standard" combinations (again the electronics industry is way ahead). The organisational structure tends to be fragmented into specialist groups with little expertise in total system design **[MGT 13]**.
- Heavy current is also a small market and has not influenced commercial CAD/CAE products as have the aerospace-, electronics- and automotive industries.

- Integrated environments work best in smaller teams with limited design scope. It is more difficult in companies with wide scope and low volume and where products range from components to complete systems.
- Product rationalisation and standardisation are necessary to get the best out of CAE systems. If a design can be done by simply selecting and configuring suitable pre-designed building blocks, CAE can be extremely successful. Analysis of the configured system (using CAE) could then be carried out to optimise the system. (The design of electrical supply systems could fall into this category).

3.2.5 Change is continuous

Today's "Hi-Tech" is tomorrow's "Old Hat". The rate of change is increasing with time and attitudes and organisational cultures will have to cope in order to survive. Managers must be wary though of attempting too much change too quickly. There is a limit to what an organisation can handle and survival is a delicate balance between rapid adjustment and self destruction.

3.3 Management role

The degree of success with which CAE systems are implemented has less to do with technology than with the management of technology within the human and organisational constraints of an organisation.

3.3.1 Commitment to change from management.

Direct involvement by Managers is vital. It does not help giving lots of verbose, verbal commitment with little visible action. I.e. get the ball rolling, then stand back and exercise "arms-length" management. This will not work. The managers of the users of the system must be involved in the details of the system (including the development). One cannot rely on a system and have no idea of what it consists of or how it is to be used. Managers need to control the development of the system (thereby gaining the necessary insight into what is involved), and they must control the procedures surrounding the use of the system. There is a tendency for a gap to form between team leaders and middle management. Unless management becomes involved, islanding is inevitable and integration becomes impossible. Managers are responsible for "Playing the Politics" in breaking down independent islands of activity. Unless this is done, any attempt at integration is seen as meddling in another's affairs and will be rejected.

Managers must at least have a basic understanding of the technology used by CAE systems and they must be trained to manage change due to the introduction of advanced technology. Without such understanding and skills, management expectations tend to be totally unrealistic. The misinformed either see computers as mystical boxes that can do wonderful things at the "press of a button", or as "Big Brother" that messes up telephone accounts. Development time and effort tend to be grossly under-estimated. A person who has developed a small spreadsheet and perhaps even written a small BASIC program is placed under the misconception that software development is easy. Development effort increases exponentially with project size [SM 08].

Expectations of what the system can do also tend to be overrated. This is mainly due to "sales pressure" talk from the marketing oriented developer. Emphasis is placed on the "fancy" features while the amount of up-front preparation work, to make use of these features, is conveniently glossed over. When the system is finally implemented, unrealistic demands are made on the system. System Managers must be aware of the details of the technology being used by their subordinates. If this is not so, realistic procedures cannot be established and the resulting lack of respect by subordinates will lead to cooperation problems.

3.3.2 Resource planning

The introduction of CAE does not occur overnight. It must be planned for and resources allocated accordingly. Some factors, due to the introduction of CAE, affecting resource allocation include:

- Re-training of people. (Refer to the paragraphs on "Training" (3.6) below);
- Time investment of key people in designing and implementing the system. Many people, usually fully allocated to their normal work, will have to spend quite a substantial amount of time with the system developers and implementation staff. This time is an overhead and must be accounted for;
- Plan for staff turnover (especially key personnel). The implementation of a system can be severely hampered by the untimely removal of key people. Contingency plans should be made (if resources allow it);
- The effects of unions and workforce demarcation need to be accounted for;
- The availability of skilled manpower must be taken into account. It is no good having a hi-tech solution with no people to run it;
- Development costs in terms of people, time, hardware and software. This cost is a major negotiation point when external contractors do the development, but is often overlooked when in-house development is done.

3.3.3 Non-traditional Design

Managers must be aware of "new (non-traditional) mechanisms" in the design process. (Refer to the paragraph on "Procedures and Administration" (3.4.2) below). People's roles need to be more carefully delimited because what one person does directly effects his neighbour. Previously, designers would have worked in isolation, compared notes at the end of the day, then gone back for the next iteration. The loss of visibility of an individual's contribution in a centralised, integrated environment must be compensated for by other intrinsic rewards.

3.3.4 The importance of system ownership

A project champion is important. Without pro-active people in an organisation, stagnation and loss of competitive spirit results. The introduction of CAE is one of those activities that places strain on an organisation and someone must create and maintain the momentum required for eventual success.

Once development is complete, the system is handed over to the "owners" and software maintainers. These "owners" must be clearly defined, as someone (an individual, or a number of individuals) must take responsibility for the system. Someone must pay for running costs. These costs include operations (CPU time, disc and tape storage), maintenance (hardware and software), enhancements, insurance, etc. It doesn't make sense spending a great deal on development and then hoping the system will look after itself. These costs must be taken into account otherwise system degradation is inevitable.

3.4 Design Philosophies, Procedures, Operations and Administration

3.4.1 Design Philosophies and practices

Traditional organisations follow a serial design philosophy. One person's activities are directly dependent on the completion of another person's activities. This can be compared to an "In-Basket / Out-Basket" operation. A preliminary design is placed on a drawing. This drawing circulates through all relevant design teams for comments and to give them the opportunity to adjust their part in the total design and in turn circulate this information to all interested parties. This method works (and has been done so for quite some time), but it is slow (therefore preventing many iterations) and it is prone to error. The final touches of getting a design to work are carried out in the field.

If the necessary integrated tools are available and the staff are adequately trained in their use, then multi-discipline, concurrent design is possible. Any work done by one team is immediately accessible to all other teams, who are then able to add their contribution (largely in parallel). Each team does not have to collect and collate information from all the other teams for their own purpose. The proliferation of locally stored, out-of-date information is largely eliminated. When one team wants to modify a design that could compromise another team's work, the system can detect and prevent such clashes. This enforces improved communications, as the building up of the total design is now everyone's responsibility. If sufficient facilities are available, the emergence of very tightly coordinated, close-knit, MULTI-Discipline design teams will emerge.

3.4.2 Procedures and Administration

New technology (especially integrated technology) spreads over traditional functions. New interfaces and procedures need to be established and managed. An organisation must be in tune with its information systems. Procedures and policies need re-evaluation and modernisation as organisational information systems evolve to utilise more modern technology. Old paper based procedures need to be replaced with "communication protocols". Communication is the new key word (as information is generally freely available). New administrative relationships needed to be established between the new teams organised to take advantage of the new integrated systems.

It takes time to implement, organise, test and establish new procedures. Management and users must accept this. The following point is emphasized once again; these new procedures will not materialise by themselves as a result of a new system being installed. They must be explicitly established through negotiation between all parties involved.

3.5 User Aspects

The three supporting structures of a CAE system are Management, Users and Technology. Management has been dealt with above and Technology is dealt with in other chapters below. Some factors effecting users (and non-users) of CAE systems are discussed.

3.5.1 Job design

Decisions need to be made about task allocation between human and computer. Some tasks previously done by people will be taken over by the system, but people are needed to run the system and their roles will therefore change. Different skills are needed. Jobs must be re-designed to make full use of the benefits of CAE and not simply a translation from manual to computer. Human aspect must be taken into account though, to prevent bitterness about having work taken away. Retraining of replaced workers, to carry out higher skill and alternative activities, should take place before a system is introduced.

Only a fraction of a designer's time is actually spent interacting with the system. Communication about a design, meetings, design reviews, etc. are still normal activities. Information gathering still consists of a lot of person-to-person contact but a lot of information would now be accessible via the system. System bugs and software and hardware issues often take up too much of a designers time. They tend to get too involved. A trained system administrator is needed to isolate users from these problems.

Users would experience more formalism and therefore less autonomy over how they do their jobs. It could be felt by designers that being forced to use a common tool may stifle creativity (in preference to better adherence to standards). Creativity and innovation are admirable and necessary qualities in a design team. Although, when the individuality and ego that accompanies these qualities becomes counter productive, then restrictive measures have their place. The system should be flexible enough to cater for individual design styles, but must be restricted within reasonable bounds.

The role of the Drawing Office Supervisor could be greatly affected by an integrated CAE system [MGT 10]. Traditionally, the drawing office is the custodian of all design data, whereas now, much of this design data is freely available to anyone requiring it. If the system is centralised, then power (and staff) tend to be removed from the Drawing Office and distributed to where they are better utilised. The authority to allocate work between human and computer could also be removed from the D.O. supervisor.

3.5.2 Skill factors

Deskilling (i.e. the replacement of skilled people with less skilled people) does not generally take place. The opposite actually tends to happen, because designers begin to do their own drafting and data control. Low skill jobs could become threatened. Much of the functionality of Drafters, tracers, data controllers, etc. who perform little more than a clerical role, would be taken over by the system and used directly by the higher skilled designers. A side effect of this elimination of lower skilled people is that older designers (familiar with paper based design) refuse to directly interact with the CAE system. This is because they see it as a "Data Controllers" job, ie. a menial task, despite the fact that a layer of unnecessary, error prone communication is eliminated.

This is unfortunate, because CAE systems require higher skilled operators than simple database systems, yet traditional designers are expecting data controllers to operate the system on their behalf. This will not work, hence the requirement for an attitude and culture change. Experience has shown that successful implementations of CAE are operated by higher skilled people. (One benefit of higher skilled users is the improved communication between system developer and users due to the more sophisticated understanding of the higher quality users).

3.5.3 Differences between users and non-users

One would expect different sentiments from users and non-users, namely:

> Non-users would tend to be negative about the technology. They perceive their jobs to be less motivating, needing less skill, of less significance, and having less task identity.
>
> Users would tend to be positive. CAE seems to provide better job opportunities, new procedures are made more important than old methods, "wizkids" are placed in the lime light, etc. This can cause resentment among non-users.

Actual findings differ somewhat from the above expectations:

> A general trend was an all round negative feeling because of the perception that designing is a dead end job (whether a user or not). This is interesting, because CAE could be perceived to open new doors, or could be seen as a threat that degrades their job status (already shown to be a false perception). Both old and young see the potential of CAE yet the elderly don't see the opportunities in their own personal future while the young see CAE as a very important part of their future yet other organisational factors (salary, working conditions etc.) tend to play an even bigger role. Non-users sentiments towards the technology also depend on whether they chose to be non-users or were excluded for other reasons. [MGT 02].

Job end goals of users and non-users are the same (e.g. get a design done) but job content and methodology differ dramatically.

3.5.4 Age factors

Older people tend to remain non-users and spend more time on supervision, high level creative/conceptual design, and support and maintenance of old designs. They spend relatively little time on the detailed design of new projects. Younger designers spend much time collecting information and are principally involved in the detailed design of new projects. Many old non-users don't see any personal benefit in learning a new "foreign" technology and are quite happy to be delegated to less important jobs. This would be the group nearing retirement.

Younger people tend to use the technology first. The average age of users is 39 while that of non-users is 48 **[MGT 02]**. (An even larger gap is evident in ESKOM). The chances of someone becoming a CAE user decline by 2% for each year of age (i.e. someone 10 years older would stand a 20% less chance of being a CAE user). New projects go to users (therefore young people). Although younger people are less experienced overall, they tend to be better educated and more experienced in modern technology. Care must be taken though, to not lose the experience of older people as they are moved aside.

Young and old have different learning capabilities. The young seem to learn faster and rely a lot on memory while the elderly learn by adjusting their experience to new conditions, ie. learn by analogy.

3.5.5 Job security

Generally there are no job reductions (as promised by vendors) **[MGT 08]**. There is often an increase in staff during transition phases and this extra staff usually remain with the organisation as benefits click into place and production is increased. The perceived job threat seldom materialises if people are prepared to be retrained for new roles. There is a fear by technicians that engineers may take over (and the same between drafters and technicians). This is a valid fear as CAE systems demand higher skilled operators. In South Africa, this "replacement" is negated by the shortage of skilled engineers and the trend to make engineers managers. The very low skilled people do face a real threat and would have to be prepared to advance themselves or face redundancy.

Non-users, and lower skilled people would be first to go in hard times. Those, in which a company has invested much in training, would be retained the longest.

3.5.6 Ergonomic factors

These are very often overlooked, yet can cause problems that only surface in the long term. Working conditions of "terminal bound" staff must be carefully considered to reduce health problems (e.g. back pain, eye strain, stressful chaotic surroundings, etc.) Reduction in on-the-job social communication must be compensated for by providing more non-job related social activities. **[MGT 22]**.

3.6 Training

Training is absolutely vital for bringing about a culture change and to reap maximum benefits from advanced technology. This is probably one of the most important, yet most overlooked facets of CAE. Training is repeatedly mentioned throughout the "Non-technical" sections of this report. Managers, Users, Developers, Maintainers, everyone interacting with the system in any way must be adequately trained to carry out required tasks. This is even more vital in sophisticated environments such as integrated CAE.

Whether CAE is used in front-end design or only down stream functions, affects skill requirements. CAE support of front-end design has higher skill requirements. "Operators" will tend to be well educated engineers or technicians. If CAE is only used in down-stream operations (e.g. drafting), then deskilling could take place. Drawing office staff, who previously took an active role in the design function, could become little more than CAD operators / Data controllers, requiring very few engineering skills. As was stated in "Right and wrong reasons for the introduction of CAE" (3.2.2), using advanced technology as a replacement for menial manual tasks seldom justifies the cost of the system. The further up-front that CAE is used, the bigger the benefits, and therefore training becomes even more important.

3.6.1 Skills shortages

Some of the most common skills shortage problems are listed:

- Lack of general computing skills: keyboard use, data management, computer usage discipline and consistency;
- Engineering ability: CAE is not creative and innovative, but is good at data capture, analysis and "what-if" scenarios. Very advanced systems may even attempt to offer some advice in how a design may be improved, but creativity remains a human trait and the computer used only as a high speed tool. Lack of engineering ability cannot be made up for by using sophisticated tools;
- Designs can be greatly improved by iterative refinement. CAE's short design cycle time capabilities are very often not properly or fully utilised due to lack of training;
- CAE encourages rationalisation and the development of a modular product range to reduce piece-part proliferation. In general, engineers are not sufficiently aware of the logistic problems caused by individual designs. Designers generally have insufficient insight into the operation and maintenance problems of the equipment they design. Modularisation and consistency are factors that enhance understanding and maintenance of systems. Modular designing for multiple purposes is an acquired culture that requires some training and a lot of practice;
- Centralised design places an extra communication burden on designers who tend to be introverts, and interpersonal skills and improved communication tend to be lacking due to traditional islanding of functions.
- Formal training (such as at Technicons or Universities) is needed in larger quantities. This is because traditional, single discipline teams, where a trainee would undergo an on-the-job "apprenticeship", are no longer well defined. There may only be one expert per discipline who would be too busy to act as mentor to trainees. The days of master and life long pupil are (unfortunately) disappearing.

3.6.2 Specific skills needed

- **Computer awareness:** Simple things like typing skills, basic computer operation, what a disk is, the difference between a PC and a mainframe terminal, etc. Without such very basic skills, further training and use of the system are severly hampered.
- **System Operation:** How to logon, how to use the menus, function key operations, screen forms, etc. What to do when something goes wrong (e.g. a network dip or the database goes down). How to use the provided facilities to query data and produce reports. In other words, how to USE the system.
- **Conceptual model and design functions:** Just knowing what keys to press does not help much if one doesn't know WHY. Design functions and the conceptual model must be mapped onto system operations, menu options, screen forms, etc. This is very important if full use is to be made of the system's advanced features.
- **System Administration:** The person(s) responsible for the administration of the system must know all the required functions and procedures to keep the system running smoothly. These functions include user registration and access profile administration, database monitoring, cleaning out log tables, importing external data, etc.
- **System Maintenance:** The team taking over maintenance of the system must be fully trained in the technical aspects of the system. The procedures to be followed in carrying out modifications, re-testing and placing back into production must be strictly followed. Standards must always be correctly applied. If maintenance is not carried out in a very disciplined manner, system degradation is inevitible. Seeing that approximately 80% of a system's life time costs is consumed by maintenance **[SM 06]**, it must be done properly, and to do this, training is necessary.
- **Training:** In order to train other people effectively, instructors themselves must be well trained. Training techniques need to be adapted to suite the skill and organisational level and personality of trainees.

3.6.3 Training methods

Various training methods are available. The most effective method(s) depend on the type and size of the system, the nature of the organisation and the nature of the trainees. Experience has shown that tutor based formal lessons are the best introductory training and thereafter on-the-job hands on training. Once some experience is gained in the use of the system, follow-up, advanced lessons can be presented. (It is advisable to provide a separate training system so that production data is not at risk). Users generally are only interested in learning just enough to get their job done. This is human nature and shouldn't be overlooked by an instructor. Subtle techniques need to be used to make users see the benefits of broader thinking. Other methods such as Computer Based Training (CBT), Interactive Video Instruction (IVI), the use of consultants etc. all have their place, depending on requirements.

3.6.4 Continuation of Training

Training needs to continue for a time equal to that of the life span of the system. New staff members and people changing roles (but still remaining as users of the system) need to be trained. It is unreasonable to expect a newcomer to simply climb in and learn the system. Continued, regular, formal training is required. Re-training may also be required after each major modification or enhancement.

3.7 Considerations for System Developers

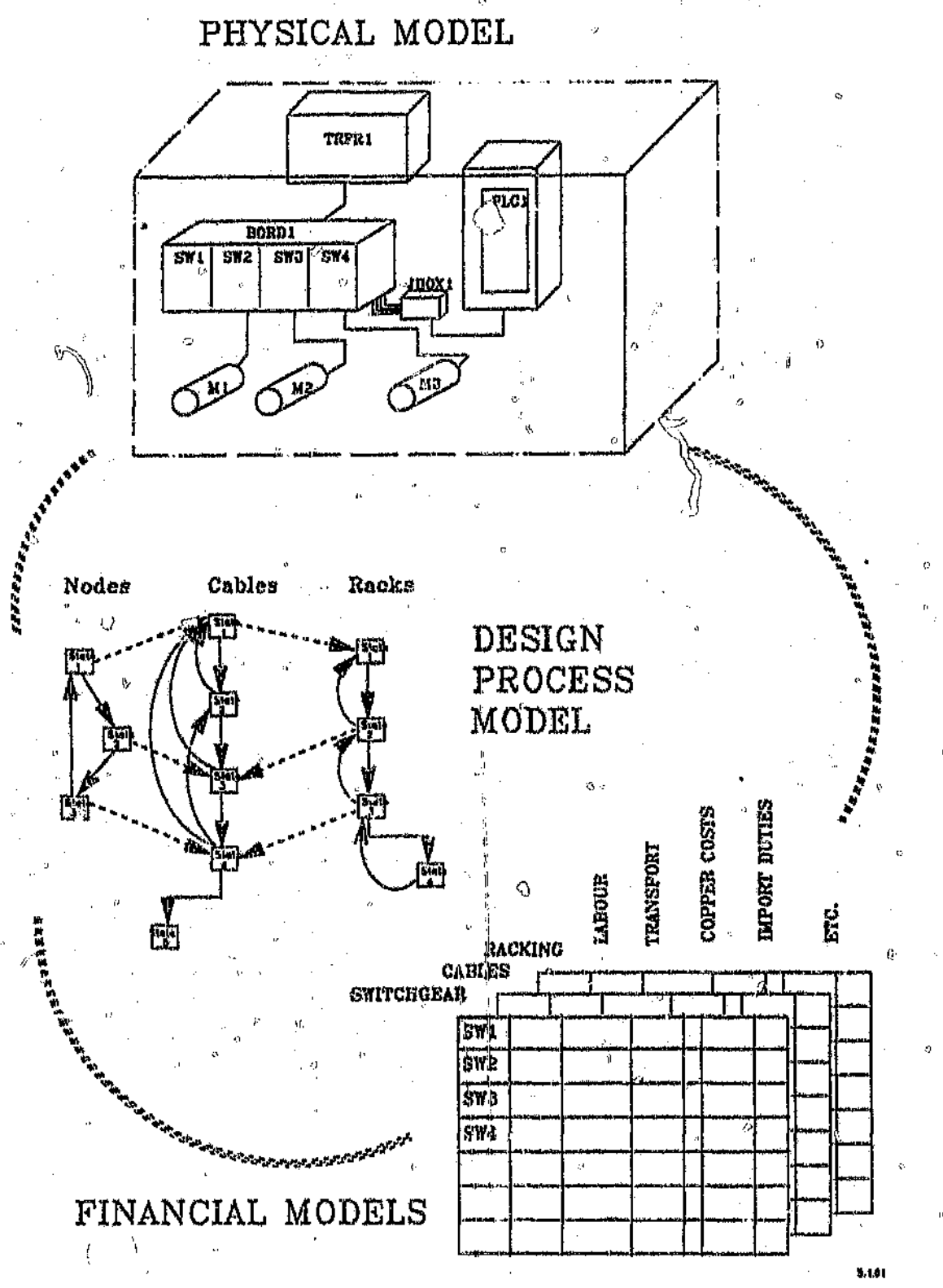
The developers of a system also play a crucial role and understanding of the above non-technical issues is a prerequisite. Generally the people allocated to establishing CAE requirements are experts in their own domains but have little knowledge of CAE technology. It is therefore difficult for them to visualise system requirements when they don't know what is possible and what is not. This is a very frustrating time for system developers because users are generally only prepared to have certain of their mundane manual tasks computerised (for fear of loosing control), whereas the developer is attempting to bring about revolutionary changes requiring a major culture change (which does not happen overnight). Computer systems should be designed in a fashion which allows for gradual introduction (i.e. evolutionary, not revolutionary) otherwise rejection of the system is inevitable. As a system is gradually introduced, users begin to experience the benefits (and frustrations of missing functionality) and will, hopefully, gradually begin to alter their behaviour in favour of further advancement. Both sides must continuously make concessions in order to keep momentum.

Management on the other hand must understand the difficulty in analysing current procedures in an unstable, dynamic environment. For example, as soon as the developers have sufficient detail about certain activities, the goal posts are typically moved (sections re-organised, people moved etc.) and large chunks of system requirements are invalidated. The developers, in turn, must account for this and create sufficiently flexible systems that are based on logic and not politics (as logic is absolute, politics fickle).

Developers need to employ "tricks" to bring about the required culture change. "Carrot Dangling" is used by emphasising how a user's vested interests can be enhanced by using the system. If it can be clearly shown that a user will save time and effort at doing something that is particularly frustrating to him, new ideas will be accepted. I.e. the developers must get to know the users quite intimately. Users must also sometimes be allowed to design small parts of the system for themselves. This provides an all too important sense of ownership. Another aspect is to concentrate on young people as they are more adaptable. Identify the key decision makers and try win them over. Others will follow out of fear of upsetting their superiors.

Users often demand that a tool must not restrict or dictate activities. This is true within reason, but one of CAE's strong benefits is rationalisation. This should not be compromised to such a degree that other related benefits are lost, just to please the users.

Development should not attempt to exceed the limitations of the computer platform as this leads to compromised, difficult to maintain software. For example, it shouldn't be attempted to create fancy graphical representations on a text-based mainframe terminal.



The Physical, Financial and Design Process Models

Figure F4.1.01

4 System Models

4.1 Introduction

Any information system must be based on some or other "model". **[MDL 25,32]** For example, an Accounting systems may reflect the Dual-Entry Journaling system and a Salary package could be based on a "Salary Profile Model".

Design systems are best based on models that reflect the equipment or system being designed. If the designer can work with the computer tool as though he was working with a model of the real system, then usage of the tool is greatly enhanced. This is because the tool provides the necessary facilities for the designer to think at an optimum conceptual level and not have to keep translating conceptual thought to a lower level suitable to the tool[1]. Consider an electrical system design package for example. A designer thinks in terms of transformers, cables, switchgear and motors. The system must therefore enable the designer to do just that. He should not have to think in terms of database records or lines and curves. The model may well be implemented using such primitive concepts, but the user interface should shield such implementation details from the designer and present him with a consistent, usable interface which facilitates thinking at the correct conceptual level.

Modelling real world situations is difficult because the model chosen is very dependent on the point of view taken. For example: a designer is interested in voltage and current levels, a site engineer may only want to know which contractor is doing what work, a project accountant may see the system as a series of related cost codes, planners may only be interested in what is done and when it is being done, and not how or why. The approach taken in developing CEEDS was:

- Firstly the system is a Design Aid;
- Secondly a Construction monitoring tool; and
- Thirdly a Contract monitoring tool (Refer to **"Financial Models"** (4.4) below).

This order of priority has obviously effected the point of view from which the models have emerged. The driving force was to create a suite of models suitable for the design and construction of electrical systems. They are based on the real-life way in which electrical systems are made up. The PHYSICAL Model is the main model and forms the foundation for all subsequent models. In order to control the design process, a DESIGN PROCESS model is proposed. This model would control the sequence and validity of operation being carried out on the Physical model. The costs of the physical equipment contained in the Physical model can be determined by having a "Cost Reference" into an appropriate FINANCIAL Model. Each of these models are discussed in detail below.

Refer to **Figure 4.1.01.**

(1) Generalised CAD systems are not optimal design tools because the designer must think in terms of primitive concepts such as lines, curves and surfaces and not in terms of the physical objects with which he is working. The "representation" presented by such a CAD system carries very little inherent information and therefore analysis of the design represented is correspondingly difficult.

4.2 Physical Model

The physical model developed for CEEDS was also influenced by certain organisational factors. It must be emphasised that the main thrust of the system was to model power distribution equipment. But the model applies equally well to process control equipment. For example, with power distribution, the "Switchgear Board" is a main component, whereas with C&I equipment, a PLC Cabinet may be the main component. The majority of functionality currently provided favors the power side. A reason for this bias is that the majority of Electrical Design is done in-house whereas the majority of Process Control Design is done by external contractors. One of CEEDS's main functions is the management of power cables and most process control cables (therefore accounting for the well developed Cable Design Functions and the conspicuous absence of other design aids).

Another influencing factor in Model design is the dependency on currently used technology. For example: Switchgear using electro-mechanical control has very different specification attributes to a switchgear using electronic control technology. This effects the model details though, and not the principles.

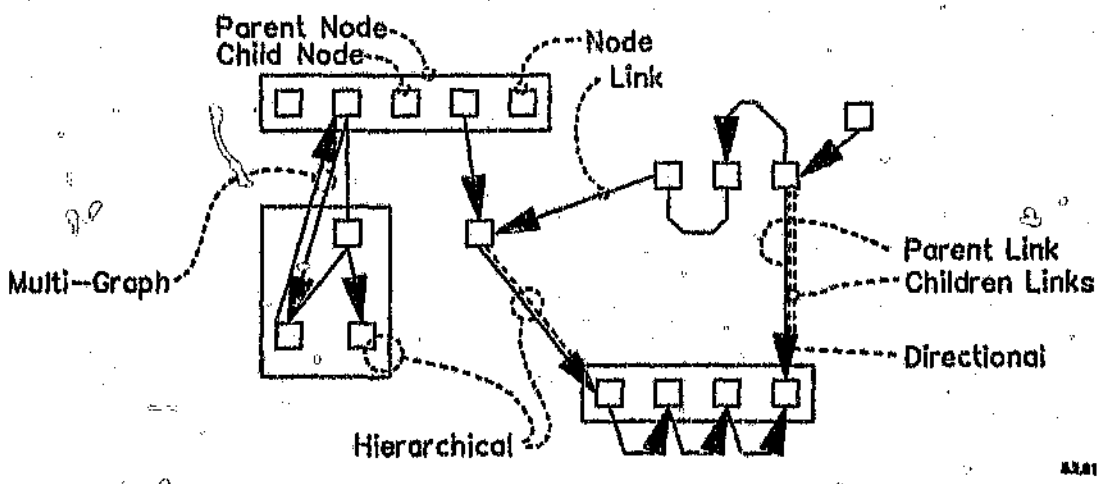
4.2.1 Graph based Node-Link Model

The conceptual model chosen is a "Hierarchical, Directional Multi-Graph based Node-Link Network".

- Graph: The data structure is a graph structure (as opposed to the simpler tree structure for example) consisting of Nodes (Vertices) and Links(edges). A Graph structure allows any node to be linked to any other node and thereby creating a "Network". A link may only be coupled to one node at either end.
- Node: Any piece of equipment that can be visualised as a "box" and has cables connected to it, is modelled as a node.
- Link: The cables connecting Nodes.
- Multi-Graph: More than one link can exist between any two nodes.
- Hierarchical: A number of nodes may be "allocated" to one node, or one node can be seen as consisting of a smaller "Network". Links can also be hierarchical in that a single conceptual link may exist between two nodes but it may consist of a number of physical links (i.e. parallel cables).
- Directional: Links can carry directional information. E.g. the normal direction of power flow or signal flow.

Figure F4.2.01 demonstrates the graph concept and **Figure F4.2.02.** shows how the model is derived from the physical situation to a conceptual representation to a data structure representation.

An example of where multiple nodes are allocated to another node is a Distribution Board (one node) that has many switchgears (each a node) "allocated" to it. Refer to **Appendix A4.3** to see how such allocations could be interpreted physically. A link is hierarchical when multiple cables are used for a common purpose, e.g. three single core cables, each with a unique identifier (cable number), are required to conduct a given current. There are three separate physical cables but functionally they are only one link.



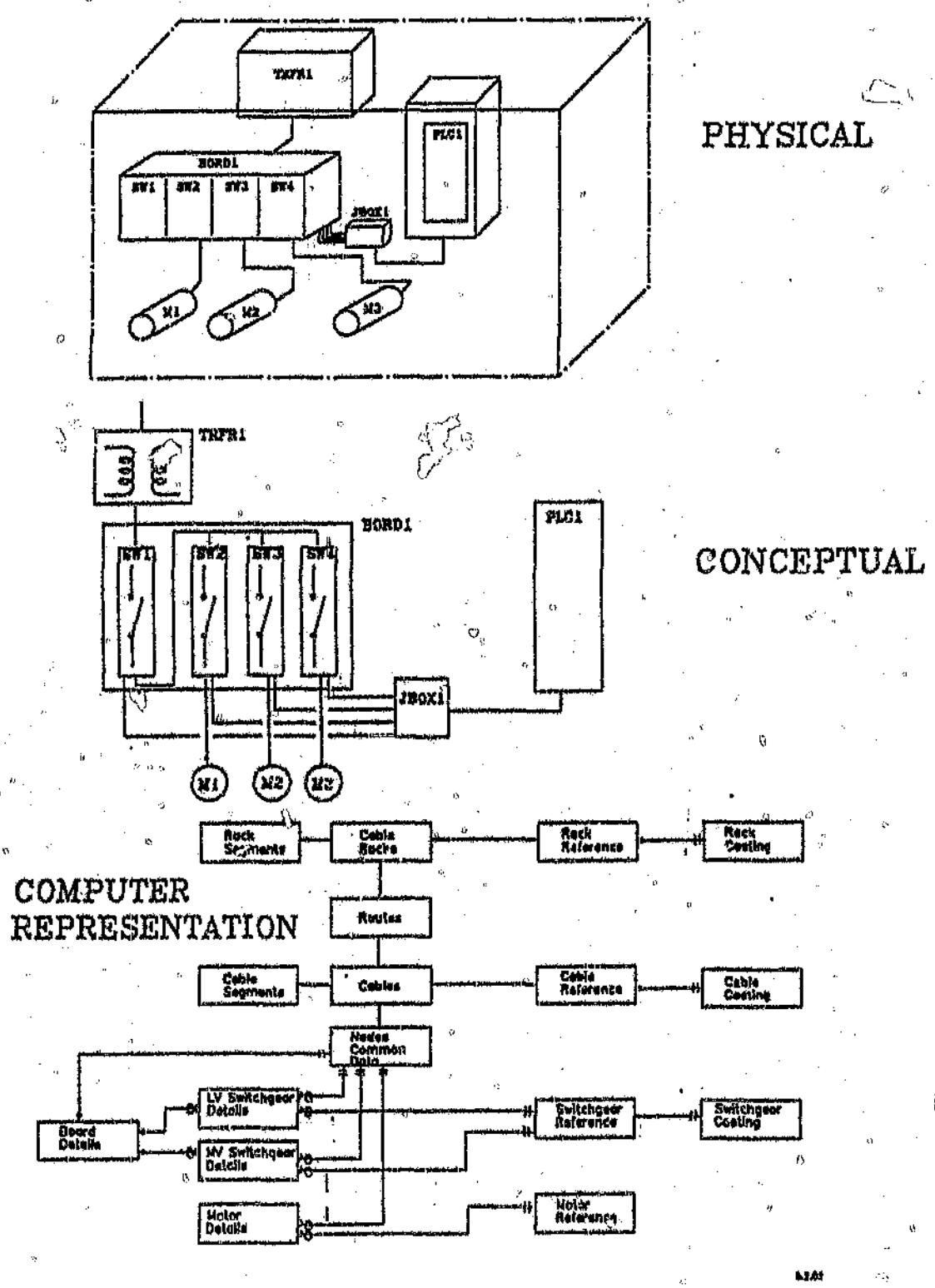
Hierarchical, Directional Multi-Graph Node-Link Network

Figure F4.2.01

Any operation involving the "link" must be carried out on all members of the link. (For example, all cables belonging to the link should be routed along the same route and not split over various alternative routes). This is achieved by having a "Parent Cable" with "Children Cable(s)" belonging to the parent.

The Level of detail that the model must manage can also vary, and there are various techniques that can be employed for these levels. For example, an electrical network can be visualised having a Macro, Mid-range and Micro connectivity.

- At a macro level, there isn't even the need for actual links. One of the attributes of a switchgear for example would be a "Feed Code". This would indicate the end user of the power controlled by the switchgear. Any nodes in-between the switchgear and the end user (such as junction boxes, transformers, speed controllers, etc.) are ignored. Ring feed systems and alternative paths are ignored by assuming power flow in only one direction (the default direction would be chosen). This results in a tree representation of the distribution network. See **Figure F4.2.03.** There are uses for this level of modeling, especially for initial design where unnecessary detail clutters and confuses the issue. For example detailed cabling need not be known in order to work out a suitable distribution system or in deciding which loads to allocate to which boards. A representation at this level would resemble a "Single line" diagram;
- At the "Mid-range" level, all nodes and all cables (links) would be modelled. This level is very good at representing connectivity between equipment. A representation at this level would resemble "Cable block" diagrams;
- At the Micro level, individual cores within multi-core cables, and the Terminal strips within Nodes would be modelled. This provides sufficient detail to carry out construction and commissioning of any modelled equipment. A representation at this level would resemble "Termination" Diagrams and detailed schematic diagrams. Modelling down to termination level makes it possible to provide automated support for the design of equipment such as junction boxes, distribution frames, splitter boxes, etc. Refer to **Figure F4.2.04.**



From Physical to Conceptual to Representation

Figure F4.2.02

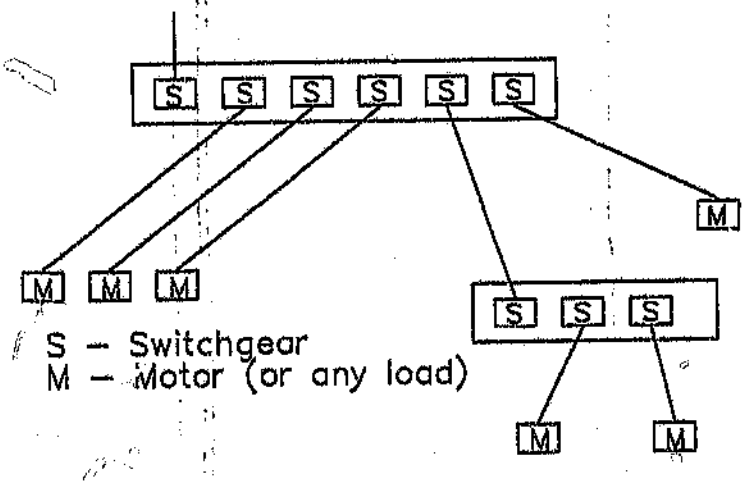


Figure F4.2.03

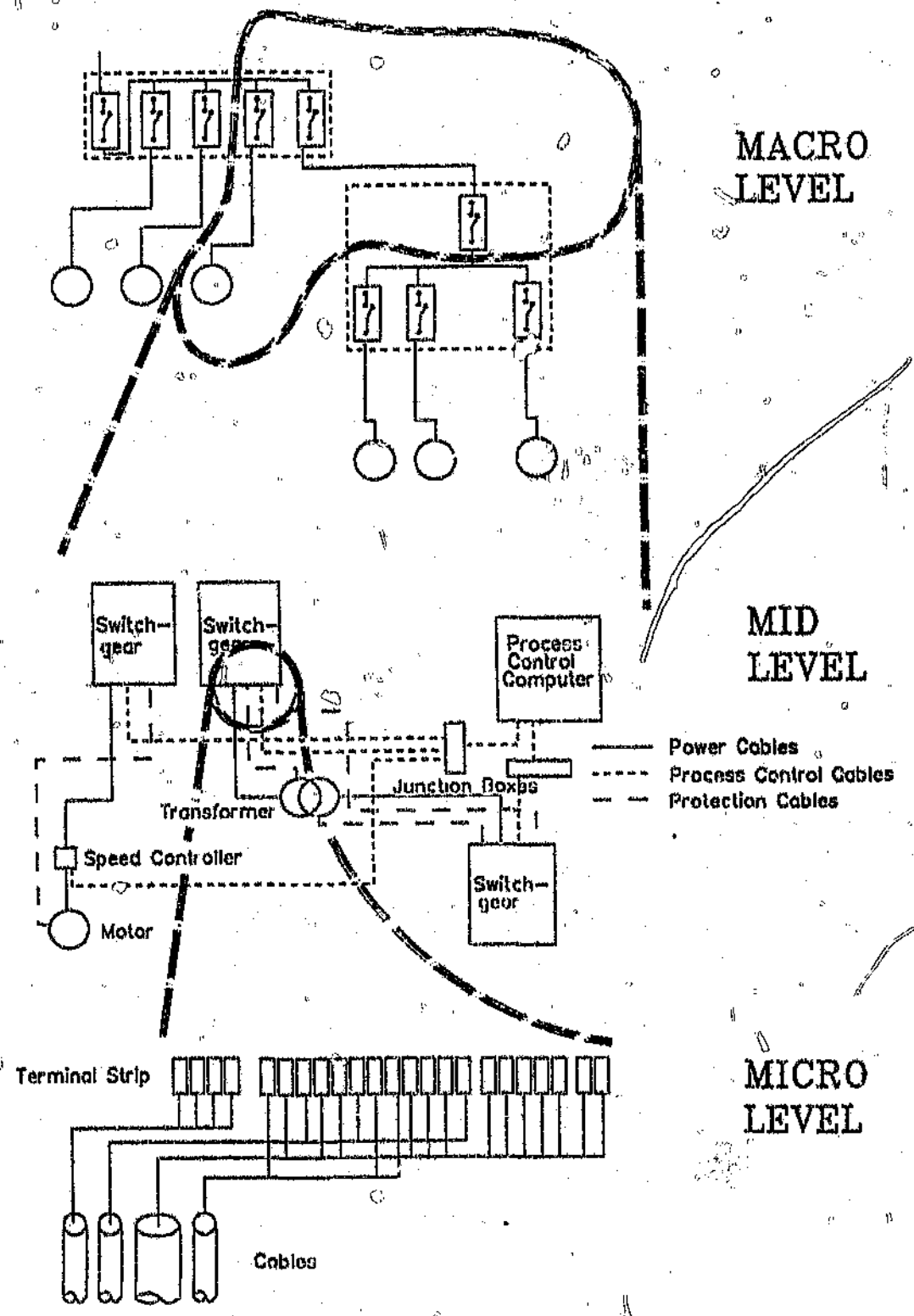
Facilities should exist whereby the integrity of these three levels is guaranteed. For example, macro level connections cannot be changed once cables are coupled, and the cable path (at the mid-level) must not conflict with the Macro connection. It is proposed to guarantee this integrity by controlling the order in which actions may take place. (Refer to the "**Design Process Model**" (4.3) below). Using the representation schemes described below, a graphical query could be set up whereby multiple levels are represented simultaneously and visual verification can take place.

4.2.2 Systems, Identifiers, Equipment Classes and Types

Each Object (Node or Link) within the model must be able to be uniquely identified. This is achieved by giving each object a unique "Object Identification Code". (I.e. every INSTANCE of a node or link is coded to indicate its place in the total system)[1]. The underlying database management system ensures uniqueness. Along with this code a natural language description is also given to enable human interpretation of what the node is.

Each object is also given an "Equipment Class", and within that Class, a Type can be specified. See **Figure F4.2.05** for an analogy between a node and a person. The Object ID Code (and attached description) describe an instance of a node and is unique while the Class and Type give details about the node itself which are independent of the situation in which the node finds itself.

(1) An international standard coding system has been developed for use on power stations. It is known as the Kraftwerk - Kennzeichensystem (KKS) Coding system. This coding system has been adopted by ESKOM for use on all new projects. The identification code used on CEEDS is code independent to allow for non-KKS "System", "Pseudo", and Dummy nodes/links and to allow the system to be used for older Non-KKS coded stations. Verification of the correctness of codes is achieved by a specific Coding system batch mode verification facility (Refer to "**Codification**" (5.3.3) under "**Design Functions**" (5) below)).



Macro, Mid and Micro Levels of Detail

Figure F4.2.04

For example, a motor of given Type can be used in multiple locations, but each location is unique. There is one other identifier which doesn't play a part during design but is used during maintenance. This is the "Stock Item" number, or Serial number of a given physical piece of equipment. A motor Node Identifier (for example) identifies the node's position and function within a system and does not depend on which specific instance of motor is actually installed during construction.

If this motor is removed and replaced with another motor of the same type, the removed motor retains its own "Stock Item Number" but not its Node Identification Number. The new motor (with its own Stock Item Number) inherits the Node Identification number from the removed motor. Both the old and the new motors should have the same Type Code. See Appendix A4.1 for details on the KKS Coding system and on the proposed Class/Type coding system.

See Figure F4.2.06 for an illustrative example.

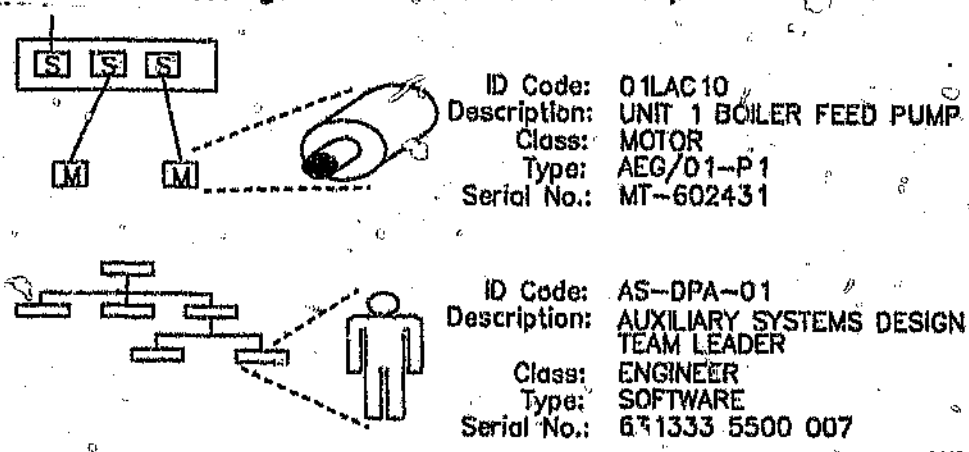


Figure F4.2.05

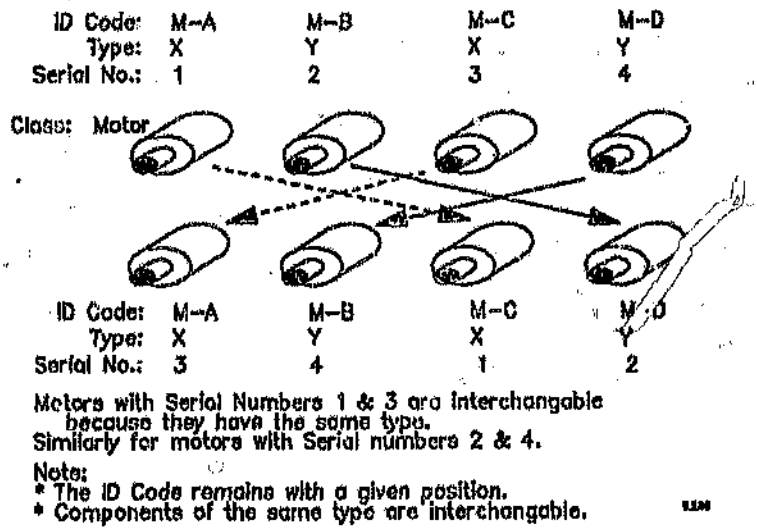


Figure 4.2.06

4.2.2.1 Type Reference Tables

Two of an object's attributes are Class and Type (as mentioned above). These two combined could be used to provide a unique reference into "Reference Data". "Type Reference" tables are used to store all data relating to a given Type of equipment. Separate tables are used for each Class of equipment. The data contained in these Type reference tables are those attributes which remain fixed for a given piece of equipment. Those attributes which could vary from instance to instance of an equipment type's usage are attached to the specific Node (or Cable). By giving an object a Type, all of the attributes contained in the reference table can be "inherited" by that object, and need not be explicitly stored with the object. Some attributes in the reference tables may be "Default" values. These could then either be inherited by an object or overwritten in a duplicate attribute attached to the object. (Refer to **"Detail of attributes of various nodes and links" (4.2.4)** below).

The attributes contained in a reference table would depend strongly on the Class of equipment whose types are stored in the table. These attributes could include:

- All fixed technical data. For example, a motor has certain [illegible]s, properties, physical sizes, connection types, etc. (variable data, such as expected load (not rated load), for a specific node, is attached to the node);
- If the computer environment is suitable, graphical data such as torque/speed curves and base plate layout could be coupled to the reference data;
- Default data (as mentioned above);
- Cost reference(s) into various financial models. One Cost Reference Code could refer to a Financial model that would indicate capital expenditure (contractual) cost for construction purposes. Other Cost Reference Codes could refer to models that indicate spares purchase costs for maintenance purposes. Certain other costs could be directly coupled to a type and not referred to via a financial model. This depends on how complex the cost determination of a type of equipment is. (Refer to **"Financial Models" (4.4)** below);
- Expected labor time (and costs) to replace, repair etc. for Trade union and work load purposes;
- and there could be many more.

This Reference Information may be common to Design / Construction systems (e.g. CEEDS) and Maintenance systems (e.g. PERMAC). If such Reference Information is available to both systems, the design system need only supply the maintenance system with minimal information (such as Object Identifiers and Reference Codes) because all other data would be available in these centralised facilities.

There are some complications in the use of this reference data. These include:

- Various projects may use different subsets of this reference data. (e.g. the Majuba project may use a different set of cables to the Kendal project);
- The cost references for a given equipment type may be different for the various projects. (e.g. even though both Majuba and Kendal use a certain type of cable, the cost of cables for Majuba may be higher than that of cables for Kendal because of higher transport costs for instance).

Possible solutions include:

- Using separate reference facilities for each project. This is the simplest method but could lead to relatively large scale duplication of data; or
- "Project codes" could be incorporated into the centralised reference system to allow access to project specific attributes; or
- Separated "Look-up" tables could be created and maintained for each project with links into the main reference tables.

For current reference facilities and for details on how switchgear are currently specified, refer to **Appendix A4.4.**

4.2.2.2 Systems

Various information contained in the model can be grouped into "Systems" as seen from different points of view. Some groupings already identified include:

- **Grouped by Contract:**
  All of the equipment that is to be supplied under a given contract is grouped together. (A document that is produced along these lines is called the "Contractors Electrical Equipment Listing"). This is achieved by allocating to every object, a "Contract Code". This is a link into a series of Contract/Contractors reference facilities containing all relevant information about the Contracts and the Contractors);
- **Grouped by "Work Package (activity)" in a Project Master Plan:**
  For construction purposes, one must be able to determine which equipment is installed and/or constructed, and in what sequence. The total construction is broken down into work packages (which are further broken down in detailed activities). These "work packages" are given a code. Each object in the physical model is then allocated such a code. Refer to the "**Design Process Model**" (4.3) for details;
- **Grouped by physical functionality:**
  For example: Turbine lubrication oil system, Soot blower system, Mill system etc. The KKS coding system used as identification for objects within the model has an inherent functional breakdown. Refer to Appendix A4.1 for details;
- **Grouped by physical location:**
  Each area/volume within a "building" is given a "Structure Code". Each object in the model is allocated to the area in which it would be located by attaching such a Structure Code to the object. In this way, lists of

equipment found in a given physical location can be produced. (The structure code is part of the KK3 Coding system. Refer to **"Extensions to the model"** (4.2.7) below and to **Appendix A4.1** for more details on Structure Codes).

With the exception of the Contract Code, all of the coding systems used in the groupings above are hierarchical in nature. (Refer to **Appendix 4.1** for an explanation of how a hierarchical code works). A grouping can be zoomed into or out of by specifying a more or less specific search criteria. For example: a complete building may have the code of **"11B"**, a large hall in that building has the code **"11BAU"** and a given floor area in that hall has the code **"11BUA01"**. One node may have a structure code of **"11BUA01"**, another a structure code of **"11BUA02"** and yet another a code of **"11BAC03"**. All three would be included in an **"11B"** grouping, only two in an **"11BUA"** grouping and only one in an **"11BUA01"** grouping. An example of the use of the functional grouping is how a distribution board can be "imploded" to represent the combined loads that it feeds. (Refer to **"Design Functions"** below).

4.2.3 Representational Schemes

On a conceptual level (i.e. human thought level) a "model" representing a real world situation can be visualised. There are any number of ways in which individuals could visualise such a model. Some visualisation schemes are identified and discussed. The computer on the other hand must be able to store, manager and manipulate this "model". A computer does not have the visualisation capabilities of a human and consequently a far more well defined and rigidly structured representation scheme must be utilised. Various schemes are briefly investigated and the scheme on which CEEDS is based is discussed in a bit more detail.

4.2.3.1 Conceptual Representation

The mental "picture" that a person would build for himself of this "model" is highly individual and very dependent on that individual's experience and point of view. A software engineer could visualise it as a series of icons joined by lines, an electrical engineer may see it as electrical equipment joined via cables in the form of a schematic diagram, a mechanical or civil engineer may visualise it in three dimensional space as a series of "boxes" occupying space and the cables as lying on cable racks. In order for a CAE tool to be as effective as possible, the representation schemes offered to the user should mimic his own internal mental picture as closely as possible. Three categories of representation have been identified:

- Textual;
- Two Dimensional (2D) Schematic (Symbolic);
- Three Dimensional (3D) Layout (Solid and/or Symbolic).

Each category has its place in a system as they present varying degrees of detail and the nature and characteristics are different in each. For example, a 3D layout would probably not be used to calculate board loading, whereas a 2D schematic representation could serve the purpose and details of a component can only be viewed through a text "screen", etc.

Declaration

I declare that this dissertation is my own, unaided work. It is submitted for the degree of Master of Arts at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.

L Bethlehem

Name of Candidate: Lael Bethlehem

31 day March, 1994.

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Chapter One: Introduction

Research objectives and rationale

There is a rich literature on the nature of industrialisation in South Africa. Writing from diverse perspectives, various theorists have attempted to account for the path of South Africa's industrial development and its consequences. Some writers have emphasised the international context of South Africa's industrialisation using the concepts of colonialism or the international division of labour. Others have variously stressed the role played by the state, the mining industry, technological dependence or cheap labour. The debates over the nature of industrialisation have been linked to broader discussions about the relationship between race, class and gender inequalities, between apartheid and capitalist accumulation, and between economic development and the rise of the trade union movement. The type of theory used to understand industrialisation therefore has important consequences for our analysis of South Africa's political economy more broadly. An understanding of the nature of industrialisation is also critical to any attempts to restructure South African industry and to shape the future path of industrial development. For this reason it is important to debate theories of industrialisation as widely as possible.

One of the more recent attempts to conceptualise South African industrialisation is found in the work of Stephen Gelb (1987, 1990, 1991). Gelb approaches the history of South African industrialisation after World War Two (WWII) from the perspective of regulation analysis. Using the tools developed by the regulation school in general, and the work of Alain Lipietz in particular, he constructs a model of South Africa's industrialisation process which he terms 'racial Fordism'. Gelb's model not only keys into the debates about South Africa's industrial path, but also into international debates about the nature and prospects of industrial development in the third world.

Gelb's conceptualisation has been widely applied and debated in South Africa. His ideas

carried particular weight in the early work of the Economic Trends Research Group which conducts research into the South African economy in consultation with the Congress of South African Trade Unions[1]. Gelb's framework has also been applied to other work, including recent research on workplace restructuring[2].

And yet despite Gelb's wide exposure, there has been little critical assessment of his application of regulation theory in general, or his notion of 'racial Fordism' in particular. The only substantive assessment of this work has been conducted by Nattrass (1989), who questions the validity of Gelb's macro-economic data, and therefore calls his analysis of economic growth and crisis into question. But Gelb's work is not only applicable at the macro-economic level. The notion of racial Fordism can be used to analyse various aspects of industrial development including work organisation, sectoral performance, trade union formation and the contribution of manufacturing to economic development. Indeed the work of the regulation school and its concept of Fordism have found wide application, not least in the field of Industrial Sociology where the Fordism framework has been used in conjunction with labour process theory to analyse industrial and economic restructuring[3]. Despite the fact that Gelb's framework has been used in a variety of settings, there has been no comprehensive assessment of his concepts other than at a macro-economic level. In particular, there has been an absence of work which engages critically with Gelb's understanding at the sectoral level. I have attempted to respond to this gap by conducting an assessment of Gelb's theory of racial Fordism at a conceptual and sectoral level. This study is a presentation of that assessment.

Methodology

I have sought to evaluate the validity and usefulness of Gelb's framework in two ways. Firstly, I have examined the conceptual roots of the theory, and assessed the internal

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[1] An example of the influence of Gelb's work on the Economic Trends Group is provided by South Africa's Economic Crisis, a volume produced by the Economic Trends Group and edited by Gelb.

[2] See, for example, Webster (1992).

[3] For an overview of this type of work see Allen (1992).

coherence of the framework at a theoretical level. In particular, I have explored the origins of Gelb's concepts by evaluating his reading of regulation theory, and his application of that theory to the South African context.

Secondly, I have attempted to assess the validity and usefulness of Gelb's notion of racial Fordism by using the framework to analyse the development path of a particular sub-sector of manufacturing - the pulp and paper industry. In so doing I have sought to test Gelb's framework against the evidence provided by a detailed case study of a particular sub-sector.

Gelb's work provides a general theory of South African industrialisation and does not claim to account for the development of particular sub-sectors. However, Gelb does claim to explain why manufacturing has developed in the particular way that it did in South Africa. He offers an account of the sources of growth, development and constraint in manufacturing. If Gelb's framework is to be useful, it should therefore, provide a basis on which to explain the development of sub-sectors of manufacturing, and in particular the larger and more dominant sub-sectors. If the experience of a significant sub-sector of manufacturing is counter the Gelb's overall thesis, then his framework would need to be questioned. If, on the other hand, Gelb's framework is useful in accounting for the development of the sub-sector, then evidence for Gelb's thesis would have been provided at a sectoral level, and this would strengthen his macro-level analysis.

Indeed, there is a well-established relationship between sectoral analysis and macro-economic analysis within the tradition of regulation theory. The notion of Fordism upon which Gelb's theory is based was originally rooted in attempts to explain the development of the automobile industry in the United States of America (Aglietta 1976). The notion of Fordism has also been used to explain the development of other economic sub-sectors both internationally and in South Africa. Examples of this include Maller and Dwolatsky (1993); Robin Murray (1988); Fergus Murray (1987) and the Greater London Council (1985). I shall examine some of these studies in chapter two. The methodological point that must be made here however, is that there is a tradition of sectoral case study analysis which draws on regulation theory in general and the notion

of Fordism in particular. I have tried to key in to that tradition by applying Gelb's overall framework to the development of a specific sector.

There are also limits however, to the case study method in general, and to a sectoral analysis in particular. I argue that a sectoral analysis can provide insight into the nature of a country's process of industrialisation, and can highlight particular aspects of industrial development that may be overlooked in a macro analysis. However, the experience of one sub-sector cannot simply be generalised for industry as a whole. While sectoral analyses are useful for developing and testing theories of industrialisation, a single sub-sectoral analysis cannot be used alone to describe a national process of industrialisation. My assessment of Gelb's analysis is therefore necessarily narrow, in the sense that I can only draw conclusions that stem from the experience of the pulp and paper industry itself. For this reason I have limited my conclusions to the sector itself and made only tentative suggestions as to their applicability to the nature of South Africa's industrialisation more broadly. In this sense I have been cognisant of the limitations of the case study method (McNeill 1985).

I have chosen to analyse the pulp and paper sector specifically because it stands out as one of South Africa's most significant manufacturing sub-sectors in the post-WWII period. Although it began as a fairly typical import-substituting industry in the inter-War period, it grew dramatically during the 1980s to become one of the leading sources of investment and foreign exchange in the manufacturing sector. In fact in terms of output, pulp and paper was the fastest growing sub-sector of manufacturing in the 1980s (IDC 1992). Given this performance, the industry presents itself as a an important case study of the dynamics of industry, and of the determinants of growth as well as constraint in manufacturing.

The nature of the labour process in the pulp and paper industry must also be taken into account. The manufacture of pulp and paper is a continuous process which takes place in closed vessels. As such it differs from the assembly line process which has been the prototype of the theory of Fordism. However, many of those who use Fordism as a framework have argued that it can be applied across the range of industries and not only

in the assembly sub-sectors. Gelb for example, argues that "labelling the growth model 'Fordism' should not be interpreted as an exclusive focus on the assembly line labour process. Fordism refers both to the relation between the expansion of productivity and thus of output, which the production-line re-organisation of the labour process made possible, and to the expansion of consumption 'norms' which became necessary to absorb the additional output. In addition, use of the label is not meant to underplay other processes of production, aside from the assembly line" (1991:14).

The use of a continuous process industry as a case study does not, therefore, present a methodological difficulty.

Research design

My analysis of the pulp and paper industry is based on research work that was conducted simultaneously for the purpose of this project and for the work of the Industrial Strategy Project[4]. Partly as a result of the dual nature of the work, it was possible to conduct extensive field work as well as archival and theoretical research. The field work component of the research consisted of interviews with managers and trade union representatives in the major companies active in the industry. I focused my company interviews on the two major companies in the pulp and paper industry, namely Sappi Limited and Mondi Paper Company. However, I also interviewed other companies in the paper pipeline[5] including Carlton Paper, Caxton Limited, Kohler Packaging and Nampak.

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[4]The Industrial Strategy Project (ISP) was a research programme designed to analyse the development and future prospects of the South African manufacturing sector. The ISP examined twelve different industrial sectors as well as various cross sectoral issues such as trade policy. The sectoral and cross sectoral studies were concerned with assessing the ability of the manufacturing sector to meet local needs and to compete internationally. The work was commissioned by the Congress of South African Trade Unions and was based at the Universities of Cape Town, Natal and the Witwatersrand. The findings of the Project will be published by the University of Cape Town Press during the course of 1994.

[5]By 'paper pipeline' I mean the set of paper related industries that stretches from forestry to paper converting. The notion of the pipeline is explored more fully in chapter three.

In addition to company interviews at the head office and divisional levels, I visited the companies' major production plants. These included two forest plantations; three kraft pulp and paper mills; three fine paper mills; two board mills and three paper packaging plants. I thus visited at least two of each type of production plant. Given that there are no more than four of each plant type in South Africa (with the exception of forestry), the samples are representative. With regard to forestry, the two plantation areas I visited were chosen because, according to the companies concerned, they were typical of the forest plantations in general. There is a fairly high degree of uniformity of labour process and product type at plantations in South Africa.

At each plant I interviewed the following personnel: General Manager, Human Resource Manager, Production Manager, Marketing Manager, Quality Manager (where applicable) and Shop Steward Committee. I thus interviewed *strategic informants* (McNeill 1985) who were well placed to answer my questions due to their particular position or expertise. The plant visits and company interviews were conducted on the basis of semi-structured questionnaires. Copies of the company and plant questionnaires are included as appendices.

In addition to the semi-structured questionnaires, I administered a structured questionnaire which was designed to produce quantitative measures of comparative efficiency. The questionnaire was designed in consultation with an industrial engineer[6] and consisted of measures of plant utilisation, raw material yield, waste and defects. I administered the questionnaire in pulp, paper and corrugated box plants, and used the results to produced comparative efficiency tables which are included in chapter three. A copy of the structured questionnaire is also included as an appendix.

The combination of qualitative data generated from company and plant visits, and the quantitative data generated from the efficiency questionnaire provided a rich and

[6] I was assisted in this process by Mr. D. van der Riet of Faull and der Riet Associates - Manufacturing and Retailing Consultants.

comprehensive source of information. This was used in conjunction with archival work (such as information gleaned from trade journals and national economic data), to provide an overall analysis of the sector. Additional information on specific questions was derived from interviewing relevant parties for their insights on particular issues. Parties interviewed for this purpose include:

The Board of Trade and Tariffs
The Competitions Board
The Council for Scientific and Industrial Research - Forestek
The Department of Water Affairs and Forestry
Farmworkers' Research and Resource Project
Faull and Van der Riet Manufacturing and Retailing Consultants
Forest Owners Association
Group for Environmental Monitoring
The Industrial Development Corporation
Labour Research Service
Packaging Council of South Africa
The Paper, Printing, Wood and Allied Workers' Union (PPWAWU)

Confidentiality

Given the small number of companies in this sector, respondents were concerned that their participation in the research might compromise their competitive position. Respondents therefore insisted on confidentiality. For this reason, I have referenced quotes drawn from my interviews in terms of date and area only. No individual or company name is revealed. Where information on specific companies is included, that information has been derived from published sources only.

The international research component

I sought to consider the South African paper sector in the light of international developments. To this end I conducted field work in the paper sector in Europe. I visited companies, plants, universities, employer federations and trade unions in Belgium, Germany, Sweden and the United Kingdom. International comparisons contained in the study are based on those interviews, as well as on published data.

In particular, the international efficiency comparisons presented in chapter three are based on the results of the structured efficiency questionnaire which I administered at a series of plants in Sweden, Germany and the United Kingdom. This provided me with a direct basis of comparison with local plants.

Sources of statistical data

The main sources of statistical information on the pulp and paper industry in this study are Pulp and Paper International[7] (PPI) and the Industrial Development Corporation's database on manufacturing. Such data includes production, trade, output and price statistics. All other data sources are specifically acknowledged.

Outline of the argument

In chapter two I review the literature which gave rise to the notion of racial Fordism, as well as various responses to the concept. I show how regulation theorists such as Aglietta, Boyer and Lipietz have developed the tools of regulation analysis. In particular I explore Lipietz's work on Fordism, Global Fordism and the rise of manufacturing in developing countries. I show how Gelb's concept of racial Fordism derives from Lipietz's schema, and describe the thrust of Gelb's analysis. I then go on to explore responses to

[7] Pulp and Paper International is published by Miller Freeman Incorporated and is edited by John Pearson.

Gelb, including important but limited critiques by Maller and Dwolatsky (1993), Nattrass (1989), and Webster (1992). I argue that Gelb's notion of racial Fordism is based on a somewhat selective reading of Lipietz and that it contains some important conceptual problems.

In chapter three I pursue my argument that the idea of racial Fordism is best tested by attempting to apply the theory to a case study, in the form of the development of a particular manufacturing sub-sector. I then examine the concrete development the pulp and paper sector, on the understanding that a detailed exploration of the history and dynamics of the sector will provide an understanding of South African industrialisation as it has been played out in that sector. I proceed by analysing the pulp and paper sector in terms of the central propositions of the notion of racial Fordism. I argue that although some aspects of racial Fordism do provide important insights into the development of the sector, the assumptions of the racial Fordism thesis are generally not borne out by the sector's development. I consider five central aspects of Fordism and conclude that they are of limited value in explaining the development of the sector. I point to a number of key elements of the sector's development, and argue that they are either obscured or insufficiently explained by the concept of racial Fordism.

I thus show that the notion of racial Fordism is insensitive to critical aspects of industrialisation as seen through the development of the pulp and paper sector. I conclude that racial Fordism is of limited value in explaining South African industrialisation and I therefore turn to an alternative model. This model is the notion of 'late industrialisation' which has been developed by Alice Amsden in relation to Korea. I briefly apply Amsden's schema to my understanding of development in the paper sector and I conclude that her conceptualisation provides a useful starting point for understanding the sector's development, and perhaps, South African industrialisation

more broadly. I close the study with a tentative proposal that South Africa's industrial path may be usefully analysed in terms of the category of late industrialisation, but that South Africa must be distinguished from other late industrialisers not only because of the centrality of racial domination but also because of ongoing dependence on the natural resource base.

Chapter two: Fordism and racial Fordism

In this chapter I will explore the origins and objectives of Stephen Gelb's concept of 'racial Fordism'. In order to do this I will examine the work of Alain Lipietz, since Gelb's 'racial Fordism' is based on his reading of Lipietz's work. Lipietz is a member of the (French) 'regulation school' and aspects of his analysis are closely related to the work of other regulation theorists including Aglietta (1976); Boyer (1990); and de Vroey (1984)[8]. My discussion will largely concentrate on Lipietz's specific theory of 'Global Fordism' since it is this theory that has given rise to Gelb's 'racial Fordism'. I will, however, refer to the work of other regulation theorists in explaining Lipietz's overall framework.

The discussion that follows will first look at the overall assumptions of the regulation school. I will then show how Lipietz has used the regulation school's concept of 'Fordism', and how he extrapolates this concept to explain global development patterns using the notion of 'Global Fordism'. I will look at some responses to 'Global Fordism' including an important critique by Alice Amsden (1990). In the second part of this chapter I discuss 'racial Fordism' and look at how Gelb uses the concept to explain the pattern of economic development in South Africa in the post-WW11 period. This will be followed by a review of some ways in which Gelb's work has been applied and/or criticised by other theorists. In particular, I will examine the work of Nattrass (1989, 1992); Maller and Dwolatsky (1993); the Sociology of Work Unit (1990) and Webster (1992) and Bethlehem (1990).

The tools of regulation analysis

In his book Mirages and Miracles: The Crises of Global Fordism, Alain Lipietz sets out a general theory of capitalist accumulation in the late twentieth century. Like other regulation

[8]This does not imply that Lipietz's work typifies all the assumptions of the regulation approach. Amsden notes that "not all regulation theorists...accept the global-Fordist extension of their work. Nor does the regulation framework adopted by Lipietz necessarily represent the most persuasive version of regulation theory" (1990:7). Indeed, Boyer's assertion that "the mode of development of the newly industrialised countries is quite distinctive [from Fordism]" (1990:xii) flies in the face of Lipietz's notion of Global Fordism.

theorists Lipietz is concerned to explain why economies grow in certain periods and stagnate in others. In particular, regulation theorists wish to explain how capitalist economies are able to overcome the contradictions which are necessarily generated in the course of capitalist development[9]. In other words, why is capitalism able to survive the conflicts and contradictions it generates - why has the system not yet 'dug its own grave'? Regulationists argue that the success of capitalist accumulation depends largely on the institutional context in which it occurs. They argue that it is possible for capitalism to exist in the contexts of highly variable sets of social relations, and that the particular nature of the social relations and institutions will determine the path of accumulation. They argue that it is possible for players in a capitalist economy to generate a set of social relations and institutions which contain or suspend the conflicts and contradictions engendered by capitalist accumulation, such that accumulation is able to proceed in a relatively stable manner. When conditions are such that stable accumulation is possible (at least for a given period), then that economy can be said to be "well regulated" (Lipietz 1987:35). Lipietz and others make the point that a successful 'regulation' is not inevitable and nor does it come into being in order to fulfil the 'needs of capitalism'[10]. Rather, when "a provisional solution for the immanent contradictions of capitalism can be found.....it is a matter of chance discovery..." (1987:24).

Regulation theorists use two main concepts in analysing the conditions of accumulation in a given economy. These are the 'regime of accumulation' and the 'mode of regulation'. The regime of accumulation consists of the particular processes of production and consumption; while the mode of regulation refers to the norms and institutions which provide the context of accumulation, including the relations between social classes[11]. These categories of analysis allow regulation theorists to describe the

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[9]For example, the tendency of the rate of profit to fall; the tendency towards over-accumulation; the tendency towards under-accumulation (See Boyer 1990:12-15).

[10]Lipietz labels the latter view 'pessimistic functionalism' (1987:17).

[11]In more technical language, a regime of accumulation can be defined as "...the fairly long-term stabilisation of the allocation of social production between consumption and accumulation" (Lipietz 1987:14); and a mode of regulation as "the set of internalised rules and social procedures which incorporate social elements into individual behaviour" (Lipietz 1987:15).

social and institutional nature of the process of accumulation, thus avoiding the naturalistic pitfalls of neo-classical economic theory. At the same time, the concepts allow regulationists to avoid the pitfalls of a more static Marxist analysis, by enabling them to show that capitalism is not a single model, and that the contradictions inherent in capitalism do not necessarily lead to its downfall, but rather to new forms of capitalist accumulation. In this way the regulationists offer a new theory of crisis. Rather than seeing capitalism's contradictions as leading to a crisis which brings the (inevitable) collapse of capitalism, they see periods of crisis as times when established patterns of accumulation break down, but when new forms of accumulation become possible. In Gelb's terms, this notion of crisis indicates a 'turning point' rather than a 'terminal disease' (Gelb 1991:8). Such periods of crisis offer social forces the possibility of overturning the capitalist system altogether. According to the regulationists however, such crises do not lead to the automatic transformation of the mode of production.

Regulation theorists offer an important alternative to a linear theory of history, and they recognise the role played by social agents in shaping society and social change. In particular, they emphasise the importance of social institutions in shaping the context in which accumulation takes place.

Fordism

One "product"[12] of the regulation approach is the theory of 'Fordism'. The concept of 'Fordism' has been used by several regulation theorists to analyse twentieth century industrial development in the United States of America. The idea of Fordism was first put forward by Aglietta[13] in 1976, and was then taken up by numerous theorists (See Boyer 1990:ix,17).

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[12]This term is used by Boyer (1990:xviii), who argues that the regulation approach should not be reduced to the concept of 'Fordism'. Rather, 'Fordism' should be seen as one of the 'products' or results of regulation theory.

[13]Although Aglietta drew the term 'Fordism' from Antonio Gramsci's essay 'Americanism and Fordism' (1971), it was Aglietta who developed the concept of Fordism as it is described in this chapter.

The concept of Fordism, as presented by Aglietta and refined by Boyer and Lipietz, is designed to capture the particular 'mode of development' (Boyer 1990:viii) in the USA in the post-WWII period. The concept is used to explain the stable and rapid expansion of the American economy after 1945, and its slowdown which began in the early 1970s. Regulation theorists have attempted to explain why the American economy showed such spectacular growth in this period, why a crisis ensued at the time that it did, and how that crisis differed from previous crises such as the Great Depression of the early 1930s.

In explaining this phenomenon, regulation theorists refer to a particular regime of accumulation and its mode of regulation. They attempt to show that it was the specific form of accumulation that explains the pattern of growth. They argue that the stable pattern of accumulation was dependent on the generalisation of particular production techniques in conjunction with the regulation offered by key social institutions including industrial trade unions, the welfare state and large corporations.

Lipietz's particular version of 'Fordism' contains two basic elements: i) the generalisation of "a revolutionary mode of work organisation" (1987:35) consisting of taylorism and automation and ii) the establishment of mass consumption norms which linked productivity growth to wage growth, thus ensuring high consumption norms throughout the society, including among the working class.

Before we look in detail at these two elements, let us examine the overall logic behind the theory of Fordism. The success of Fordism was essentially dependent on a match between production and consumption such that manufactured goods were mass-produced using a innovative labour process, and these mass produced goods were then mass consumed in the domestic market. New mass production techniques enabled manufacturers to lower unit costs dramatically, but in order to avoid a crisis of under-consumption, these mass produced goods needed to find a large and stable market. Once the unit cost of mass produced goods was lowered, the way was opened for mass consumption - provided that aggregate demand could be sustained at a fairly high level. This was achieved through the generalisation of high wages for the industrial workforce,

and the provisions of the welfare state which ensured basic consumption levels even among the marginalised and unemployed. The essential logic of mass production and mass consumption was that high levels of productivity could be achieved in the realm of production, and the benefits of this level of productivity could be spread sufficiently through society to ensure that the under-consumptionist crisis represented by the Great Depression could be avoided.

In order to 'unpack' this argument, let us look more closely at Lipietz's work. The first element of Lipietz's definition of Fordism relates to the regime of accumulation and is centred on the nature of the labour process which was an important source of productivity growth. The labour process was epitomised by the work organisation practised in Ford's automobile assembly plants from the 1920s, but which became generalised throughout American industry only after WWII. It consisted of a combination of taylorism (or scientific management) and flow-line technology. The use of this labour process enabled manufacturers to lower unit costs using economies of scale, and through lowering labour costs by making craft workers obsolete. Lipietz explains that taylorism was the process "whereby the skills of worker collectives were expropriated and systematised by engineers and technicians using methods of 'Scientific Management'. A further step was taken when that systematised knowledge was incorporated into an automatic system, with machines dictating working methods to workers whose initiative had been expropriated. This was the 'productive aspect' of Fordism" (1987:35). This process cheapened the cost of labour power by 'deskilling'[14] work so that knowledge which was previously specialised and restricted to craft workers, now became generalised and incorporated into a production system. This was done by breaking the labour process up into small constituent parts, such that each worker repeatedly performed a small aspect of the production process. In this way, the design or 'mental' aspects of work were removed from workers and placed in the hands of management. Management was able to use this knowledge to shift the balance of power in the labour process such that they could dictate the nature and the pace of work.

[14]This term was coined by Braverman (1974).

Management control over the pace of work was first achieved through Taylor's time-and-motion studies, and then consolidated through the invention of moving assembly lines which regulated the speed of production. The organisation of work under Fordism was necessarily hierarchical, as supervisors consolidated managerial control over workers and made sure that the detailed instructions provided by the planning departments were carried out to the letter. Management hoped that the combination of supervisory and technical control[15] would enable them to prevent workers from 'soldiering', that is, restricting their output. This type of workplace design resulted then, in top-down management, and was implicitly opposed to any form of worker initiative.

Fordist production was best suited to the manufacture of standardised articles since the repetitive labour process and the economies of scale were best exploited when producing long runs of undifferentiated products. Fordist factories were therefore designed to mass produce standardised articles.

Fordism was however, more than a production process. At the same time as raising productivity and lowering unit costs in production, the Fordist mode of regulation established a market for mass produced goods by spreading the benefits of productivity growth across classes and by incorporating the working class in particular into mass consumption. This was partly achieved through the institutionalisation of industrial unions so that wages were implicitly linked to rising productivity, and wage earners could participate in mass consumption. According to Lipietz: "...a new mode of regulation allowed Fordism to develop fully. A new element was introduced: the continual adjustment of mass consumption to rises in productivity. This adaptation led to huge rises in the life-style of wage-earners - to its 'normalisation' and to its incorporation into capitalist accumulation itself" (1987:36). In this way workers were drawn into the norms of mass consumption. This not only had the effect of raising aggregate consumption levels but also laid the basis for a degree of consensus on the shopfloor. Since workers were incorporated into productivity gains they were more amenable to top-down

[15]This term was first used by Edwards (1979).

managerial authority.[16]

Industrial unions were not, however the only institutions underpinning mass consumption. In addition to the role of the wage relation, we find an important role played by the state. The state's role in raising and stabilising aggregate consumption was two-fold: the systematic provision of welfare and expansionist monetary policy. These are both elements of Keynesian macro-economic management and together with rising wages they ensured sufficient effective demand to meet the growing output of the mass production industries.

Under these conditions, investment (capital stock per worker), real wages and productivity all grew at roughly the same rate. The rate of profit therefore remained stable and accumulation could proceed at a steady rate.

While Aglietta limited his analysis of Fordism to the USA, Lipietz extended the term to apply to the advanced capitalist countries in the form of OECD[17] members. According to Lipietz:

> "For a period of twenty years, the OECD countries enjoyed exceptionally high and regular long-term growth. There were, of course, conjunctural slow-downs ('recessions') and there were also major differences between the growth rates of different countries, but it can be said that each country experimented with Fordism and developed it to its advantage by expanding internal demand" (1987:38).

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[16]This can be conceptualised as a trade-off or compromise between capital and labour. The notion of a labour-capital compromise has been most fully developed by Bowles, Gordon and Weiskopff (1983) whose approach has much in common with that of Lipietz. For a discussion of the parallels between the two sets of theorists see Boyer (1990:xix-xxii).

[17]Organisation for Economic Co-operation and Development

But the 'Golden Age' of Fordism was not to last indefinitely. According to Lipietz, the early 1970s saw the beginning of the onset of crisis in Fordism. The crisis is characterised by a long run (or non-reproductive) downturn in the economic cycle, and especially by falling aggregate rates of profit. For Lipietz this indicates the 'exhaustion' of Fordism as a regime of accumulation and ushers in a period of heightened social conflict as a struggle over the resolution of the crisis begins. For Lipietz the crisis of Fordism was caused by a combination of factors which span the shop-floor as well as the macro-economic climate. The key factor however is a slowdown in the rate of productivity growth due to the limitations of Fordist work organisation and the principles of Taylorism in particular. Lipietz notes that taylorist organisation "means that the majority of producers have no control over their own work and that the activities of engineers and technicians become the only source of productivity. The only way that they can increase overall productivity is to invent ever more complex machines. We can thus see why the downturn in productivity goes hand in hand with a rising coefficient of per capita fixed capital" (1987:44).

There has been vigorous international debate on the nature of the crisis and on the character of Fordism's successor. The details of that debate are beyond the scope of this study. I will however return briefly to the crisis of Fordism in the discussions of Global Fordism and racial Fordism that follow below.

From Fordism to Global Fordism

We have noted above that Lipietz uses the notion of Fordism not only in relation to the USA but also in relation to the OECD countries. This extension of the theory of Fordism to the OECD prefigures Lipietz's particular theoretical contribution - the concept of Global Fordism. Unlike some other regulation theorists such as Boyer, Lipietz sees Fordism as a concept which can be used to understand international economic development, and especially to explain the different levels of development attained in

different countries. The objective of this work is to develop an analytic framework which will go beyond what he calls the 'stalemate' of the 'Dependency-versus-Modernisation' debate, and will help to explain the dynamics of differential global development.

Lipietz is concerned to show that accumulation takes place on a global scale, and that the patterns of global accumulation explain the differing levels of development in different countries or regions. In setting up his theory of accumulation therefore, Lipietz creates a framework which he uses to explain the development of the 'periphery' ('underdeveloped'/'third world' countries), in the context of their relationship to the dynamics of the 'centre' (advanced capitalist countries). In this way his analysis assumes the existence of a global system, and implicit in this method is the notion that a given country's pattern of development can be explained principally through an analysis of that country's place in a global system. Lipietz is sensitive however to the dangers that arise from classifying specific national economies in terms of their place on the international stage. Accordingly, while he uses a set of terms and labels to conceptualise the relative development of various types of economies, he warns that "the reader.....would do better to burn this book without reading it, if all she is going to get out of it is a new collection of labels to stick on real nations and actually existing international relations without first analysing them carefully" (1987:5).

This warning notwithstanding, Lipietz's theory has a global sweep, and all national economies have a place in his analysis. As we shall see, the various categories involved in his global system can account for the stage of development attained anywhere on the globe at a given moment. And when that moment is the second half of the twentieth century, all international development can be explained with reference to a single international mode of development: Global Fordism.

The logic of Global Fordism

According to Lipietz's schema, while the centre (essentially the OECD countries) was characterised by Fordism, parts of the periphery[18] can be characterised by variations of Fordism including Primitive Taylorization, sub-Fordism and Peripheral Fordism. I will explore these concepts below. However, I will examine sub-Fordism in the greatest detail since it is this concept that is the prototype for Gelb's notion of racial Fordism.

Primitive Taylorization

According to Lipietz, Primitive Taylorization (or 'bloody Taylorism') is a regime of accumulation which can be distinguished from Fordism in two ways: i) it is an attempt to industrialise on the basis of low-wage labour intensive industry where jobs are "fragmented and repetitive, but they are not linked by any automatic machine system" (1987:74); and ii) the regime of accumulation "is designed to extort as much surplus value as possible, and no attempt is made to reproduce the labour force on any regular basis" (1987:76). As a result, consumption levels are not raised in the local market, but rather, "markets are sought where there is pre-existing demand" (1987:76), that is, in the centre.

Primitive Taylorization then, displays neither the Fordist regime of accumulation (which includes automation or technical control), nor the Fordist mode of regulation (which includes the extension of mass consumption to the working class).

Lipietz notes that countries attempting to industrialise through Primitive Taylorization have had limited success since "the local ruling classes...know only too well that they cannot remain the warders of capitalist prisons forever" (1987:86-7). Primitive Taylorization's labour repressive strategies, which rely on sharply rising rates of surplus value extraction and on depressing working class consumption will lead, for Lipietz, into

[18]Lipietz warns that "insofar as it is a regime of accumulation, Fordism is not taking over the whole periphery" (1987:81). He does not, however, comment on how he would distinguish those areas of the periphery where Fordism has 'taken over' from those where it has not. He also does not say how he would understand the place of 'non-Fordist' peripheral countries in his overall schema.

a cul-de-sac characterised by resistance and social dislocation. As a result, the ruling classes of such countries are, according to Lipietz, "being forced to.....adopt a rather different logic which we can describe as 'peripheral Fordism'" (1987:87).

Peripheral Fordism and sub-Fordism

According to Lipietz, Peripheral Fordist countries display aspects of the Fordist regime of accumulation (Taylorism plus mechanisation providing the basis for intensive accumulation), and the Fordist mode of regulation (a growing market for consumer durables through the spreading of mass consumption norms to the working class). Despite this however, they remain peripheral in terms of the international regime of accumulation in that the most skilled and technologically advanced production and design processes remain outside those countries. Their domestic markets are also limited to "a specific combination of consumption by the local middle classes, with workers in the Fordist sectors having limited access to consumer durables, and exports of cheap manufactures to the centre" (1987:79). Local consumption is not adjusted to productivity gains in the Fordist branches of these economies.

Sub-Fordism, on the other hand, is not merely a limited or peripheral version of Fordism, but is, according to Lipietz, "a caricature of Fordism" (1987:62). Whereas peripheral Fordism "is a true Fordism in that it involves both mechanisation and a combination of intensive accumulation and a growing market for consumer durables" (1987:78-9), sub-Fordism can be described as "a caricature of Fordism, or as an attempt to industrialise by using Fordist technology and its model of consumption, but without either its social labour process or its mass production norms" (1987:62). Sub-Fordism, according to Lipietz, is based on the initial success of import substitution strategies which began in the 1930s, and became more generalised by the 1950s. A critical point about the sub-Fordist mode of development is that "it failed to enter the virtuous circle of central Fordism" (1987:61). This is the case because i) its labour process, ii) its markets and iii) its patterns of foreign trade, failed to replicate the Fordist regulation which led to steady patterns of accumulation.

Let us look at each of these three aspects of sub-Fordism in detail. According to Lipietz, the sub-Fordist labour process is different from Fordism because sub-Fordist economies attempted to imitate Fordist production methods by simply importing machinery, but without constructing the "corresponding social relations" (1987:61). As a result, the economies in question lacked the necessary managerial skills and an experienced working class. Without these, the imported forms of production never achieved their "theoretical productivity" (1987:61). "Technology", Lipietz concludes, "is not a transferable resource which grows in the forests of the North" (1987:61).

Sub-Fordist markets are also to be distinguished from their Fordist counterparts because there was no significant growth in consumption levels among workers or peasants. Mass consumption in the local market was therefore not a feature of these economies. The markets for the products of such economies were therefore restricted to:

"1) the ruling and middle classes created by the export economy. This market was in any case limited, but it was also sociologically stratified and resistant to the consumption of standardised articles. 2) The foreign market, in other words the centre itself.....but wage differentials notwithstanding.... ..peripheral manufacturing activity was not yet competitive because of its low productivity" (1987:61).

In other words, sub-Fordist economies were unable to take advantage of the Fordist match between mass production and mass consumption because on the one hand, they lacked a domestic market which was willing and able to absorb standardised mass-produced articles, and on the other hand, they were not competitive enough to export mass-produced articles to the centre.

Similarly, Lipietz argues that sub-Fordist patterns of international trade depart from Fordism because moving into advanced mass production techniques would require a significant increase in imports of capital goods, at a stage when sub-Fordist countries were primarily exporting raw materials. Given that the value of imported capital goods would outstrip raw material exports, a balance of payments constraint would ensue. In making this argument Lipietz assumes that an increase in raw material exports "could not

make up" (1987:62) for the increase in the volume of investment required for capital goods imports.

In concluding his assessment of the sub-Fordist pattern of accumulation Lipietz notes that the weakness of these economies stems from both local and international factors. On the one hand, sub-Fordist development was caused by "the internal social structure, which was consolidated by the survival of a very unequal distribution of income in the primary export sector, by the failure of agrarian reform to redistribute wealth, and by the failure to expand the manufacturing sector or to incorporate mass consumption into the regime of accumulation" (1987:62). On the other hand, international patterns of accumulation also played their part. For Lipietz, this point goes far beyond the historical legacy of colonisation, and centres on the fact that by the mid 1960s the vast proportion of foreign trade in manufactures was taking place "within the centre" (1987:69), that is, between the OECD countries themselves. Lipietz argues that "it was the fact that the centre had become so auto-centred that had the greatest impact. The diffusion of the intensive regime of accumulation led to an increasing gap between centre and periphery in terms of competitiveness, and expelled the periphery from the international trade in manufactures" (1987:62).

One can conclude from a reading of Lipietz's discussion of sub-Fordism that sub-Fordist economies are, in fact, substantially non-Fordist. Although they display some of the features of Fordism on the surface (eg. imported mass production machinery), they do not replicate the Fordist 'regulation' - that is the 'virtuous circle' created by the match between mass production and mass consumption. In terms of regulation theory then, the conditions which provided a pattern of stable accumulation in the centre were not achieved in the sub-Fordist periphery. The use of the term sub-Fordist can only be understood as an analysis of these economies relative to what they are not, rather than describing what they are. The notion of sub-Fordism is therefore best seen as explaining a country's development by way of analogy to the Fordist economies.

Critiques of Global Fordism

Boyer - a more modest version of Fordism

We have already noted that Robert Boyer is a leading regulation theorist, whose analytic tools are similar to those used by Lipietz. Boyer, writing in The Regulation School - a Critical Introduction (1990), defends the regulation approach, and the concept of Fordism in particular. He argues that Fordism is a "central yet misunderstood concept" (1987:ix) and defends it against various criticisms[19]. He argues that the notion of Fordism provides key analytic insights that enable scholars to answer important questions about contemporary economic crises. Boyer argues however, that the notion of Fordism cannot provide answers to every question of economic crisis in every situation. He contends that the concept of Fordism should not be stretched too far. In particular, he objects to an analysis of Fordism in which "the labour process is treated as the beginning and end of the regime of accumulation, obscuring its other determinants. This had resulted in the tendency to infer the likely existence of a Fordist mode of development, perhaps somewhat modified, from the utilisation of Fordist techniques in certain sectors or firms". Boyer argues instead that "it is perfectly possible for a mass production system, using mechanised assembly lines, to exist without long-term contracts governing the wage relation, an essential characteristic of Fordism. It is for this reason that concepts such as 'bloody Taylorism' or 'peripheral Fordism' are more dangerous than fruitful" (1990:xii). He later goes on to say that "Fordism is only one of the historical forms of the accumulation process" and that the use of regulation analysis has "revealed a great variety of modes of development". Certain economies including oil rent economies, agricultural economies, and the economies of dependent countries "display modes of development which have little to do with Fordism, whether peripheral, shackled, or incomplete" (1990:xviii).

Boyer's version of Fordism then, is a more modest formulation, which restricts the Fordist mode of development to specific times and places. He explicitly rejects the idea

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[19]For the specifics of this discussion see Boyer's introduction to the English-Language edition of The Regulation School - a Critical Introduction (1990 Columbia University Press New York).

that Fordism is a global regime of accumulation, or that Fordist development in the centre is the starting point for the analysis of all other economies. He argues that the regulation approach is "a method of analysis, not a complete theory which represents an alternative to more ambitious constructs, whether neoclassical or Marxist in inspiration" (1990:xviii). Rather he sees regulation theory as a method which must be specifically and rigorously applied to each separate economy. The result of such an analysis may or may not make use of the notion of Fordism.

Amsden's critique

Alice Amsden shares Boyer's view that Global Fordism is not a useful concept for analysing international patterns of development. Her critique however goes beyond Boyer's in that she makes use of a different theoretical paradigm to provide alternative explanation of development in newly industrialised countries. Although she does not reject regulation theory out of hand, she contends that Lipietz's concept of global Fordism "has no explanatory or predictive power", and she therefore seeks to provide an alternative explanation by using the concept of 'late industrialisation' (1990:1).

Amsden's critique is based on her understanding of industrial development in South Korea in the post World War 11 period. Although she confronts Lipietz using Korea as her starting point, Amsden not only challenges Lipietz's understanding of Korea, but also his entire framework for understanding Third World development. Similarly, her framework not only provides a different understanding of Korea, it also poses an alternative theory of industrial development. The debate over Korea centres on Lipietz's notion of peripheral Fordism. Amsden shows that various aspects of that concept are unable to stand up to a detailed examination of Korea's history. I will not summarise the details of the discussion about Korea however, since it has limited relevance for our purposes. Rather, I will concentrate on Amsden's general critiques of global Fordism, and on the alternative framework she offers.

Amsden questions global Fordism on four basic counts:

i) Amsden argues that a central problem with global Fordism is that it tries "to understand the periphery in terms of the centre" (1990:7 emphasis added). She argues, for example, that "the novel phenomenon of the partial industrialisation of the Third World," can be shown to be "the result of the various ways in which elements of the logic of Fordism has been extended to the periphery" (1987:6). Amsden argues that in this way global Fordism falls into the same conceptual traps as dependency theory, despite Lipietz's attempts to distance himself from the dependency school. "We know in retrospect from the failure of dependency theory" she says, "that the dynamics of growth in the Third World cannot be analysed satisfactorily in terms of the categories of 'centre' and 'periphery'. To the extent that Lipietz employs these categories, he is a dependency theorist, and no more successful than they in explaining Third World industrialisation" (1990:10). Rather than explain Third World development in terms of the centre, Amsden proposes that a proper explanation will examine the specific history and conditions under which development occurs in a particular country. In so doing, she does not dismiss the importance of the international context, but rather she refuses to see that context as the starting point for understanding the development of a specific country[20].

ii) Amsden notes that the global Fordism paradigm suggests that underconsumption is the major stumbling block to economic growth in developing countries, and that it is the lack of mass consumption norms that has stifled the 'sub-Fordist' and 'peripheral Fordist' economies. For Amsden however, the real constraint facing Third World industrialisation is low productivity and a lack of international competitiveness. Korea's industrialisation, for example, was achieved largely on the back of exports, since Korean manufacturers became productive enough to compete in international markets. Amsden asserts that it is dangerous to understand Third World development constraints as a problem of demand alone, as this will obscure the problems of productivity. Amsden

[20] In this sense Amsden has much in common with Brenner (1977) who has criticised Dependency Theory for taking the 'centre' as the starting point of analysis.

notes that "...any country, particularly a small one, can produce without regard to its home market so long as it can export. The problem is that most Third World countries cannot export because they are not competitive internationally, despite low wage rates. Nor can they sell domestically at international prices, at high levels of productivity that would enable them to pay high wages and expand their internal market size. Ultimately therefore, as the Korean example suggests, the problem of industrialisation is a problem of increasing productivity, not demand" (1990:11-12).

iii) Amsden argues that global Fordism offers an inadequate theory of the state. Lipietz argues that in order for peripheral Fordism to occur, the state requires 'autonomy' from foreign domination, from the "ruling classes connected with either the primary export economy or the growth of the home market", and from the popular masses. In other words, for Lipietz, "it usually requires a dictatorship to break the old balance and to use the state to.....play the part of the ruling classes within a new regime of accumulation". While Amsden agrees that the strength and autonomy of the state played an important part in Korea's industrialisation, she believes that a more specific theory of the 'developmental state' is required to fully explain the state's role in industrialisation. She notes that Lipietz's explanation of the state focuses on the strength or power of the state and excludes two other important factors: "the conditions under which the strong state acts 'developmentally', investing long-term rather than speculating; and the precise policies which the developmental state follows in order to further industrial growth" (1987:72-3).

iv) Amsden argues that because Lipietz sees peripheral industrialisation as an extension of Fordism, he believes that taylorist work organisation is a necessary feature of industrialisation in the Third World. Amsden shows however, that taylorism was never 'transferred' to Korea or to other Newly Industrialised Countries including Japan and Taiwan. Rather, alternative ways of organising work have emerged in those countries. Amsden shows that, for reasons we shall explore below, late industrialisation gave rise to "a more participatory (and as it turns out, more productive approach) to work relations" (1990:13) and to a 'strategic focus on the shop floor' which never included top-down taylorist management, and which succeeded partly as a result of that fact. She

therefore argues that it is impossible to understand the relative success or failure of Third World industrialisation using categories which are derived from a western experience and which have little or no relevance to late industrialisers on the Pacific Rim.

Amsden's alternative

Arising from her critique of global Fordism, Amsden offers an alternative framework for understanding the so-called 'Newly Industrialised Countries', which she conceptualises as 'late industrialisation' or 'industrialisation through learning' (1990:14).

Amsden's framework is based on a particular reading of the historical path of industrialisation. She prefers the term 'late industrialisation' to 'newly industrialised' because "lateness matters to competitiveness and hence to development" (1990:14). In order to grasp Amsden's view of late industrialisation, we need to understand how she views the history of industrialisation. She sets up a distinction between those countries which industrialised 'early', and those which industrialised 'late'. The earlier industrialisers grew on the basis of generating new technology which gave them a huge advantage over other nations. Britain's development for example, beginning in the eighteenth century was based on the invention of new products and processes, in the context of individual entrepreneurs operating in small-scale firms. For Amsden, this process of invention was the driving force behind the First Industrial Revolution. Similarly, the path of industrialisation in the USA and Germany was achieved on the basis of technological and product innovation, in the context of the large modern enterprise run by the corporate manager. This process constituted the Second Industrial Revolution. Late industrialisers however, cannot use new technology as a springboard for development, but must rather industrialise on the basis of 'learning' from advanced countries, of 'borrowing' and modifying technology from these countries. The path to successful learning for Amsden, is created by an institutional framework which allows the late industrialiser to 'borrow' effectively. She argues that "the general properties of an industrialisation process based on learning, or borrowing technology, are entirely different from those of an industrialisation process based on the generation of new

products or processes - the hallmark of the First and Second Industrial Revolutions. Thus, the late acquisition of international competitiveness has given rise to certain common tendencies in otherwise diverse countries - Japan, Korea, Taiwan, India, Turkey, Brazil and Mexico. Further, growth rates among these countries have differed not because markets have been allowed to operate more or less freely but because the institutions general to late industrialisation have functioned with varying degrees of effectiveness" (1990:15).

For Amsden then, the success of late industrialisers depends largely on whether key institutions are able to facilitate the process of learning successfully. The role of these institutions, and the path to successful industrialisation, are examined below.

Understanding successful late industrialisation

Amsden believes that successful late industrialisers such as Korea have prospered as a result of four factors:

i) Getting relative prices 'wrong'

Amsden notes that many explanations of successful industrialisation in East Asia have claimed that these economies have 'got prices right' in the sense that they have allowed market forces to determine the relative prices of capital, labour and various other inputs. Amsden disputes this perspective and argues that these countries have succeeded precisely because these countries have 'got relative prices wrong', in the sense that the prices of exports, inputs, and technology have been subsidised in order to propel firms into a more competitive position. Thus the state has played an interventionist and developmental role designed to "overcome the penalties of lateness" (1990:16). If the role of the developmental state is compared with the role of the state in the First and Second Industrial Revolutions, we find that "government intervention has tended to be greater than in the past, both because technology has not constituted a competitive asset and because at international prices the low wage rates of late industrialisers have been insufficient to compete against higher productivity levels of more advanced economies"

(1990:16).

For Amsden, the notion of the 'developmental state' is an important concept in explaining the success of late industrialisers such as Korea. A successful developmental state is however, more than simply an interventionist state. It is a state which is able to intervene in a strategic manner, which has not only the power to be autonomous from capital (in Lipietz's sense), but also has the vision to enable it to "discipline big business, and thereby to dispense subsidies to big business according to a more effective set of allocative principles" (1990:16). It is for this reason that the Korean state has been successful as an agent of development, whereas some other interventionist states have not[21].

ii) Conglomerates

The second factor in Amsden's explanation is the structure of capital in successful late industrialisers. She notes that a particular feature of such countries has been the diversified business group. Amsden argues that diversified business groups have been able to provide a unique competitive advantage for countries like Japan and Korea, because they allow for a diversified industrial base while still maintaining close connections among all the businesses in the group. This gives such groups economies of scope (that is, the ability to enter new industries quickly and efficiently), and provides them with the scale and power to compete in international markets.

iii) Strategic shop-floor focus

The third explanatory factor behind successful late industrialisation is what Amsden calls the 'strategic shop-floor focus'. She argues that because late industrialisers have had to compete on the basis of 'borrowed' technology, they have had to find ways of using that technology more effectively than the countries which originated it. "Because products similar to those of the company are internationally available," says Amsden, "the strategic

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[21]In this sense Amsden's analysis can be seen as building on the foundation built by Gershenkron (1962) who argued that 'latecomers' to industrialisation were more dependent on state intervention than early industrialisers. Amsden however, is not simply concerned with state intervention *per se*, but with strategic intervention through the process of national industrial strategy.

focus is necessarily to be found where the achievement of incremental yet cumulative improvements in productivity and product specification occur, and therefore enhance competitiveness" (1990:18).

Part of this strategic focus on the shop-floor has been a style of management which Amsden calls 'participatory organisation', and which has been especially effective at raising productivity. Amsden sees the process of involving labour in aspects of decision-making (eg. shop-floor problem solving), as inextricably linked to the fact that technology was brought in from the outside, and that consequently, even top-level managers lacked the technical knowledge to instruct workers in the top-down taylorist style. She argues that the "shop-floor focus started with the attempt to unpackage technology transfer and ultimately dispense with foreign technical assistance" (1990:26). The same process mitigated against the division between mental and manual labour so familiar in the taylorist plant. Because the technology was new to everyone in the plant, managers were forced to learn about production on the job. Consequently, in order to "operate the [steel] mill efficiently, the best managers were assigned to the line. Even shift supervisors were experienced people with college degrees....newly recruited managers were required to work on all three shifts in order to become familiar with every operation" (1990:26). This is a far cry from the Fordist factory where 'mental' labour was confined to the planning department, and where the initiative of workers was actively discouraged.

iv) Labour

Amsden's final explanatory factor deals with the nature of labour in late industrialising countries. According to Amsden, Korea's success has been partly based on the fact that its labour force has been highly skilled as well as highly 'disciplined'. With regard to skill, Amsden shows that, compared "with other late-industrialising countries, Korea is at the top of most educational indices", and that "Korea has been a successful learner partly because it has invested heavily in education, both of the formal academic variety and that derived from foreign technical assistance" (1990:19). For Amsden, this high level of education has enabled Korea to shape a manufacturing workforce that is able

to make a conceptual contribution to production, particularly in the light of the participatory work organisation mentioned above.

Amsden's second point is more ambiguous. She argues that "cheap labour is the anchor of late industrialisation" and that "labour repression is the basis of late industrialisation everywhere" (1990:18). She concludes that late industrialisation cannot proceed without the initial benefit provided by cheap labour, but she does not accept that cheap labour is a sustainable competitive advantage or that cheap labour alone can provide a springboard for industrial development[22]. She argues that cheap labour can only sustain competitive advantage in the most labour intensive branches of industry and that in the long term "industrialising by the gun does not promote high rates of productivity growth or quality on the shop-floor. At minimum, workers have to be motivated to work efficiently because all their efforts cannot be policed" (1990:29). Amsden resolves this apparent paradox by arguing that wage rates and working conditions have improved steadily along with rising levels of productivity. This has in fact been critical to sustained advantage as Korea has entered more and more sophisticated areas of manufacturing. In steel production for example, workers "must have a fairly good understanding of the physical and chemical processes involved in iron-making and steel-making, in order to ensure a high quality product.....workers have had to be paid relatively well to enable them to think clearly in the presence of variability in the production process" (1990:30). In short, Amsden sees cheap repressed labour as a critical initial advantage but believes that this must be transformed into higher paid, more skilled labour in order to sustain advantage in the course of development. Rising wages are therefore seen as compatible with successful industrialisation provided that they are matched with rising productivity. Presumably the disciplining of labour by the state is needed to ensure that wages do not rise ahead of productivity, and to ensure "the successful repression of labour organisation or labour practises hostile to higher productivity - that is, industrial unions and their associated work rules" (1990:26).

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[22]Amsden argues that since all late industrialisers rely on cheap labour, this factor cannot be used to explain the relative success of various late industrialisers. Rather the differences between these countries "are best explained in terms of the discipline imposed on big business, not labour" (1990:18).

Amsden has then provided us with a conceptual alternative to global Fordism. She provides a framework which, like the regulation approach, draws on the institutional context of development. Unlike the regulation approach however, she furnishes an account of industrialisation that shows why some developing countries are able to industrialise successfully and some are not. In so doing she provides a possible alternative framework for understanding South Africa's path of industrialisation. We shall return to that possibility in chapter four.

Racial Fordism

We have examined the framework provided by Lipietz, as well as some critiques of his work. I shall now look at how Gelb has used Lipietz's work in order to formulate the notion of racial Fordism. The first task is to explain what the concept claims, and how Gelb uses it to explain accumulation and crisis in South Africa. The second task is to look at the ways in which Gelb's concept has been used, and/or criticised by other South African writers.

Stephen Gelb's analysis of the South African economy is rooted in his understanding of growth and crisis, and specifically the crisis that emerged in South Africa from the early 1970s. Gelb's early work on crisis in South Africa was undertaken with John Saul, and was based on the Gramscian notion of "organic crisis" (Saul and Gelb 1981:3; 1986:67). According to Gramsci:

"A crisis occurs, sometimes lasting for decades. This exceptional duration means that incurable structural conditions have revealed themselves...and that, despite this, the political forces which are struggling to conserve and defend the existing structure itself are making efforts to cure them within certain limits, and to overcome them. These incessant and persistent efforts...form the terrain of the conjunctural and it is upon this terrain that the forces of opposition organise" (cited in Saul and Gelb 1981:3).

For Saul and Gelb there was evidence of a structural or organic crisis in South Africa's

system of 'racial capitalism' from the early 1970s. Among the indicators of such crisis they included the 1972/3 Durban strikes, the Soweto uprising of 1976, and guerilla operations undertaken by the African National Congress. They use the notion of organic crisis to analyse the process of limited political reform undertaken by the National Party government in South Africa from the late 1970s. They argue that, beginning in the early 1970s, South Africa had entered an organic crisis in the sense that the very structure of society threatened the future of capitalist accumulation, and only fundamental change could resolve the crisis. Their general analysis of the National Party reform program was that it was evidence of 'political forces struggling to defend and conserve the existing structure', in Gramsci's terms. At the same time, the existence of the organic crisis provided the terrain upon which opposition forces could organise. The outcome of the 'conjunctural struggle' and the way in which the crisis would be resolved, would determine the future of the society. For Saul and Gelb one possible outcome would be the establishment of a socialist society, once racial capitalism had been overthrown.

Arising from his work on racial capitalism and organic crisis, Gelb then turned to regulation theory for an explanation of the origins and outcomes of crises in capitalist accumulation. He began to apply the theory to South Africa, and found that "the regulation approach seems to offer a plausible account of growth and the transition to crisis in South Africa, and substantial promise as a method of analysing the crisis itself" (1987:46).

Gelb continued to develop a regulation approach in analysing patterns of economic growth, and ultimately constructed the concept of racial Fordism which he uses to capture the nature of accumulation in South Africa. The notion of racial Fordism is derived from a reading of Lipietz, and is a variation on Lipietz's notion of sub-Fordism (Gelb 1991:15). In introducing his approach Gelb discusses the overall assumptions of the regulation approach. He shows that regulation theory is concerned with an analysis of the path of capitalist accumulation, and the ways in which the inherent instability of capitalism are countered or managed by social institutions. Gelb emphasises the fact that crises represent opportunities for new forms of capitalist accumulation to emerge as well as opportunities for the destruction of the capitalist system. The resolution of

crisis can, therefore lead to a new form of capitalist accumulation, rather than the creation of a non-capitalist society.

Gelb goes on to use the tools of regulation theory in order to analyse post-WWII accumulation in South Africa. He argues that the period between 1945 and 1973 which was characterised by steady positive growth in the Gross Domestic Product, was one where accumulation proceeded at a rapid and sustained rate because of the stable regulation of the regime of accumulation. In the period from 1973, however, the relationships and institutions which had previously sustained accumulation began to fail. The mode of regulation which had fostered growth now reached its limits and a 'non-reproductive' (or organic) crisis ensued. This crisis continued until the early 1990s, when, according to his most recent commentary, it will be resolved in one of two ways, depending on the balance of forces. I will return to this point later.

What then, was the character of successful accumulation in the post-1945 period? Gelb's analysis of macro-economic indicators leads him to conclude that South Africa's growth path[23] during that period can be labelled as 'racial Fordism'. The essential argument behind the term racial Fordism is that accumulation in South Africa in the post-War period was similar to that of the 'Fordist' or advanced capitalist countries, in the sense that it proceeded on the basis of "the extension of mass production with the extension of mass consumption". The essential difference between South Africa and the Fordist economies however, was that in South Africa the mass production and mass consumption were extended "in a manner that was restricted on both sides of the equation" on the basis of race (1987:39). In other words, racial Fordism involved a regulation based on mass production and mass consumption, but one which was restricted to the white community. In this sense South Africa displayed a racially limited version of Fordism.

[23]Gelb uses the terms 'growth model' and 'growth path' to describe "the form of capitalist accumulation within the particular economy, as well as the nature of its insertion into the world economy as a whole" (1990:11). It is similar to Boyer's term 'mode of development' which is discussed above.

In Gelb's words:

> "From the perspective of regulation theory, the post-war combination of apartheid and import substitution industrialisation can be seen as the defining characteristics of a 'racial Fordist' growth model. Like Fordism in the advanced countries, accumulation in South Africa during this period involved linking the extension of mass production with the extension of mass consumption; in South Africa however, both production and consumption were racially structured" (1991:13).

In further developing the concept, Gelb argues that "the growth model which emerged in South Africa was of the type that Lipietz (1987:62) has called 'sub-Fordism', the qualification translating naturally into a racial one for the South African case" (1991:15). Gelb quotes Lipietz's argument that early "import substitution policies.....did result in a real social transformation and the emergence of a modern working class, modern middle strata and modern industrial capitalism. [The results] might be described as a 'sub-Fordism', as a caricature of Fordism, or as an attempt to industrialise by using fordist technology and its model of consumption, but without either its social labour process or its model of mass consumption norms" (1991:15-16).

For Gelb then, the path of accumulation in South Africa can be summarised roughly as follows. The choices of the South African state from 1948 were shaped by two main factors: the desire to raise white living standards; and the fact that South Africa was a major exporter of precious minerals. The 'choice' of accumulation strategy which followed from these was a strategy of import substitution industrialisation built on the foundations of mineral (and especially gold) exports. In other words, mineral exports made it possible to import mass production technology, which was then used to manufacture goods domestically, behind the protection of tariff barriers. The manufacturing economy produced almost exclusively for the white domestic market, while foreign exchange was provided by raw material (mineral) exports. For Gelb this can be seen as a limited or 'sub' Fordism in the sense that manufacturing developed through a process of raising white living standards such that whites (including white workers), could absorb the manufactured products of the mass production industries. The position of

white workers in particular can be seen as replicating the Fordist model. According to Gelb:

> "The situation of the white working class was institutionalised along very similar lines to that of the working classes of the Western economies' an increased proportion of this group moved into skilled and supervisory positions in the labour process, with steady rises in their real wages making possible the spread of mass consumption of housing and locally produced consumer durables. Structures of collective bargaining, a social welfare system and very favourable subsidy and consumer credit arrangements all underpinned the process. In this fashion underconsumption was made impossible and at the same time whites captured the lion's share of overall productivity gains" (1991:16).

For Gelb then, the institutions which underpinned the mass production - mass consumption regulation were, for the white group, similar to those of Fordism - industrial unions with access to structures of collective bargaining; provision of welfare by the state, and credit arrangements.

Although Gelb's analysis of the regime of accumulation centres on the dynamic relationship between mass production and mass consumption among whites, he does include the black population in his analysis. He argues that the African working class did obtain some portion of the productivity gains which flowed from the introduction of mass production techniques. However, says Gelb "as is well known, Africans occupied a subordinate position in the labour market, with restricted mobility, and without legal collective bargaining power. Strict control at the point of production was complemented by equally severe limits in the consumption sphere. Urban Africans (including those from the middle classes) were strictly excluded from the mass consumption 'norms' which applied to whites, and at later stage, to the indian and coloured groups. Consumption levels in the urban townships were not significantly different from rural standards" (1991:17).

Black South Africans were then excluded not only from the mass consumption norms,

the productivity gains and the social welfare system which served whites, but they were also subject to white control 'at the point of production'. Gelb notes however, that the development of the industrial economy did produce a differentiated labour force, including a "stratum of semi-skilled permanently urbanised workers", and that the real incomes of black workers increased under racial Fordism, "although at a far slower rate than that of whites" (1991:17).

The stability of the racial Fordist regulation was reflected, for Gelb, in a number of macro-economic indicators. Firstly, in the period from 1945 - 1973, there was a stable investment coefficient, that is a stable relationship between fixed investment and aggregate production. Secondly, although there was a steady rise in the capital-labour ratio, this was matched by a similar rise in the rate of productivity growth. Thirdly, the wage share of manufacturing remained stable at around 46% (1991:17). These stable relationships ensured optimal conditions for accumulation by preventing crises stemming from underconsumption on the one hand, or overaccumulation on the other. For Gelb, these indicators pointed to stable conditions of accumulation, or a successfully regulated regime of accumulation.

The Crisis of Racial Fordism

According to Gelb, the racial Fordist growth mode entered a crisis for reasons related to local as well as international conditions. He shows that the "limits of racial Fordism were, in part, the consequence of the apartheid based mode of regulation" (1991:19). Gelb provides four main reasons for the emergence of crisis in racial Fordism. Firstly, the consequences of apartheid education and training policies came to be felt in industry with increasingly severe skills shortages. These skills shortages constrained the rate of productivity growth. Secondly, South Africa was unable to develop significant export capacity in manufactured goods. Thirdly, the ending of the fixed international gold price (which was linked to the crisis of Fordism), led to fluctuations in export revenues, and this had undermined the "stabilising effect" (1991:22) which gold exports had had on the accumulation process. Fourthly, the cost of machinery imports rose (partly as a result of the crisis of Fordism in the West), and this contributed to a rise in the inflation rate and in the

and in the cost of productivity-improving investments.

These factors acting together, precipitated the crisis of the early 1970s. In explaining the crisis, Gelb is particularly concerned to show that the crisis must be explained with reference to local and international factors, and that the crisis of racial Fordism was not simply a result of the crisis in the centre. Rather, Gelb argues that racial Fordism's mode of regulation was not flexible enough to withstand the pressure exerted by the international factors. "The transmission of crisis tendencies from the international economy created stresses within racial Fordism that could not be absorbed" (1991:22). One reason that these stresses could not be absorbed, according to Gelb, was rooted in the position of black labour within the economy. According to Gelb, the growth of large-scale production industries in the 1950s and '60s had led to the increasing concentration of workers in large factories. This in turn created conditions which were conducive to organisation, and the subsequent formation of industrial unions led to rising real wages and "signalled that the 'racially despotic' labour relations system within production had reached its end" (1991:22).

The crisis of racial Fordism continued to develop throughout the decade of the 1970s. The conditions described above were further exacerbated by the oil shocks of the 1970s, and by political and strategic considerations which governed state spending, and led to capital flight. In tracking the development of the crisis, Gelb notes the various measures taken by the South African government in an attempt to restore stable conditions of accumulation. He argues that state policies in the late 1970s were an attempt to "continue the logic of the 'sub'- Fordist linking of mass production and mass consumption", (1991:25) but to extend its limits. In other words, restructuring efforts were based on an attempt to link wages with productivity growth for a small section of the black working class, and on this basis, to enlarge the domestic consumer market by incorporating sections of the black community into mass consumption. Policy-makers hoped that this process would also 'domesticate' (1991:25) black trade unions, and thus limit their economic demands and blunt the political power.

These attempts at restructuring, as well as other attempts which were concerned with

deregulation, monetary policy and limited political reform were also unable to address the structural nature of the country's economic and political problems. Rather the political and economic crisis continued to intensify into the 1980s, and by the late 1980s, "it was acknowledged that the initial attempts to restructure racial Fordism had been unsuccessful" (1991:28). It was only the "dramatic political developments of late 1989 and early 1990....which would finally make it possible for a new growth model to emerge in the future" (1991:28).

For Gelb, writing in 1991, the resolution of crisis was not yet assured, and the nature of any possible resolution was contested. Gelb notes two possible 'models' of a new growth path, - a 'neo-liberal' approach advocated by the De Klerk government and large sections of the business community, and an alternative approach associated with the African National Congress and its allies, and supported by Gelb's argument.

Applications of the racial Fordism model

The framework provided by Gelb's notion of racial Fordism has been applied and used by some writers, and criticised by others. I will now briefly survey these writers and show how their work debate the value of racial Fordism as an explanatory tool.

Maller and Dwolatsky - 'rediscovering the labour process' under racial Fordism

Judy Maller and Barry Dwolatsky argue that the use of regulation theory and the concepts of Fordism and racial Fordism have been helpful in understanding post-war developments in the advanced countries and in South Africa. They argue, for example, that "Fordism as an ideal type, has considerable explanatory value in identifying and linking many significant characteristics of the post-war boom period in the industrialised economies" (1993:70). They also accept that in the case of South Africa, Gelb "has effectively used regulation theory to make sense of the post-war South African economy and explain the nature of its present crisis" (1993:75) and that his analysis "has been particularly useful in facilitating the development of new economic policies" (1993:76). While they accept the overall framework provided by the concept of racial Fordism,

however, they argue that Gelb's work has placed too little emphasis on the concrete dynamics of the labour process within South African manufacturing, and that this has produced flaws in his overall analysis. They argue that Gelb's analysis "assumes the ubiquitous adoption of Fordist manufacturing techniques" (1993:76) but fails to investigate these claims empirically. When Maller and Dwolatsky do investigate the nature of the labour process, through a survey of work organisation and the restructuring of work in the metal industries, they discover that the labour process is essentially "non-Fordist" (1993:85) in nature. The reason for this, according to Maller and Dwolatsky, is that South African manufacturing has not enjoyed the benefits of the mass production-mass consumption regulation, because there has not been a mass consumption domestic market for manufactured goods. Rather, as a result of the racially skewed nature of consumption, the local market has been too small and fragmented to allow manufacturers to benefit from the economies of scale so crucial to the productivity of the Fordist regime of accumulation. They find that "the small runs, customised production and non-continuous plant layout contradict the fundamentally fordist features of mass production" (1993:83-4). These features are largely the result of the absence of a market for standardised, mass produced goods. They conclude that "the racially skewed nature of consumption has exerted a major effect on the nature of the labour process by preventing the emergence of mass production in significant sectors of manufacturing" (1993:84).

We are left then, with a limited critique of racial Fordism. Maller and Dwolatsky claim that racial Fordism is a flawed concept because it does not take account of the way in which the nature of the market limits the possibility of the emergence of mass production. However, they limit their critique of racial Fordism to the idea that it takes insufficient account of the labour process and its link to the nature of consumption. They continue however, to accept the overall value of the categories of Fordism and racial Fordism, and do not offer an alternative, except to say that there is "a need for a more detailed investigation of the labour process and the restructuring of work in formulating South Africa's future economic policies" (1993:85).

Other applications of racial Fordism

Eddie Webster, in an article charting the directions taken by South African sociology from the 1970s to the early 1990s, draws on Gelb's work to analyse the links between the workplace and broader social structures. Webster, following Gelb, argues that "racism complicated any simple transfer of Fordism to South Africa. Put simply," he argues, "Fordism is mass production plus mass consumption. What emerged in South Africa after 1945 was not Fordism but a caricature of Fordism; mass production was introduced but whites monopolised the skilled and supervisory positions in the labour process. The wages of white workers rose steadily making possible the spread of mass consumption of housing and locally produced consumer durables, while africans were excluded from the mass consumption 'norms'" (1992:55).

Webster goes on to argue that current changes in the organisation of work do not indicate the emergence of 'post-Fordism' as some would have it, but rather a "slow and uncoordinated drift towards new technology and new methods of organising work" which "can best be understood as a crisis within racial Fordism rather than a transition to post-fordism" (1992:59).

We have noted above that Maller and Dwolatsky, and Webster use the racial Fordism framework to analyse, or comment on, changes in work organisation. Similarly, a report written by the Sociology of Work Unit (SWOP)[24] for the National Union of Metalworkers of South Africa, uses a comparable framework to analyse changing conditions in the workplace and the labour market. Although the SWOP report does not use the term 'racial Fordism', the analysis of crisis in South Africa is similar to Gelb's. The report uses the notion of Fordism to explain developments in South African industry but argues that in "South Africa there have been very important differences in the development of fordist production" (1990:2). In particular the report refers to the fact that the introduction of Fordist technology was not accompanied by high wages (as it was

[24]The Sociology of Work Unit (formerly the Sociology of Work Program) is located in the Department of Sociology at the University of the Witwatersrand. The Unit conducts research on the nature of work, and on changing workplace relations in South Africa.

in the classic Fordist case), because trade unions were repressed under apartheid laws until the late 1970s. It also refers to the high rate of unemployment in explaining the lack of mass consumption norms, arguing that as a result of unemployment "black workers' wages could not be used to buy luxury goods such as motor cars and TV sets, because workers had to support many unemployed people in their families. They therefore became mass consumers of subsistence goods only, like food and transport" (1990:2). The report goes on to argue that one of the responses to the crisis in South Africa has been to restructure work in an attempt to achieve greater levels of flexibility. This process is akin to the "post-fordist" restructuring of work in the advanced industrial countries, and includes initiatives such as multi-skilling, casualisation, Just-In-Time production and participatory management[25].

I now turn to one other application of the racial Fordism model -my own earlier study of a single pulp and paper mill (1991). In that study I described the nature of work organisation at the mill in terms of racial Fordism, and claimed that the crisis facing racial Fordism was leading to a series of energetic but superficial changes in the nature of work organisation. I argued that Gelb's framework could be used to analyse the organisation of work at the mill, and particularly the nature of relationships between workers and managers on the shop-floor. I argued that racial Fordism was a useful concept in that it provided a link between theories of the labour process and the macro economy. I did not however conduct a assessment of the usefulness of racial Fordism at a sectoral level, nor did I analyse the theoretical assumptions behind the concept. In short I used racial Fordism as an extension of labour process theory rather than considering its broader implications.

My study, like that of Maller and Dwolatsky, the Sociology of Work Unit and Webster, accepted the basic validity of the notion of racial Fordism[26]. All of these studies used

[25]On this latter point there is a difference of opinion between the SWOP report and the perspective put forward by Webster (1993) who argues that the changes in work organisation do not amount to "post-fordism" but rather represent a piecemeal response to the crisis of racial Fordism.

[26]It is interesting to note that these writers were all attached to the Sociology of Work Unit at the time when they produced the work in question.

racial Fordism as a starting point without conducting an overall conceptual or empirical assessment of the theory and assumptions behind the term. I will argue later in this study that a proper assessment of racial Fordism reveals important weaknesses with the concept.

Nattrass - a rejection of 'racial Fordism'

We have noted that Maller and Dwolatsky, SWOP, Webster and my own earlier work, all accept the basic argument embodied in the notion of racial Fordism. Nicoli Nattrass differs from these writers in that her response to Gelb's notion of racial Fordism is to reject it completely. Her work also differs from that examined above in that it approaches Gelb's work on the macro-economic level rather than through an analysis of the labour process.

The essence of Nattrass's argument is that Gelb's analysis is unsustainable on its own terms. She argues that there is no empirical evidence to support Gelb's characterisation of development in South Africa because the key economic trends do not fit with Gelb's periodisation of the economy. She argues that regulation analysis rests on the idea that during stable periods of regulation, accumulation occurs steadily, and this is marked by a secular rise in the rate of profit and the rate of exploitation. A sustained downward trend in profitability indicates the onset of a 'non-reproductive' downturn, and the emergence of crisis. In terms of regulation theory, if South African accumulation had followed the same pattern as that of the Fordist countries of the West, it should have exhibited a rising rate of profit and a rising rate of exploitation during the period under consideration. However, she argues that the rate of profit in South African manufacturing has declined steadily since 1948 and that South Africa displays a fundamentally different pattern of accumulation from the advanced capitalist countries. She shows that during the 1960s for example, (which Gelb considers the 'golden age' of racial Fordism), South Africa experienced a falling rate of profit as well as a falling rate of exploitation. "In sharp contrast to the Fordist pattern of accumulation in the advanced capitalist countries" she argues, "South Africa showed no signs of there being any stable form of co-ordination between wages and productivity such that consumption and

production were regulated, and the profit rate stabilised. In other words, none of the indicators of a fordist (limited or otherwise) regulation were apparent during the 1960s boom" (1989:10) She therefore concludes that the 1960s boom should not be characterised in terms of Fordism because such a characterisation implies macro-economic balance between production and consumption such that profit rates do not fall.

Nattrass concludes that in terms of regulation theory's own assumptions there is no case for characterising South Africa's economy as Fordist when macro-economic indicators are taken into account. As an alternative Nattrass argues for a more contingent understanding of the relationship between accumulation and apartheid in the post-1948 period. Apartheid should be seen as having had contradictory effects on the process of accumulation rather than simply facilitating accumulation for an extended period[27].

Some conceptual problems with the concept of racial Fordism

We have now explored the origins and meanings of Gelb's term 'racial Fordism' and looked at some of the ways in which the concept has been applied or criticised by other theorists. I will now go on to specify some of the conceptual problems with racial Fordism. Thereafter I will examine the performance of the South African paper sector, in order to determine racial Fordism's usefulness in light of a specific sectoral analysis.

Is racial Fordism really Fordist? - The problem of limited consumption

We have seen that Gelb describes the growth path under racial Fordism as "the extension of mass production with the extension of mass consumption, but in a manner that was restricted on both sides of the equation" (1987:39). Maller and Dwolatsky pick up on this limited version of Fordism, and argue that since mass consumption was absent (because consumption was racially structured), mass production was impossible. Rather,

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[27]Like Amsden, Nattrass does not reject regulation theory out of hand. Rather she argues that regulation analysis "has some potential.....it is after all important that analyses of South Africa locate economic developments firmly within the parameters of apartheid institutions and structures" (1989:?*) For Nattrass however, such an analysis must be applied empirically and in a non-functionalist manner.

as their study of the metal industry shows, South African manufacturing has been characterised by short-run, fragmented production, rather than by the mass production of standardised articles. In this way, local manufacturers have lost out on the potential benefits of economies of scale, and have not achieved the associated productivity growth that characterised accumulation in the Fordist countries. In fact, the inability to achieve economies of scale has stunted productivity growth and formed a barrier to the achievement of international competitiveness. Maller and Dwolatsky conclude that "it is precisely the non-fordist nature of the labour process that emerges as a primary factor in explaining its ongoing decline in productivity" (1993:85).

This critique identifies an important weakness in the concept of racial Fordism, but is somewhat misplaced. Maller and Dwolatsky mistakenly argue that racial Fordism is an adaptation of Lipietz's notion of peripheral Fordism (1993:75). In fact, Gelb asserts that racial Fordism is a type of sub-Fordism, rather than a variation of peripheral Fordism. This is much more than a semantic distinction. A careful reading of Lipietz's concept of sub-Fordism shows that he anticipated the exact problem that Maller and Dwolatsky identify. He describes sub-Fordism as a 'caricature' precisely because it lacks mass consumption norms. As we noted above, he argues that the lack of mass consumption, coupled with the limited nature of the labour process and the export of raw materials rather than manufactured goods, prevented the sub-Fordist economies from entering "the virtuous circle of central Fordism". With regard to consumption patterns, Lipietz describes sub-Fordist economies as follows: "In terms of markets.....there were very few cases of any significant expansion of peasant or worker purchasing power.....[Local] markets therefore remained restricted to the ruling and middle classes.....This market was in any case limited, but it was also sociologically stratified and resistant to the consumption of standardised articles" (1987:61).

He also notes that because of the nature of the labour process under sub-Fordism, "the imported forms of production never achieved their 'theoretical' productivity" (1987:61). Lipietz is thus saying quite clearly that sub-Fordism did not achieve the productivity growth associated with the 'virtuous circle' of Fordism, partly because of the limited and stratified nature of its local markets, and partly because of its labour process. Lipietz

then goes on to say that mass production was further blocked in the sub-Fordist economies because "wage differentials notwithstanding.....manufacturing activity was not yet competitive because of its low productivity" (1987:61) and therefore it was not possible to mass produce for export markets.

We see therefore, that not only did Lipietz anticipate the problems associated with a small and fragmented domestic market, but he also recognised the inability of manufacturers in such economies to export because they failed to achieve the productivity levels necessary for international competitiveness. Maller and Dwolatsky's critique is therefore restating (or showing empirically), that when a mass consumption market is absent from the equation, we do not find Fordism, but rather something which Lipietz describes as a caricature of Fordism. I would say that what Lipietz describes as sub-Fordist should in fact, on Lipietz's own terms, be described as non-Fordist, since the defining characteristics of Fordism are absent.

But where does this leave us in terms of our analysis of racial Fordism? I argue that partly for the reasons discussed above, racial Fordism is a misguided label. Gelb argues that "[t]he growth model which emerged in South Africa was of the type that Lipietz has called sub-Fordism, the qualification translating naturally into a racial one in the South African case" (1991:15). His analysis however, is based on a selective reading of the concept of sub-Fordism in the sense that he does not acknowledge Lipietz's insistence that sub-Fordist economies never entered the 'virtuous circle' of mass production and mass consumption. While he does point to the racially limited nature of the market, he continues to describe the logic of the growth path as based on the extension of mass production and mass consumption albeit 'restricted on both sides of the equation'. I argue that the absence of a mass consumption market prevents mass production, and that if mass production and mass consumption are absent, there is little explanatory value in describing the growth path as Fordist - in any sense. The label sub-fordist can only illuminate the path not taken, it cannot explain the source of growth or crisis. In analysing South Africa's path of accumulation then, we can use the idea of sub-Fordism, and with it, racial Fordism to tell us how our path differs from that of the Fordist countries, or to describe by way of analogy (as I shall argue below), certain features of

our economy. We cannot use it as a theory explaining the development of the South African economy.

My argument offers a critique of Lipietz's notion of sub-Fordism as well as Gelb's analysis. The problem with Lipietz's concept is that, although the content of 'sub-Fordism' shows that a sub-Fordist economy is non-Fordist (it does not achieve the essential match between mass consumption and mass production which is the source of productivity growth and rapid accumulation in the Fordist countries), the term sub-Fordist does suggest that such an economy presents a variation of Fordism rather than a departure from it. This problem has led Boyer to argue that labels "such as 'peripheral Fordism' are more dangerous than fruitful" and that many developing economies "have little to do with Fordism, whether peripheral, shackled or incomplete" (1990:xi,xviii). The problem with Gelb's reading of Lipietz is that he adopts the label sub-Fordism but ignores its content. He therefore treats South Africa's growth path as a type of Fordism, rather than as a type of non-Fordism.

We can conclude then that the notion of racial Fordism is misleading in terms of its own theoretical framework. But as we shall see below, it is also possible to critique racial Fordism in terms of competing theoretical frameworks.

Underconsumption or productivity?

Amsden notes that "the Fordist model regards underconsumption as the major stumbling block to economic growth" whereas she argues that "the problem of industrialisation in the Third World is a problem of raising productivity and creating international competitiveness, not of effective demand". This is because "any country.....can produce without regard to the size of its home market, so long as it can export" (1990:10-11). If a country can manufacture productively, then it can compete internationally and thus export its products. In other words, one could argue that what Lipietz called a sub-Fordist economy (one which lacks a domestic market for mass produced goods) could create a market for its mass produced goods, if it is productive enough. This shows, for Amsden, that it is preferable to conceptualise the constraints on Third World industrial

growth as stemming from problems of productivity rather than underconsumption.

Bringing this back to the South African debate, we could argue that a further problem with racial Fordism is that it fails to identify the problems associated with low productivity in South African manufacturing. In fact, Gelb tells us very little about productivity or competitiveness. He does note that South Africa's failure to develop export capacity in manufacturing was not a significant problem so long as mineral exports were stable. The failure to develop export capacity in manufactured goods did however, present a significant problem as soon as the price of gold began to fluctuate and export revenues dropped (1991:15,20). Gelb's commentary on the causes of our inability to export manufactures is however, limited. He points to two factors:
i) that a shortage of skilled labour imposed a constraint on productivity growth; and ii) that given South Africa's technological dependence on the Fordist countries, the rising cost of capital equipment from the early 1970s, lowered the efficiency of investment. But beyond these rather bald facts, his analysis does not tell us how the dynamics of manufacturing influenced or precipitated the development of the crisis in racial Fordism. His analysis of the crisis rests on the changing behaviour of mineral exports, and the effect of the international slowdown on South Africa. In this sense, although Gelb uses a concept which is rooted in the manufacturing sector, he has very little to say about what goes on in manufacturing. While the theorists of Fordism are concerned about the ways in which the Fordist labour process contributed to a slowdown in productivity growth, Gelb treats the manufacturing process as something of a black box[28]. In short, Gelb's analysis fails to identify the problem as one of productivity and competitiveness, and reveals little about why South African manufacturing is uncompetitive.

In response to this problem, I will now examine the performance of a manufacturing sub-sector, in the hope that we will learn more about the dynamics of manufacturing and the source of constraints in this area. I will explore the development of the pulp and paper industry. This will be done in two ways. I will first present a description of the

[28] Maller and Dwolatsky, SWOP, Webster and Bethlehem re-open that black box. However they fail to identify the essential problems of manufacturing performance and to link the problems on the shop-floor with sectoral trends.

performance of the sector since 1945, and will then move on to an analysis of the reasons for the successes and failures which have occurred. I will then use this analysis to comment on the nature of industrialisation in South Africa, and on the idea of racial Fordism in particular.

Chapter Three: Racial Fordism and the South African pulp and paper industry

At the conclusion of chapter two I argued that one way to test the concept of racial Fordism is to examine the historical development of a manufacturing sub-sector, and to see the extent to which the concept is able to explain the development of that sector.

I will now demonstrate that racial Fordism is of limited value in explaining the development of the pulp and paper industry. I will show that the framework provided by racial Fordism provides only a partial insight into the development of the industry and that it fails to explain key aspects of the growth of the industry.

Before I proceed with this analysis however, I will provide a brief overview of the historical development of the sector in order to familiarise the reader with the major features of the industry, and in order to situate the analysis which follows.

Overview of the pulp and paper industry

The pulp and paper industry is one of South Africa's more successful manufacturing sub-sectors. In 1920 the industry was comprised of a single, small paper mill which relied on imported pulp, and produced only low grade packaging paper. By 1940 a new mill produced pulp and paper from straw and began to meet the needs of the local market. By 1993, the industry has grown into a manufacturing giant, providing 85% of paper consumed by the domestic market and exporting a third of its products. In contrast to most of the manufacturing sector, the industry grew steadily during the 1980s. The industry and is now an important earner of foreign exchange, and directly provides almost 20 000 jobs in urban and rural areas. South African companies such as Sappi and Mondi have recently begun to expand internationally, acquiring paper mills in Germany, Austria and the United Kingdom.

The pulp and paper industry is however, only one part of the paper pipeline or paper

sector. By pipeline I mean the set of industries which make paper-related products. The pipeline begins with the multi-billion rand commercial forestry industry. (At present the pulp and paper industry consumes over 40% of the forestry industry's total wood crop). The pipeline then moves through the pulp and paper manufacturers themselves, and on to the manufacturers of paper products. These products include paper packaging of various types, tissue and disposable products, printed goods, including school and business stationary, and publications such as books and magazines. Manufacturers of these products are referred to as converters, because they convert paper into paper products. When this pipeline of industries is considered as a whole, we see that the paper sector is extremely diverse, and has important linkages throughout the economy.

In this analysis I will concentrate on the performance of the pulp and paper industry itself. However in order to explain the dynamics of the sector I will, from time to time, refer to other parts of the pipeline including forestry and the paper converting industries.

Historical development

1920-1945

Paper manufacture was first attempted in South Africa in the 1820s. However, the difficulties of producing paper on a commercial scale thwarted various attempts to set up paper mills between 1820 and 1920. The difficulties were related mainly to the availability of a suitable fibre resource for the manufacture of pulp - the raw material needed to produce paper. Paper can be manufactured from any vegetable-based matter which contains cellulose fibre. This material must be 'pulped' - or broken down into a mass of fibres. These fibres can then be arranged so as to produce a sheet of paper. In South Africa, various materials, including straw, sugar cane bagasse[29] and wood have been utilised in the production of paper. The first commercially viable paper mill in the country was established in 1920 and used imported woodpulp for the production of low-

[29]Bagasse is fibrous waste which is left over from the manufacture of sugar.

grade packaging paper. The mill struggled however, to sustain its production, and closed after less than ten years. In 1936, a second, more successful attempt was made, backed by a British-owned mining house called Union Corporation. After being approached by local and international entrepreneurs, Union Corporation agreed to provide capital to build a South African pulp and paper mill which was to rely on straw as its raw material. In December 1936 Union Corporation set up a public company which was registered under the name of South African Pulp and Paper Industries, Limited (SAPPI). The mining house held majority ownership of the new company, and provided finance as well as technical assistance. The mill was built during the course of 1937 near Springs on the East Rand. It aimed to produce both pulp and paper. Since the pulp was to be produced from straw, the mill was given the name 'Enstra' - Enterprise Straw (Hocking 1987:21-3).

After encountering a range of difficulties, Enstra eased into producing a regular supply of various paper grades to the South African market. It was too small however, to meet the bulk of local demand. In 1937 for example, South Africa imported 25 000 tons of newsprint; 27 000 tons of kraft papers, and 16 000 tons of printing and writing papers. By contrast, Enstra had a total capacity of 14 000 tons per annum (Hocking 1987:17-19).

When the Second World War broke out in 1939, imports of all kinds, including paper, were disrupted. Enstra did not have the capacity to meet the sudden increase in demand for its paper, and the War years saw great shortages of paper. In response, the Government appointed a 'Paper Controller' to oversee the rationing of paper supplies. Hocking describes how a number of end-users tried to consume paper more sparingly:

> "Setting an example, the Post Office introduced half-size postage stamps to cut down its consumption of gummed paper. The wine industry identified bottles with paper strips instead of the generous labels favoured before the war. Many businesses converted to half-size stationary, and envelopes were used again and again" (1987:53).

During the War, and immediately thereafter, it became clear that as South Africa's

economy expanded, larger supplies of paper would be needed. Both the state and local companies saw the opportunity to replace imports with locally manufactured papers. One of the problems facing any local producer however, was that in order to produce larger quantities of paper, extensive raw material supplies would be needed. Enstra mill had meanwhile discovered that there were serious difficulties in using straw as raw material base, and by the early 1940s Enstra managers were experimenting with wood as an alternative. The problem however, was that South Africa had very limited natural forests, and those natural forests that did exist had been over-exploited in the late nineteenth and early twentieth century, largely to meet the timber needs of the mining industry. A steady supply of timber for paper production would therefore have to come from commercial forests - forests which were specifically planted in order to provide timber. Even the fastest growing species of timber, however, took ten to fifteen years to reach maturity. Fortunately for Sappi's Enstra mill, the South African state had identified the problem of timber shortages during World War One, and had set about planting and managing state-owned forests in an effort to achieve self sufficiency. D.W. van der Zel describes the state's forestry plans at the time as follow

> "The timber famine occurring during the War years[30] was a strong motivation after the War for the RSA government to establish sawtimber plantations with the object of attaining self-sufficiency within 50 years. The economic depressions in the post-War period, and unemployment coupled therewith, provided the incentive for the RSA government to embark upon large afforestation schemes to provide a living to poor Whites and returned soldiers" (1989:7).

The period between the two World Wars saw state afforestation proceed at a rate of 6 000 hectares per annum, and most of the timber crop was used by the sawmilling industry. By 1945 there were 65 000 hectares of commercial forests - more than triple the figure for 1920 (1989:9-11). These timber resources would provide the basis for pulp and paper production after World War Two.

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[30]World War One

1945-1973

After the war, the paper industry began to expand rapidly, aiming to replace imports of paper in the long term. Sappi grew briskly, opening several new mills and starting its own forest plantations in 1950. The period 1948-1970 saw the opening of a total of seven new mills in the country. Some of these mills were established by Sappi, whereas others were run independently. In 1954, Sappi opened the Tugela mill which, at the time, was the largest mill on the continent. Tugela was built to produce pulp from hardwood timbers which were to be supplied from state forests, and eventually from Sappi's own plantations. The pulp produced from hardwoods would then be used to make a strong brown paper known as kraft paper, which would be converted into paper sacks and cardboard boxes. In 1964 Sappi established a third pulp mill at Ngodwana in the Eastern Transvaal, and also established forests in that area. In the same year, Sappi bought a small independent mill in the Eastern Cape, where it planned to produce printing and writing papers. In 1965 Sappi also acquired an interest in a tissue plant, which was later to become Carlton Paper.

During this time, certain papers which had formerly been imported were now being substituted with locally produced papers. Domestically produced newsprint for example, was first used to print The Star newspaper in Johannesburg in 1952.

While Sappi was expanding rapidly others were watching the growing potential of the industry. South Africa's rapidly expanding economy led to a growing market for pulp and paper, and to steady profits. Hocking notes that until the late 1960s "Sappi's management had headed off potential rivals before they could gain a foothold". In 1966, however, there was a new effort to break into the market. "This time" says Hocking "the rival was backed by the largest of the mining houses, the Anglo American Corporation of South Africa, in partnership with Bowaters of Britain" (1987:177). Anglo American succeeded in establishing a paper company in 1967, and named it Mondi Paper. Mondi immediately established a large mill at Merebank in Durban, where it produced a range of papers including printing and writing papers and newsprint. Mondi soon acquired forest plantations, and added to the expansion of South Africa's commercial forests.

Thereafter Mondi also entered the cartonboard market by acquiring South African Board Mills, a company which produced cartonboard for the packaging industry.

1973-1990

The early 1970s saw a levelling off of investment activity in pulp and paper. This was partly due to the downturn in the economy beginning in 1972. The industry was also affected by the Durban strikes of 1973, as black workers at a number of mills including Tugela mill joined the strike action.

The 1970s in general saw a consolidation of the industry, and the only major investments of the decade were in a new machine at Merebank, and the establishment of a small independent mill at Stanger. The planting of new commercial forests continued however, as the paper companies and the state increased their holdings.

By the early 1980s the industry was poised for further growth and the decade proved to be the most successful so far. This growth took place largely as a result of the fact that increasing amounts of mature timber were now coming on stream. Sappi and Mondi were however, taken by surprise by the prolonged weakness of the local economy, and so new markets had to be found for the mature timber supplies. The solution came in the form of export-led growth during the 1980s. Despite the general weakness of the South African economy, the industry's investment, production, employment and exports all expanded dramatically. This was mainly due to the establishment of two world-scale pulp and paper mills in 1984 - Sappi's Ngodwana mill[31], and Mondi's Richards Bay mill. Both of these were massive constructions which cost in excess of one billion rand each. The investment at Ngodwana was in fact, the largest private investment in the country's history. The 1980s also saw the expansion of a number of other mills and the consolidation of paper holdings into the hands of Sappi, Mondi, and Carlton Paper which became independent of Sappi. The decade saw an annual average increase of 7.9% in the industry's fixed capital stock as well as a steady growth in employment, at an average

[31] A small pulp mill had in fact, been established at Ngodwana in 1964. This site was however transformed with the building of a world-scale mill in 1984.

3.2% per annum. By 1990, 17 310 workers were employed directly in the pulp and paper industry and another 60 000 were employed in forestry. The growth in capital stock and employment were both in sharp contrast to trends in the manufacturing sector as a whole[32].

The physical output of the industry also showed striking growth in this period. The volume of pulp production increased by 40% during the 1980s, while paper and board production expanded by 33%. The growth was driven by a combination of exports and import substitution. Pulp exports grew by 88%, and paper and board exports by 65%. Imports declined as a result of the new capacity - the volume of pulp imports declined by 90%, and paper and board imports fell by 45%.

Overall growth in the local market however, was limited. Although total consumption of paper and board increased by 12.5% between 1980 and 1990, per capita consumption declined from 47.3 kg. to 44 kg. per annum. This reflects the poor economic position in the country as a whole during this period.

Forest plantations also continued to expand during this period, reaching a new high of 1.2 million hectares by 1990.

The 1980s also saw a rise in the overall profitability of the industry, although profit levels fluctuated due to international trading conditions and local levels of investment. Wages saw a steady growth as did the rate of labour and capital productivity. Given the substantial rise in labour productivity the unit cost of labour declined slightly.

Key trends in the development of the industry are illustrated below.

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[32]All data in this chapter relating to the volume of production, consumption and trade is sourced form Pulp and Paper International (1991, 1992) and the Industrial Development Corporation Manufacturing Data Series (1992). Data on commercial forest plantations is drawn from Van der Zel (1989).

Figure 1: Capital stock in the South African pulp and paper industry 1980-1990

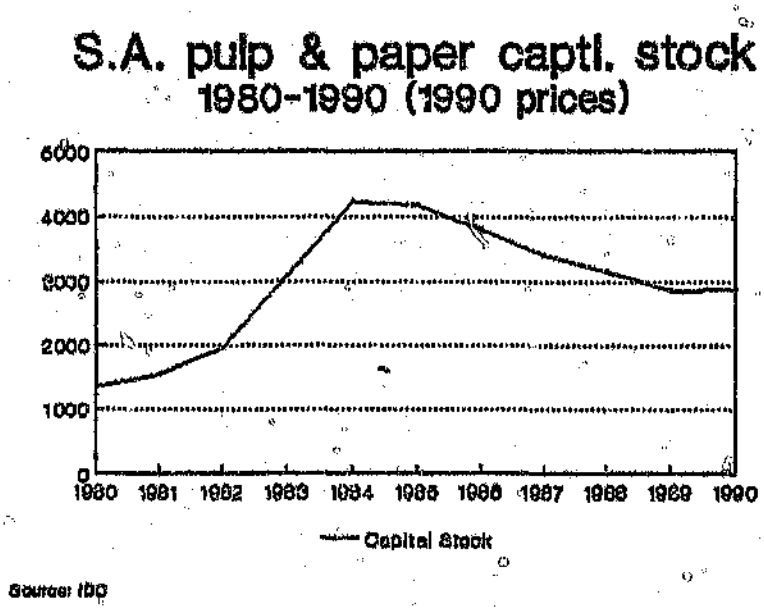


Figure 2: Production output of the South African pulp and paper industry 1980-1990

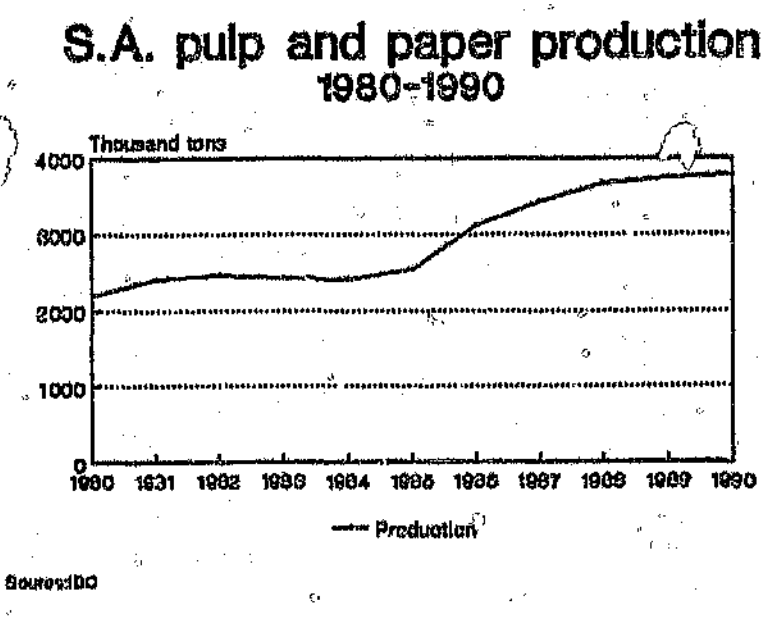
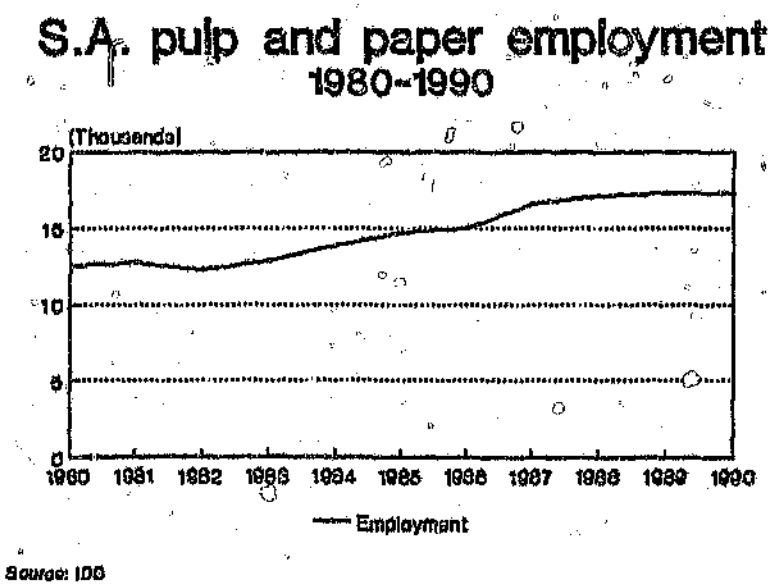


Figure 3: employment in the South African pulp and paper industry 1980-1990



Source: IDC

The current economic status of the pulp, paper and board industry

There are now nineteen pulp, paper and board mills in South Africa. Between them these mills produced 2.23 million tons of pulp and 1.8 million tons of paper and board in 1991. Exports accounted for 27% of pulp production and 29% of paper and board production and were worth R2 282 000m. At the same time, 180 000 tons of pulp, paper and board were imported which represents 10% of the volume of the South African market.

The industry comprised 3.7% of the value of all manufactured exports from South Africa and contributed 2.9% of all manufacturing value-added and 3.2% of manufacturing fixed capital stock.

Largely as a result of the massive increase in capacity during the 1980s, South Africa began to carve out a position as significant player in the international market. In 1992 South Africa was the 10th largest producer of pulp, and the 22nd largest producer of paper and board in the world. The country's absolute share of international production is, however, small at 1.4% of world pulp, and 0.7% of world paper and board. South Africa is however the 12th largest exporter of pulp, and the 20th largest exporter of paper and board in the world. In terms of company size, one South African firm, Sappi, ranks among the world's top 150[33]. Based on 1992 results, Sappi is placed at number 35 when ranking is measured according to gross sales. In terms of earnings, however, Sappi's ranking improves - Sappi was the 20th most profitable pulp and paper company in the world in 1992.

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[33]Mondi is not listed among the top 150 companies, but this is not necessarily because it does not warrant a place. Mondi is not a listed company, and therefore its results are not published. If Mondi results were published, the Company would probably find a place among the top 150.

Racial Fordism and the pulp and paper industry

How could the development of the pulp and paper industry be analysed within the framework provided by racial Fordism? In order to answer this question I will take the essential elements of Gelb's analysis and apply them to the development of the pulp and paper industry. I will show that racial Fordism is of limited value in analysing the development of the industry, and that the theory fails to direct our attention to important sources of growth and constraint in the sector.

In conducting this analysis I will examine five aspects of racial Fordism and assess to what extent they are applicable in the pulp and paper industry. The five aspects are:

1. Mass production and consumption
2. International competitiveness
3. A Capital-Labour Pact or labour repression?
4. Race on the shop floor
5. The role of the state

These aspects will be examined in turn.

1. Mass production and consumption

1a. Domestic mass consumption as the key source of growth

According to the notion of racial Fordism the key source of manufacturing growth in South Africa in the post-1945 period was the extension of mass production and mass consumption. Gelb has argued that although the extension of mass production and consumption was racially restricted, the growth of domestic demand was still the key to the growth of manufacturing in this period. In other words, South Africa's economy expanded on the same basis as the Fordist economies, although the extension of mass production and consumption was racially limited in South Africa. With regard to the pulp and paper industry, there are two problems with this thesis. The first is that the growth of the industry from 1945 was only partially driven by a growth in domestic

demand, but was also influenced by supply-side factors as well as exports. The second is that the (racially) fragmented nature of domestic demand at the consumer-products end of the pipeline deprived the industry of a market for standardised products.

The domestic market for paper and paper products was clearly expanding in the period from 1945 to 1970. This was partly as a result of the fact that consumption of paper is closely related to growth in the Gross Domestic Product[34]. The climate of economic growth and the extension of white consumer power and white education did provide the industry with a growing domestic market and opportunities for large scale production. The newly established local industry was able to take advantage of this growing local demand in a climate of import protection. One example of the industry's ability to substitute imports with locally manufactured products was in the newsprint market. Newsprint was wholly imported before 1954, but by the mid-1960s the local mills supplied the bulk of local demand. Similarly local producers were able to meet a large proportion of demand for kraft and other packaging papers by the mid-1960s. In this way the expansion of domestic demand coupled with import substitution drove the growth of the industry in the period 1945-1970. During this period there was a steady decline in imports as a percentage of domestic demand. Imports accounted for 74% of domestic demand in 1950, but only 55% in 1960 and 32% in 1970. Imports continued to decline in importance after 1970 although this occurred more slowly that it had in the preceding decades.

This pattern is exactly what we would expect if we follow the logic of racial Fordism. In the period 1945-1970 therefore, the assumptions of racial Fordism are borne out by the experience of the pulp and paper industry.

In the period from 1970 import substitution and growth in domestic demand began to level off. This was partly the result of the sustained economic weakness beginning in 1973/4. In terms of racial Fordism we would expect that this would lead to stagnation in

[34]There is a well established link between the level of paper consumption and the Gross Domestic Product (GDP). This is due to the paper industry's linkages throughout the economy, and especially the linkages to the packaging and advertising industries. For a closer discussion of the relationship between consumption and GDP see Bethlehem (1993).

the industry. However, this was not the case. Rather, the industry expanded steadily from the mid-1970s on the back of increased exports. The industry had not exported at all until the early-1960s, and even then exports grew slowly until 1975 when they reached 10% of production. By 1980 exports had jumped to 17% of production, and by 1985 they comprised 20% of production. Exports have remained around 20% since 1985, representing 21% of the value 28% of the volume of production in 1990.

Import and export trends are illustrated below:

Figure 4: Imports as a percentage of domestic demand 1950-1990

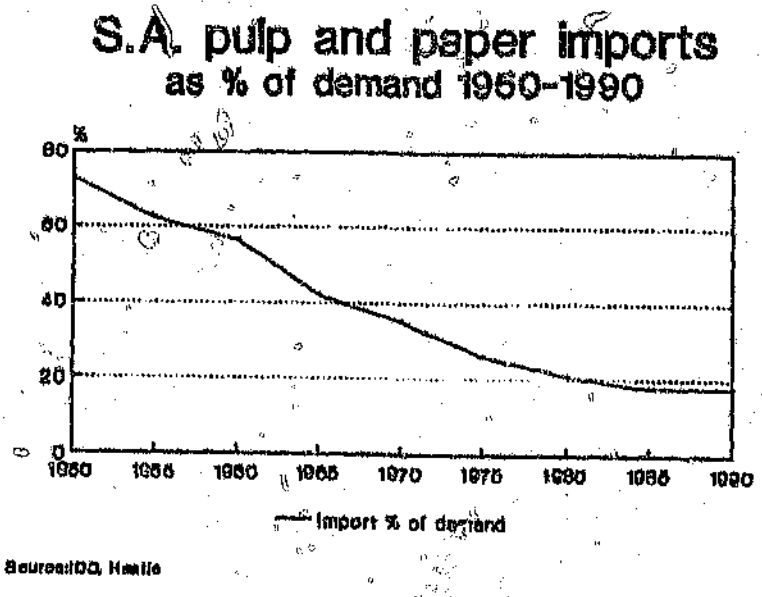
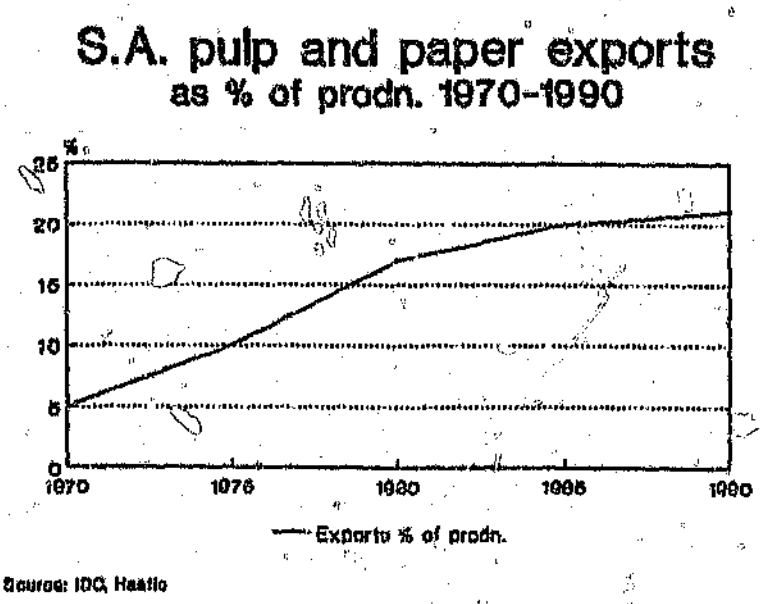


Figure 5: Exports as a % of production 1970-1990



Source: IDC, Hastie

Why is it that this industry was able to expand at a time when domestic demand in general, and the opportunities for import substitution in particular were stagnating? Why did the sector grow while the rest of the economy slumped? How is it that the industry was able to break into export markets?

The answer to these questions lies not in the structure of domestic demand as racial Fordism would suggest, but rather in the realm of supply, or production. The expansion of the industry was driven by a supply factors - the maturation of large tracts of commercial forestry in this period. Due to the fact that the state and the paper companies had been planting aggressively since 1965, large quantities of hardwood and softwood species were ready for harvesting by the early 1980s, and large quantities of timber supplies would continue to come on stream throughout the 1980s and into the '90s. Given that the raw material could not possibly be taken up by the domestic market, companies needed to find an alternate outlet, and this was done through the export market. South Africa's ability to break into the export markets was not a result of

expressing international demand but rather signified South Africa's capacity to break into export markets particularly in the pulp, newsprint and kraft paper markets.

The fact that the major source of growth in the pulp and paper sector was the export market (rather than the expansion of domestic demand) is at odds with Gelb's schema. However, this does not suggest that Gelb's framework is entirely incorrect since this industry could be seen as an exception or an 'outlier' in Gelb's framework. It does however point to the fact that the notion of racial Fordism is based on the relationship between domestic production and domestic consumption and sees these as the driving factors behind either growth or stagnation. In the case of pulp and paper, while the basis of the industry was laid by the extension of domestic demand coupled with import substitution in the period 1945-1970, it was the export market that was the primary source of growth thereafter. In addition, it was a key supply-side factor (increased raw material availability) that precipitated expansion. My first critique of racial Fordism is therefore, that it is insensitive to both the impact of **international demand** and to **supply-side determinants** of growth. I propose that rather than understanding the growth of the pulp and paper industry through the (domestic) mass production and consumption equation alone, we need to take account of the impact of changing supply conditions as well as the capacity to export.

But this raises a second question. Why was the local industry able to compete in international markets at all? What was the source of the industry's ability to break into those markets despite an international recession? This important issue is tackled in the section on international competitiveness below. Before I consider that question however, I will examine the second problem with Gelb's idea that the extension of mass production and consumption was the key source of growth.

1b. Mass consumption? The structure of domestic demand

We have seen that Gelb's understanding of the growth facilitated by the match between mass production and mass consumption is only partially accurate in relation to the pulp and paper industry. But the mass production-mass consumption equation also runs into a

second problem with regard to this industry. The theory behind Fordism and racial Fordism is that the existence of mass consumption markets facilitates the mass production of standardised products thus allowing producers to maximise economies of scale and lower unit costs. For commodities like newsprint and kraft paper this analysis is fitting, as companies have been able to mass produce a relatively undifferentiated product and thus exploit economies of scale. In the manufacture of printing and writing papers[35] as well as converted paper products however, this assumption does not hold. Local companies have been unable to make use of economies of scale because the consumer markets which they have been supplying are small and highly fragmented. This is due to the structure of consumer demand for printing and writing papers and paper products.

By international standards South Africans consume relatively little paper. South Africa ranks 22 in terms of total consumption of paper and board, but in per capita terms, this ranking plummets to 42, due to the fact that the vast majority of South Africans consume very little paper while a small proportion consume large per capita quantities. South Africans consumed 44.3 kg. of paper per capita in 1992, and this is way behind the top twenty consuming countries, (who averaged 192.3 kg per capita), and below the world average of 47.8 kg[36]. Comparative international per capita consumption is listed below:

[35]Printing and writing papers comprise coated and uncoated papers, and range from commodity-type grades such as copy paper, to highly specialised art papers, or fine packaging grades.

[36]In this respect we fall far below the consumption rate of many developing countries, including Malaysia (60.8 kg p.c.); Costa Rica (53.9 kg p.c.); United Arab Emirates (49.1 kg p.c); and Panama (48.2 kg p.c.)

Table 1: Per Capita consumption of paper and board
Selected international comparison 1991

Country	Kg/capita/annum
USA	311.4
Finland	279.2
Sweden	230.7
Japan	228.3
Netherlands	203.8
Singapore	188.9
United Kingdom	163.5
Israel	104.4
South Korea	101.7
Bahamas	58.4
Cyprus	57.6
Internatnl. average	47.8
South Africa	44.3
Egypt	10.7
Zimbabwe	10.0

Source: PPI 1992

The market for paper in general and for printing and writing papers in particular is relatively small because the majority of South Africans have had limited access to books (including textbooks), magazines, printed materials and writing papers. In addition, the market is highly fragmented. In other words, a limited number of people consume small amounts of a wide variety of papers. Unlike newsprint or packaging papers, where only a few variations of paper are possible, printing and writing papers are almost endlessly varied. The papers may vary according to colour, texture, weight, end-use and appearance. As a result, many different grades of each type of paper need to be produced in order to meet consumer demand, particularly in a sophisticated and relatively

affluent market. By contrast, in a situation where a company supplies to a very large market for printing and writing papers, one machine, or one mill can concentrate on one type of paper, and make relatively few changes in their production cycle. In South African however, concentrating on one type of paper is difficult because domestic demand for any one paper is small. Consequently, South African mills tend to produce a very wide range of papers, in order to meet the small demand for each type of paper. The bulk of South Africa's printing and writing papers are then produced in relatively small mills which produce a very wide range of papers. The strategy followed by these mills is to produce low tonnages of a wide variety of papers - to be 'all things to all people'. Paper companies have chosen to focus on this small market, and to supply most of the paper grades it demands.

The problem with this strategy from an efficiency point of view, is that economies of scale (or mass production economies) cannot be achieved because machines need to be re-set on a regular basis. Each time a machine is re-set, it must stand idle for a certain period, thus limiting its output. South African mills thus lose economies of scale in an effort to respond to the small and fragmented market for printing and writing papers. There is for example, only one paper mill in South Africa (and indeed in Africa,) which produces coated printing and writing papers. This mill produces a very wide range of coated papers. The volume of each production run is small and would be considered uneconomical by producers who operate in larger markets[37].

By contrast, major international producers of commodity printing and writing papers, use large machines which are dedicated to the production of a small number of grades. Machine downtime and waste are minimised, and the quality and consistency of the product is high.

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[37]It should be noted that in competitive terms, the smaller, more flexible mills present both a problem and an opportunity. The strength of the mills is that they are flexible enough to produce a wide range of speciality papers which are not produced in great volumes anywhere in the world. There is potential to increase the export of some of these papers into international niche markets. The mills have developed important skills, such as efficient change-over from one grade to another, and a highly adaptable workforce. The problem, however, is that the production of commodity grades (such as copy paper,) in the small mills cannot be efficient in international terms. The small, flexible mills are, therefore an important resource, for the production of high-value, niche market grades, but inefficient producers of commodity grades.

This suggests that Gelb's notion of mass consumption in the South African consumer market is misplaced. My analysis of the paper industry, like Maller and Dwolatsky's analysis of the metal industry shows that there are real obstacles to mass production which are a direct result of the exclusion of the majority of South Africans from mass consumption of consumer goods.

2. International competitiveness

Gelb claims that one of the most "pressing problems of the early 1970s was the failure of the manufacturing sector in South Africa (as in most 'sub-Fordist' economies) to have developed a substantial export capacity" (1991:20). He argues that the "underlying problem" causing the inability to export manufactures, was pressure on the balance of payments which resulted from declining gold exports and rising costs for imported capital equipment[35]. But Gelb does not venture into an explanation of the dynamics of competitiveness **within** the manufacturing sector itself. He does not cast his analysis in terms of international competitiveness and nor does he point to specific determinants of manufacturing performance. Rather he sees the manufacturing sector's failure to export in terms of macro-economic balance, rather than in relation to the dynamics of manufacturing itself. This is indicative of the problem that Amsden has identified with the notion of Fordism in general - that it conceptualises the core problem of development as **underconsumption** rather than as a lack of productivity or competitiveness. In failing to devote attention to the issue of competitiveness and to the determinants of productivity, Gelb has overlooked a central problem of industrial development.

In response to this silence in Gelb's work I propose that it is imperative to analyse industry's development in terms of competitiveness. There are two main reasons why international competitiveness is important. The first is that the sustained growth in the industry since the early 1970s has been largely export driven and we need to account for why this has been the case. It is therefore important to examine the source of the industry's ability to break into export markets, as well as any competitive problems which

[35]According to Gelb, both of these factors were rooted in the crisis of Fordism in the West.

companies have faced. Secondly, it is clear that as South Africa re-integrates into the international economy in the 1990s, local companies will need to compete internationally not only when they attempt to export, but also as they face the increasing presence of imports in the local market in the post-sanctions era. Any discussion of future development would therefore, need to be based on an assessment of competitiveness.

In analysing the pulp and paper sector through the lens of international competitiveness, I will show that contrary to Gelb's statement, some manufacturers have developed significant export capacity because of key advantages which they have in relation to the international market. This will demonstrate that it is insufficient to assess the export capacity of South African manufacturing in terms of macro-economic factors[39] alone. Rather we need to analyse the capacity of each industrial sector according to the specific conditions in that sector.

We have already noted that South African pulp and paper companies were able to break into export markets in the mid-1970s, and that they consolidated their position in the 1980s. This suggests that the sector is competitive enough to survive and even grow in the context of foreign competition. But the ability to export does not in itself indicate a thoroughly or uniformly competitive position throughout the sector. In order to make a full assessment, we need to disaggregate the industry's exports and we need to analyse the sources of competitive advantage as well as constraint.

The competitive position of the pulp and paper sector reflects a paradox: South Africa is an internationally low cost producer of pulp and commodity papers such as newsprint and kraft paper. However the country is a high-cost producer of printing and writing papers as well as paper products. In other words, South Africa is more competitive at the 'upstream' end of the pipeline (the production of lower value products such as pulp and newsprint), and less competitive downstream (the production of higher value papers and converted products).

This is reflected in our trade balance which is illustrated below:

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[39]Such as the balance of payments or the exchange rate.

Figure 6: South African paper sector exports by volume 1991

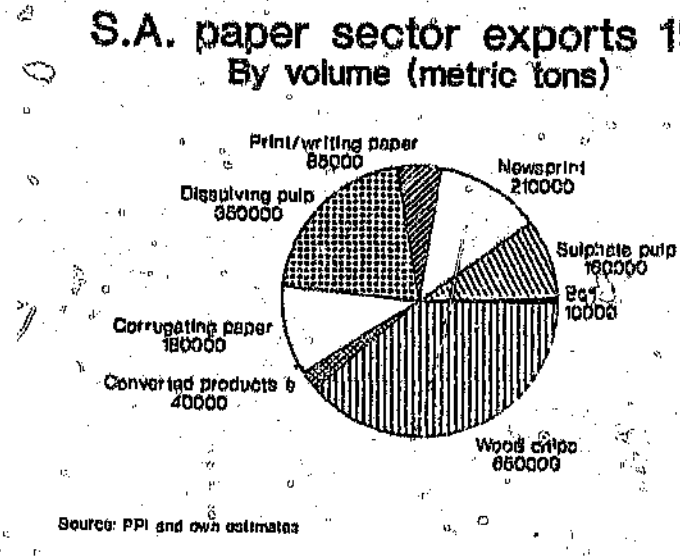
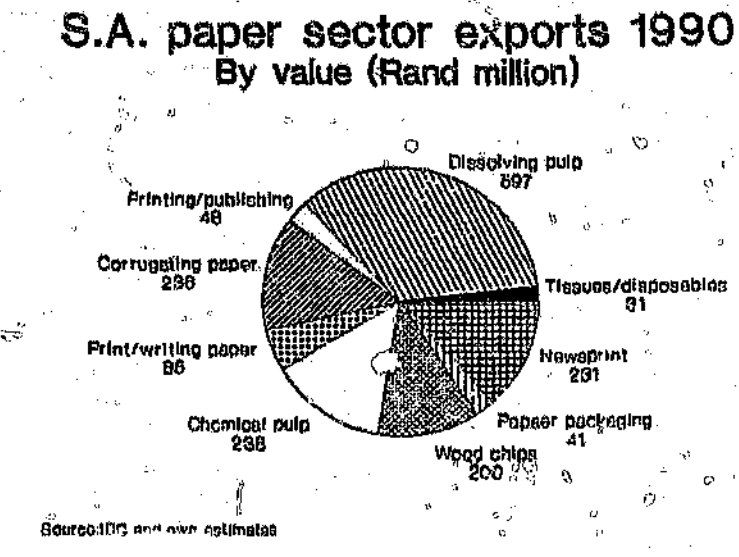


Figure 7: South African paper sector exports by value 1990



Why is this the case? Why is south Africa able to compete vigorously in the commodity grades but not in the higher value products? I argue that in order to answer this question we need to understand the roots of competitive advantage and disadvantage in this sector. In attempting to uncover these roots I will refer to a number of factors including key elements of the cost structure, production efficiency and the nature of domestic demand.

2.1 Raw materials, energy and capital

South Africa is competitive in the manufacture of kraft pulp; dissolving pulp; newsprint and kraft paper. All of these products are found 'upstream' of the paper pipeline - that is, they are relatively close to a raw material state. As we have seen in figures 6 and 7 above, the bulk of the sector's exports are comprised of these products.

Why is this the case? Firstly, the major source of South Africa's competitive advantage in pulp, newsprint and kraft paper is that our wood costs are very low and wood costs are critical to the price of these products. The cost of wood accounts for about one third of overall pulp production costs. Pulp in turn is the key raw material for the production of newsprint and kraft paper, accounting for 25% of newsprint production costs, and 45% of kraft paper costs. Low wood costs therefore provide the basis of competitive advantage for these three products.

The importance of wood costs in determining the cost of these products can be illustrated by comparing the relative positions of various national producers with differing wood (ie. fibre) costs. The effect of the wood cost on pulp and newsprint production in particular is illustrated below by examining the relative cost position of producers with low and high wood costs respectively. An indication of the comparative position of various producers is given in the tables below. In each case, the lowest cost producer = 100. The competitiveness of the other producers is shown relative to the lowest cost producer[40]. The fibre cost as a proportion of total cost is also shown.

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[40]The data used for calculating these comparisons was drawn from a number of sources including Resource Information Systems Inc. (1992), various local and international interviews, and personal communications. The comparisons are intended as an approximate indication of relative competitiveness, and not as an exact measure.

Table 2: Pulp production cost comparison 1991/2

Lowest cost producer = 100

	Bleached hardwood kraft pulp	Wood as percentage of total cost	Bleached softwood kraft pulp	Wood as percentage of final cost
Brazil	100	24%	-	-
Chile	-	-	100	25%
Southern USA	105	28%	110	30%
South Africa	110	29%	115	32%
Sweden	140	44%	150	48%

Table 3: Newsprint production cost comparison 1991/2

Lowest cost producer = 100

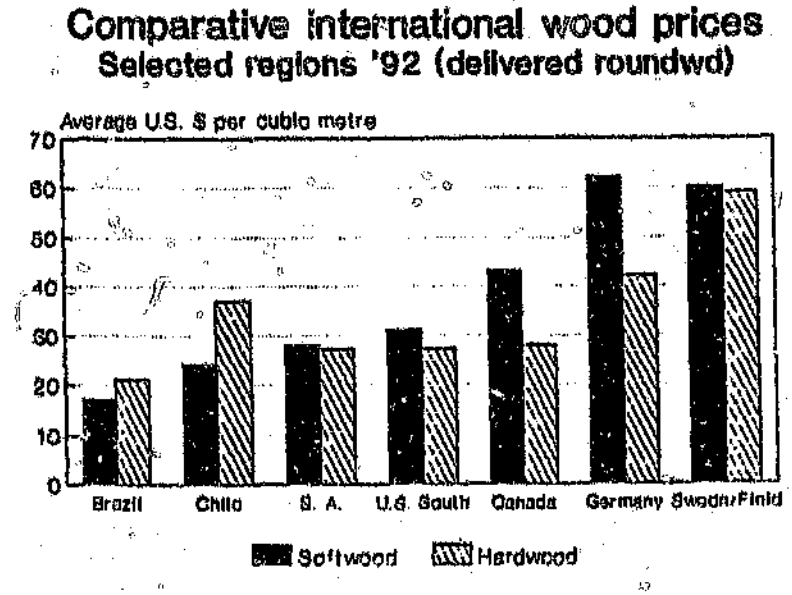
	Newsprint cost - 1991/2	Fibre as percentage of total cost
Southern USA	100	19%
Sweden	120	29%

These tables illustrate the significant advantages enjoyed by the southern producers of pulp and newsprint. A similar situation exists with regard to kraft paper which is even more sensitive than newsprint to the cost of pulp since fibre costs account for almost half

of total production costs[41].

The reason that the southern producers are at such an advantage is that climatic conditions in the southern countries allow timber to grow very quickly. For example, hardwood trees (such as eucalyptus species) grow to maturity in 7-9 years in South Africa or Chile, and 60 years in Sweden. Softwoods (such as pine) can be harvested after about 18 years in South Africa or Brazil and 80 years in Finland. These fast-growing trees translate into a major wood cost saving for the southern countries. South Africa's wood costs are comparable to Chile for softwoods, and to the southern USA for both hardwoods and softwoods. South Africa then, enjoys a similar competitive advantage as these countries in the international pulp, newsprint and kraft markets, as a direct result of favourable wood costs. Relative international wood costs for 1990 are illustrated below.

Figure 8: Comparative international wood prices 1992



Source: Wood Resources International

[41]Unfortunately it was not possible to gather the same internationally comparative production data for kraft producers as it was for pulp and newsprint producers.

Cheap wood is, then a key advantage for South Africa in the international market for pulp, newsprint and kraft paper. But we also have another key advantage in the form of cheap energy. South Africa's energy costs are among the lowest of the major pulp and paper producers. Of a sample of five major producers, South Africa's industrial electricity cost was 13% below the average (Edwards 1990). Given that pulp and paper production is energy intensive, a low energy price is important. Energy costs are typically 5% of total pulp production costs, 15% of newsprint costs, and 7% of kraft paper costs.

We have seen that South African pulp, newsprint and kraft producers have a number of important advantages when compared with other major producers[42]. **The source of this competitive advantage lies squarely in South Africa's raw material base - in cheap wood from South Africa's forests, and cheap energy from our coal deposits.**

But this raw material and energy base can only be exploited if and when there is sufficient capital investment to facilitate the transformation of the raw materials into useful products. We have noted in the overview above that sustained investment has been forthcoming in the pulp and paper sector, even when aggregate investment was dropping in the economy as a whole, as was the case for most of the 1980s. Importantly, the major investors in the industry have been South Africa's mining houses. Both Sappi and Mondi are controlled by mining houses. Mondi is wholly owned by Anglo American through the Anglo American Industrial Corporation (AMIC), while the controlling share of Sappi is held by Gencor. Both Sappi and Mondi were initially established by the mining houses, and their growth and development have been dependent on capital injections from the parent companies[43]. The fact that investments from mining houses have been critical in the development of the sector further illustrates the importance of the South Africa's resource base to the growth of manufacturing. We have already seen the importance of the raw material or resource base in the form of timber and energy. Now we see that the investment capital which is so critical to the development of a sector like

[42]As we shall see in the section on labour below, the cost of labour has little impact on South Africa's competitive position in relation to other major producers.

[43]For a discussion of the role of mining house investment in the growth of the industry see Hocking (1987).

pulp and paper, is also partly derived from the resource base through the transfer of capital from mining to manufacturing[44].

What is clear then, is that the combination of cheap raw materials, cheap energy and mining house investment is at the heart of the competitive position of pulp, newsprint and kraft producers. These factors are in turn related to South Africa's extensive resource base.

South Africa is generally less competitive however in the production of printing and writing papers and paper products than we are in pulp, newsprint and kraft papers. Our lesser competitiveness in printing and writing papers is reflected in our trade performance: in 1991 we exported 21% of our printing and writing production (85 000 tons), but imported almost as much as we exported (80 000 tons). Some of these are imported because they are not made in South Africa (eg. Light-Weight Coated magazine paper and thermal facsimile paper). However, imports of these grades account for less than half of the volume of our total imports. The remainder of imports are in products which compete with South African grades. Printing and writing imports have increased steadily in recent years, largely because massive international overcapacity led producers to explore new markets, including the South African market. A new 10% import tariff on uncoated printing and writing papers was introduced in 1992 and tariffs on printing and writing papers now range between 10% and 15%. It remains to be seen how the new tariff on uncoated papers will influence the extent of imports.

Import patterns for printing and writing papers[45] are illustrated below:

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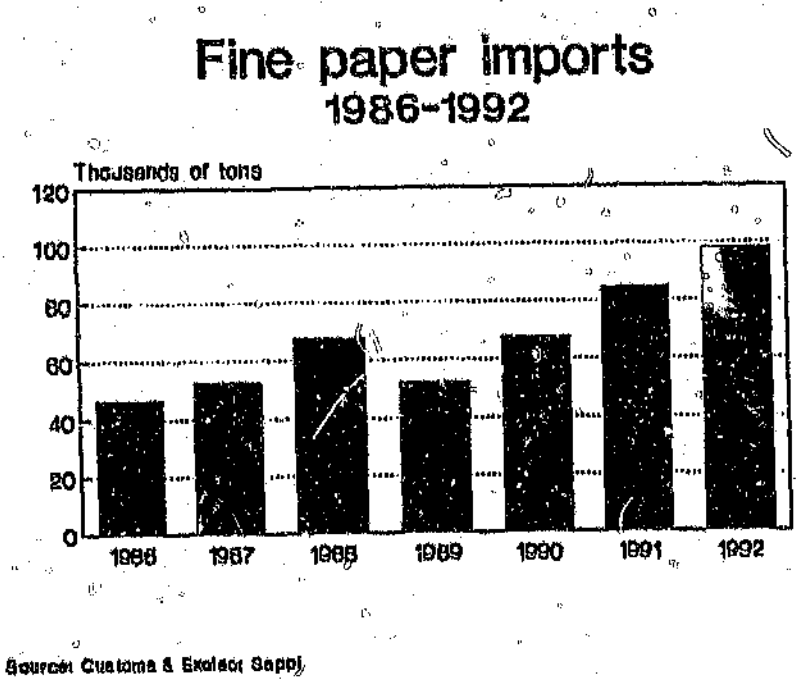
[44]Graeme Bloch (1980) has noted the key role played by mining houses in the development of South African manufacturing between 1939 and 1969.

[45]The category 'Printing and Writing papers' can be roughly equated with the category 'Fine papers.' For reasons of data availability, I have tracked Printing and Writing paper imports through the category 'Fine papers' below.

Figure 9: Fine paper imports 1986-1992



Source: Customs & Excise; Sappi

There are a number of reasons why we are less competitive in the printing and writing grades. Printing and writing papers can be divided into a number of different categories. For the purpose of this discussion, I will be divide them simply into uncoated and coated papers. Firstly, fibre and energy costs account for a smaller proportion of the cost structure of printing and writing papers than it does for pulp, newsprint and kraft. For uncoated papers, fibre comprises 20-30% of the final cost for a southern producer, and 30-35% for a northern producer. For coated papers, fibre cost can be as low as 10% for

a southern producer, and about 15% for a northern producer. In other words, fibre is a lower proportion of the final cost for printing and writing papers than for pulp, newsprint or kraft, and southern hemisphere producers like South Africa therefore have less of a competitive advantage based on production factors.

Fibre costs are however, still significant, and all else being equal, should still provide a springboard for competitive production of printing and writing papers. There is however a serious constraint in this segment of the industry - the fact that local manufacturers produce small quantities of a large number of printing and writing papers. As we have seen above, this results in short production runs and prevents the achievement of economies of scale thus lowering the efficiency of production.

2.2 Production efficiency

Another major factor which influences the productivity of South African pulp and paper production as a whole is the **efficiency of production** with regard to the labour process itself. I argue that production throughout the sector is marred by inefficiency.
The efficiency of production stems from two factors: the technology being used for production, and the way in which that technology is utilised. The quality of the technology being used in the sector is mixed, with state-of-the-art technology found in the large pulp mills such as Ngodwana, Saiccor and Richards Bay, and older technology in some of the fine paper mills (eg. Enstra) and paper product factories (eg. in the printing industry). Technology used throughout the sector is imported, usually from the UK, Germany, the USA and Japan. What is common throughout is that the maximum efficiencies of the imported machines are not achieved. Our production efficiencies are on average, below international best practice. This point is illustrated by the following comparison of the average performance of a number of South African kraft pulp mills with a highly efficient kraft pulp mill in Europe. (For the sake of convenience, the South African mills are called Safpulp, and the European mill is called Europulp).

Table 4: Comparative efficiency of South African and European kraft pulp mills 1992/3

	Safpulp	Europulp
Planned downtime	4.4%	2%
Unplanned downtime	5.4%	0.9%
Raw material yield[46]	87%	96%
Person hours per ton[47]	5.1	2.07

In comparison with the European plant, the South African plants achieve low levels of plant utilisation. The Safpulp plants are down an average of 10% of the time, for planned or unplanned reasons (compared with 2.9% at Europulp). Given the extremely high overheads, this practice is very costly. In particular, the degree of unplanned downtime is significant as it suggests a lack of control over the process, and a low degree of predictability.

The Safpulp plants also achieve relatively low yields on their raw material. An average of 87% of the available raw material is converted into prime saleable product. Europulp achieves a 96% raw material yield, thus making an important raw material saving in comparison to Safpulp. South Africa's relatively low raw material yield, essentially means that we produce more defects than the European mill.

In addition to these problems, the South African producers use significantly more labour to produce a ton of pulp than the European mill.

In summary, the South African pulp producers use more people, and achieve lower yields

[46]That is, percentage of raw material converted to prime saleable product, which is not discounted or repulped.

[47]Full employee complement, including management.

on their capital equipment and their raw materials.

The notion that we are relatively inefficient pulp and paper producers is not a new one. The National Productivity Institute, for example, has published figures which suggest that our productivity in this industry is among the lowest in the world (NPI 1992). This is illustrated below:

Table 5: Value added per employee in paper and paper products 1989 (US$)

Country	US$p.a.
Australia	61923
Brazil	48407
Canada	91459
Chile	69876
Finland	85293
Japan	91325
Mexico	26724
Singapore	34964
South Africa	33208
Sweden	85989
United Kingdom	47732
United states of America	99036

Source: NPI

Similar efficiency problems are found in the paper products industries. A comparison of local corrugated packaging manufacturers with an efficient European manufacturer, shows that local producers are hamstrung by inefficiency. This is illustrated below.

Table 6: Comparative efficiency of South African and European corrugated box plants 1992/3

	Safbox	Eurobox
Plant Utilisation	72%	94%
Unplanned downtime	14%	8%
Raw material yield	82%	90%
Person hours per ton	23	15

The four parameters measured above are all critical to the performance of a plant. All bear directly on the efficiency and profitability of an operation. The comparison demonstrates that South African plants are considerably behind the highly efficient European producer. The South African plants demonstrate low levels of plant utilisation, and high levels of unplanned downtime. This indicates that the Safbox plants do not make optimal use of their machinery.

The high levels of unplanned downtime indicate an inability to use the equipment to its maximum benefit, and point to a high degree of unpredictability in the process. Downtime erodes a plant's profitability significantly, because capital is being spent to run the plant, but no value is being created.

Safbox plants also demonstrate lower levels of raw material yield. This means that a significant proportion of the raw material which in is wasted. The Safbox plants also use considerably more labour to produce a ton of product, than the Eurobox plant. This too, impacts on the efficiency of the process.

Two major points arise out of my analysis of the competitive status of the pulp and paper industry so far. Firstly, I have shown that South African pulp and paper manufacturers

have key raw material advantages which provide them with a basis to compete successfully on international markets, but that this advantage is eroded by the impact of inefficiency. This has given rise to a situation where we use our wood (and other) cost advantages to cushion our inefficiency, rather than to maximise our competitiveness. This point was articulated by the general manager of a major pulp and paper mill as follows:

> "In the past, our big advantages in wood costs have been offset by inefficiencies. But now that international pulp and paper prices are so low the whole world is bringing costs down, because only the lower cost producers will survive. So, we can no longer afford to produce inefficiently. We will need our wood cost advantage just to survive" (Interview, Natal, 1993).

The second main point is that the pulp and paper sector is much more competitive at the upstream end (in the manufacture of commodities) than it is at the downstream end (in the manufacture of consumer products). This is partly as a result of the fact that the consumption market is small and fragmented and that local producers have been unable to achieve economies of scale. There is however a further reason that the South African industry has been unable to pass the raw material advantages downstream and that is the pricing regime which is examined below.

Paper converters (including corrugated box manufacturers, tissue producers and printers) have consistently argued that although South Africa is an internationally competitive producer of pulp and certain papers, the price that they pay for their paper inputs is generally above prevailing world market prices. For example, although South Africa is an internationally competitive producer of kraft paper, the companies that convert kraft paper into boxes and sacks claim that kraft paper costs them approximately 10% more than it costs their major international competitors. The reason for this they claim, is the limited nature of competition in the local market, combined with import parity pricing.

We have already noted above that the supply-side structure is such that there is limited competition between local paper producers, since each grade is produced by only one or

two suppliers. This is further illustrated below.

PRODUCT	MANUFACTURER
Pulp	Mondi, Sappi
Dissolving pulp	Sappi
Cartonboard	Mondi
Newsprint	Mondi, Sappi
Kraft papers	Mondi, Sappi
Uncoated printing/writing papers	Mondi, Sappi
Coated Printing/writing papers	Sappi
Tissue	Carlton, Nampak, Sappi

In addition to the limited degree of competition among domestic producers, the access of foreign producers is limited by tariffs, distance and the exchange rate. Despite the fact that printing and writing paper imports are subjected to a relatively low nominal tariff structure of 10-15%, the exchange rate and the transport cost make the real level of protection much higher. Estimates of the effective rate of protection vary from 19% (BTI 1992) to 22.2% (IDC 1990). This level of protection is sufficient to cushion South African producers from international competition.

The limited nature of competition is not only likely to favour local producers in terms of the actual volume of paper which they sell in the domestic market, it is also likely to raise the price of domestically produced papers. Local paper manufacturers know that consumers have little choice but to buy local products, or to buy imported products which are likely to be more expensive as a result of transport costs and tariffs. It would therefore be rational for local producers to set their prices close to the price of the imported product, even if that price was substantially higher than the cost of producing the paper domestically. This is the practice of 'import parity pricing' which one paper

converter described as "the norm in the South African paper industry" (Interview, Transvaal, 1992).

It is difficult to establish whether in fact this practice is widespread in the South African paper market. It would however be financially rational for companies to price their products in this way, as a result of the supplier structure of the South African market. It thus seems clear that the limited competition in the South African paper market tends to inflate the price of paper paid by the South African converter, and that this in turn retards the competitiveness of paper product manufacturers and raises the price paid by local consumers. Import parity pricing then, is a likely contributor to the difficulties of the paper sector in competing downstream.

I have now considered the competitive position of the South African pulp and paper industry. What does this analysis reveal about the notion of racial Fordism? Firstly it suggests that a major weakness of racial Fordism is that it fails to consider the dynamics **within** manufacturing which influence the ability of a sector to compete in world markets and to produce exports. By contrast, my specific analysis of the sector's internal dynamics shows that some parts of the manufacturing sector have been able to export successfully because they enjoy key competitive advantages. Secondly, my analysis has shown that the restricted and fragmented nature of demand has constrained the production efficiency of the manufacture of consumer goods, and that this is in sharp contrast to the experience of a Fordist economy. Thirdly, I have demonstrated that the competitive performance of the sector diminishes as we move downstream. For this reason it is important to take a 'pipeline' approach and to disaggregate the analysis accordingly. Fourthly, I have shown the importance of South Africa's raw material base in determining manufacturing performance. The basis of the industry's ability to compete is provided by cheap timber and energy supplies, and by capital flows that are derived partly from the mining industry's profits. Finally, I have shown that the corporate structure and the competitive regime facilitate pricing practices that inhibit the performance of downstream sectors and that limit the impact of our raw material advantages. These five factors are crucial to understanding the development of the industry, but are absent from Gelb's analysis.

3. A Capital-Labour Pact or labour repression?

Having already considered the fact that Gelb's theory fails to take account of productivity and international competitiveness, I will now turn to a further critique of racial Fordism. This critique concerns the class structure of South Africa and the nature of labour control. The notion of Fordism rests on the idea of a pact between capital and labour such that labour accepts managerial authority and agrees to maintain a high degree of industrial peace, in return for rising real wages and incorporation into a culture of mass consumption. With regard to racial Fordism, Gelb has argued that such a pact existed between capital and the white working class during the apartheid period, and that this was crucial to the stability of the racial Fordist growth path. Although Gelb notes that the black working class was excluded from such a trade-off, he does not see this exclusion as fundamentally altering the 'racial Fordist' structure of class relations. Indeed he argues that while racial Fordism delivered the "lion's share" of productivity gains to the white working class, the "African working class did obtain some portion of these gains" (1991:16).

But to speak of Fordism, or even racial Fordism, is to speak of modern class relations - agreements between capital and labour, and a formal industrial relations system. And yet, during much of the period which Gelb describes as racial Fordism, black trade unions were excluded from the industrial relations system, and a deeply authoritarian regime was in evidence both inside and outside the workplace. In the pulp and paper sector this is most evident in the system of labour control in commercial forestry. The initial development of the forestry industry was largely dependent on cheap labour. Van der Zel notes that:

> "in the initial years the forestry industry was fortunate enough to have at its disposal sufficient cheap labour. Mostly this was excess labour presenting itself to forestry at any price.....wages remained low, as the labourers had no means of negotiation" (1989:15).

The fact that forestry workers had "no means of negotiation" was facilitated by the fact

that they were excluded from the industrial relations system. Even when black trade unions were recognised as a result of the Wiehahn reforms of 1979, forestry workers (along with farm and domestic workers), were excluded from the provisions of the Labour Relations Act. It was not until 1993 that South Africa's 60 000 forestry workers were accorded legal employment rights under the Act. Partly as a result of this, wages in the forestry sector are extremely low when compared with industrial wages in general, and with wages in the paper manufacture and converting sector in particular. Forest workers who are employed by the larger forestry companies earn an average of R100-110 per week, although the rates are considerably lower in some areas[48], while the average rate for paper and paper products workers is R245 per week (LRS 1992). Forest workers' wages are therefore equivalent to about 40% of paper workers' wages.

Forest workers also typically work long hours, and perform strenuous work. The average working day in the forests is nine hours.

Forest workers are usually accommodated in company hostels where conditions are sometimes "appalling" (Zikalala 1992)[49]. Women forestry workers suffer particular problems. They are routinely employed to perform the lowest paid jobs. Some of these jobs, such bark stripping, planting and weeding are extremely strenuous, and are associated with a variety of health problems.

Forestry workers are also vulnerable to the practise of sub-contracting. In an effort to cut costs and increase flexibility, a number of forestry companies have moved towards sub-contracting parts of the forestry process to small, privately-owned contractors. It is estimated that about 30% of all forest work is now sub-contracted, although in some companies, sub-contracting is as high as 50%. Use of contractors has been especially high in the harvesting process where an estimated 60% of harvesting is now performed by contractors. This has led to substantial retrenchment, and also to lower pay and poorer working conditions in the sub-contracted areas. Family housing, medical benefits,

[48]Estimate based on a sample of forest employers.

[49]It should be noted however that when the cost of company housing, medical clinics and schooling are taken into account, the real cost of labour rises to R750-800 per hourly-paid worker per month.

schooling and pensions are often not provided by contractors and contract workers typically work longer hours, and have less access to training or health and safety protection (Zikalala 1992). Contract workers are almost completely non-unionised as they are much more difficult to organise, due to the proliferation of employers, and the small, rural locations.

The problems of sub-contracting can illustrated by the following examples:

A forest division of a major pulp and paper company in Natal sub-contracted some of its processes during the course of 1992. As a result a section of the workforce was retrenched, but some workers were re-hired by the contractor. The re-hired workers report that their wages fell by 33% (from R12 per day to R8 per day) while their hours were increased by 20% (Interview, 1993). Another Natal contractor is reported to pay workers only R4-5 per day (Evans 1992).

Levels of unionisation are currently low among forestry workers in general. This is partly due to sub-contracting, but even forestry workers who work for large employers are poorly unionised. Part of the reason for this is that forestry work is spread out over very large areas, and this poses organisational problems for trade unions. Unionisation is also difficult because of authoritarian management practises in many areas. Most forest plantations are located in conservative rural areas, where a racist and authoritarian culture often prevails. On state forests in particular, a coercive management style is common (Zikalala 1992).

What does this pattern of labour repression tell us about the usefulness of racial Fordism? I argue that these working conditions are more aptly described using Burawoy's notion of 'colonial despotism' (1985:226) than Gelb's notion of racial Fordism[50].

[50]Burawoy uses the notion of colonial despotism to describe the production regime in colonial contexts where labour control is based on coercion and racial division. Coercive forms of managerial control include the prevalence of physical violence, authoritarian forms of supervision and constant surveillance. He also points to the merging of the realms of production and reproduction which arose due to the fact that workers lived at the workplace. The existence of company hostels adjacent to the workplace make the worker entirely dependent on the company for food and accommodation and increase the worker's dependence on the job. Burawoy's point is clearly illustrated in the case of the forestry industry where workers live in company compounds and are subject to paternalistic and

Authoritarian industrial relations are not confined to the forestry industry, however. Conflictual relations and low wages are also evident in pulp and paper manufacture. Trade union organisation only became widespread in the sector in the late 1970s, and the wages of paper workers are still low when compared to most other paper producing countries, and particularly those in the West. This is illustrated below:

Table 7: Comparative wages of pulp and paper employees 1990

Country	US$/hr
Canada	15.50
Chile	2.06
Finland	13.86
Germany	14.33
Japan	14.46
Mexico	1.35
South Africa	3.66
Spain	9.55
Sweden	18.23
United Kingdom	13.01
USA	12.30

(Source: ICEF 1992)

In addition to the question of wages, there has been widespread conflict between trade unions and management in the sector over the last decade, particularly over the issue of centralised bargaining[51]. This is quite different from the pattern of industrial relations that one would associate with a Fordist compromise between labour and capital.

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authoritarian forms of control.

[51]For a more detailed discussion of industrial conflict in the sector see Bethlehem 1993.

Gelb's analysis is however applicable to the situation of white workers. He makes important observations about the nature of the relationship between capital and the white working class during the apartheid period. He argues that rising real wages, structures of collective bargaining, credit facilities and a social welfare system all facilitated rising levels of white working class consumption in the post-War period. For Gelb, this pattern is very similar to that of the working class in the USA in the same period. This is indeed, a striking comparison. However, given the small size of the white working class and the exclusion of black workers, this dynamic cannot be seen as the defining feature of the industrial relations regime. Indeed the exclusion of the (large) black working class from consumption norms and from consensual industrial relations prevented the Fordist regulation evident in the USA. At best, Gelb's use of the notion of a Fordist compromise between labour and capital produces a partial picture of the class structure. At worst, it obscures crucial aspects of the class relations which have shaped the manufacturing sector, and downplays the labour repressive nature of South African society.

4. Race on the shop-floor

Gelb notes that black workers in South Africa have been subject to "strict control at the point of production" (1991:16). He thus recognises that the workplace has been characterised by severe racial inequality with regard to skill as well as power. He also argues that skill shortages among black workers in particular have had a severely detrimental effect on productivity levels in industry.

I agree with Gelb that racial domination has influenced the production process as well as the labour market. I would argue however that this point can be taken further than Gelb suggests, by conducting a more thorough analysis of the labour process itself. I will show that when such an analysis is conducted, it becomes clear that despotic racial authority has not simply resulted in "strict control" of black workers, but that it has profoundly shaped the nature of industrial work. This not only results in particular forms of conflict and resistance, but also constrains the performance of manufacturing.

We have noted above that there has been entrenched conflict between the major trade

unions and management in the pulp and paper industry. In the last five years, most major pulp and paper mills have experienced serious strikes. Some, such as the 1990 strikes at Sappi's Ngodwana and Mondi's Merebank mills, lasted as long as nine weeks. There was considerable violence (on both sides) during some of the strikes. Although strike activity has fallen in the last two years, there are a number of local and national conflicts which continue to occupy the minds of workers and managers. One of these is the ongoing conflict over the level of wage bargaining. Workers, through PPWAWU, have demanded that wages be negotiated on a national basis for the industry as a whole. Companies have consistently resisted this demand, and wages are still negotiated at plant level throughout the industry. The demand for centralised bargaining has been a feature of many of the strikes and stoppages in the industry.

There are also conflicts that are less visible. Racial conflicts and divisions abound in South African mills. Racism often corresponds with, and deepens other divisions, like conflict between workers and supervisors. One of the reasons that this is significant because it makes co-operation and problem solving difficult on the shopfloor, and this in turn limits productivity growth. One example of racial conflict in production is provided by the views expressed by a group of white foremen and supervisors during an interview at a pulp and paper mill in Natal in 1993. One said:

> "Things have really changed over the last few years and we're not happy about it. We need someone to protect white interests at this place.....the management is now trying to allow the blacks to use our toilets -just let me catch a black or an indian using our toilet and we'll see what happens to him....."

The group believed strongly that black people, by law, pay less tax by virtue of their race:

> "Blacks are striking and carrying on, but they get more money than us. If we earn the same as them, they pay 1% tax, and we pay 30%".

The racial and political conflict clearly had an effect on the management style of these

supervisors. They commented:

> "Now we are being intimidated by the blacks, and especially the union members. As foremen we would like to maintain our line of authority, but now some of us are scared to discipline..... because these people are getting more defiant. If you try to discipline them, they accuse you of being a racialist, and then they make a complaint against you with the shop steward, and then you have to have an enquiry.....the black trade unions have made the country and this mill ungovernable. Maybe our [white] trade union should start learning something about mass action....".

The group expressed concern that 'affirmative action' would threaten their jobs. They clearly feel that their job security and their authority are undermined by the presence of a black trade union, and by the current political changes in the country.

This type of racial tension and racial conflict illustrates that race and power are inextricably linked on the shop-floor and that racial and political divisions shape workplace relations. These divisions share some of the features of what we have called 'colonial despotism' in the forestry industry. However the divisions in pulp and paper manufacture are perhaps better understood as a type of racially despotic taylorism since racial authority is often combined with a taylorist mode of organisation which includes steep hierarchies and narrow job definitions. South African pulp and paper mills have an average of fifteen employment grades for hourly paid workers, whereas Swedish mills, for example, have six. The elaborate grading system also encourages rigid job demarcation and large numbers of supervisory workers - features which are typical of taylorist forms of management.

A number of mills have attempted to move away from taylorist work organisation and introduce various forms of teamwork and multi-skilling. However, these have had limited success, largely as a result of underlying racial and political conflicts. This was illustrated in three mills which had attempted to introduce Japanese-style 'Green Area' meetings. The idea of Green Areas is to bring teams of workers together on a daily basis

to discuss and resolve production problems, and continuously improve their work. The Green Areas idea lasted for less than six months in two of the mills and enjoyed limited success in the third. The meetings were usually led by white supervisors, some of whom admit freely that they do not believe that black workers have insights to offer. Many workers, on the other hand, feel cynical about the Green Areas idea and believe that their ideas would either not be taken seriously or that they would be denied credit for work improvements. One worker commented that he would be prepared to make suggestions on how to improve production, "if it could be kept confidential from my head of department" (Interview Transvaal 1992, interview Natal 1993)[52].

Similarly, at a mill where workers were sent on a 'Quality and Teamwork' course, workers reported that:

> "After we went on the quality course, we did want to reduce waste and improve quality. We were explained that we are all responsible for quality and we should never allow a defect product to reach the customers hands. But then when we returned to the mill, the supervisor was still worrying about volume. We tried to reject the defect production when it came to packing, but the supervisor said 'Ry, ry (go, go) - you are here to work, you are not a quality controller. Just pack.' So we just packed the rejects. Then again, if there is a problem with the machines, the foreman doesn't ask you, he just instructs. He tells you that it is not your job to point out the problem. You must just do what you are employed to do, which is carry out instructions" (Interview, Transvaal, 1992).

[52]I have previously reported a similar incident (Bethlehem 1991). The incident showed how a strike at a pulp and paper mill in 1990 revealed a severe lack of communication between workers and managers. During the nine-week strike, the mill was kept running largely by line managers and artisans. While working on the paper machine, an artisan discovered a wasteful and frustrating problem. A part of a particular worker's job was to check the machine temperature on an indicator, and when necessary, adjust it, using a valve. Prior to the strike, the management was unaware that the temperature indicator was located on the bottom floor of the mill, but the valve was located three flights of stairs up. For years, the worker had been checking the temperature, climbing the stairs to adjust the valve, climbing down the stairs to see if his adjustment had had the required effect, and so on. The worker was thus involved in a frustrating and unproductive exercise, and both he and the mill management stood to gain from a simple change. The lack of communication in the mill, however, prevented the problem from coming to light. This is a far cry from the Japanese practise of 'continuous improvement'.

This example illustrates that line managers have had almost unbridled power to instruct workers whose subordinate position is underscored by the racial and political inequality in the society. The attempts to introduce 'Quality and Teamwork' programs and other forms of participatory management are unlikely to succeed while work continues to be organised in line with the traditional hierarchies.

One company in the sector has tried to respond to shop-floor conflict and poor product quality through instituting 'value-sharing workshops'. These workshops are designed on the assumption that racial and political barriers prevent the development of a common vision, and therefore limit co-operation on the shop floor. In order to address this problem workers and managers are asked to spend a weekend together, developing a set of shared values as company employees. On their return to work, it is hoped that they would adhere to the values, develop greater loyalty to the company, and therefore co-operate more effectively in production. These workshops appear to have had little impact on production however, and in fact caused more conflict in a number of mills where the trade union objected to the workshops on the grounds that union structures had not been consulted about the workshops. Union officials reported that there was concern in the union that the 'common values' were designed to undermine the role of the independent trade union.

One of the reasons that trade unions such as PPWAWU have resisted 'participatory management' initiatives is that some companies in the sector have attempted to present the company as a 'family' in which all members are seen to have the same interests. This corresponds to a unitarist view of industrial relations, in which it is assumed that no inherent conflict exists in the workplace. It seems inevitable that companies which rely on a family concept for their total quality programs will run into difficulties. Not only is the family concept contrary to the experience of most workers, it also implies that there is no need for trade unions.

Another difficulty with the introduction of participatory management in the sector relates to the daily material conditions experienced by unskilled and semi-skilled workers. There was a strong feeling among shop stewards interviewed that workers will continue to

mistrust management's motives while there is still a high degree of inequality between workers and management. As one shop steward put it:

> "You know, many of our members are living in shacks in the township. We are lacking money for a housing loan, or for education. My manager is driving a BMW, and yet they want us to share values with him. Workers are confused about that. Management wants quality production from us, but they are not prepared to offer quality employment" (Interview, Transvaal 1992).

And yet, many shop stewards understand the need to improve production all too well:

> "The management wants a world class company. Well, it can be our aim too. But management must be prepared to co-operate with the workers hand in glove. For example, sometimes it can take them up to five days to fix a machine, because they don't ask us to help them. If we did not have so many supervisors, foremen, superintendents, department managers and managers, this company will be prosperous. We know that if this company cannot prosper we will join the unemployed. So we do want things to change.....but that change must come from us and our union, not simply the management" (Interview, Transvaal, 1992).

I came across only one significant departure from traditional work organisation during my plant visits. This was at a pulp and paper mill which had recently installed a new process. Employees in this new part of the mill are all artisans, with at least three years of technical training. These (mostly white) employees are all employed on the same grade, and there is no supervision. By contrast, in other parts of the plant there are up to 21 grades, and extensive supervision. Mill managers feel that while they would like to duplicate this pattern throughout the mill, they will have to wait until there is a sufficient pool of highly skilled employees in the job market. Some managers seemed sceptical that the existing workforce could be trained sufficiently, and believed that they would have to wait for a new generation of school-leavers before they could implement the model more widely (Interviews, Natal, 1993).

On aggregate then, traditional work practises are alive and well in the industry. Levels of communication are generally low, and there is considerable shop-floor conflict. These problems are at least partly responsible for the inefficiencies demonstrated in the international comparisons above. But these work practices are also linked to poor human resource development. There is little doubt that levels of skill are extremely low in the South African pulp and paper industry, when compared with international best practise. In Sweden and Germany, for example, an average paper mill worker will have received 2-3 years post-secondary training in paper production or related fields, and a supervisor is likely to have received 4 years training (ILO 1992). In South Africa, the average worker has probably received little or no post-secondary education. In fact, a large proportion of the workforce will not have completed high school. Data on skill and education levels are not available for the industry as a whole. However, a sample of seven pulp, paper and board mills, revealed the following trends:

Table 8: Formal educational levels of hourly paid employees

Std. 5 and below:	18%
Std. 6 or 7:	22%
Std. 8 or 9:	31%
Std. 10	19%
Post-matric:	10%

Many South African mills use the terms 'unskilled, semi-skilled and skilled' in their employee classifications. A sample of five such mills revealed the following skills breakdown for hourly paid employees:

Table 9: Skill levels of hourly-paid according to mill classifications

Unskilled:	26%
Semi-skilled:	28%
Skilled:	31%
Artisans:	15%

In recent times, the industry as a whole has recognised the importance of improving training, and some companies have begun to invest more heavily in training efforts. One of the major companies recently opened its own training college, designed specifically for production workers. Prior to this, production worker training was limited to on-the-job training. The college offers three months of residential, theoretical training for machine operators. This is followed by a nine month stint in the mill, where the trainee is supervised by a mentor. This system is designed primarily for existing employees in the industry, rather than for school leavers. The company concedes however, that at present budget levels, it will take approximately twenty years to train all its machine operators to average training levels attained in Europe.

In summary, work in South Africa's pulp and paper mills is profoundly shaped by racial inequality and conflict. This not only moulds the experience of work, but also limits the competitive performance of the sector. Although Gelb is cognisant of racial inequality on the shopfloor, he does not sufficiently theorise the nature of work organisation or the ways in which racial conflict has combined with taylorist work organisation to shape production. He therefore underestimates the impact of racial domination on the nature of conflict, resistance and performance in manufacturing.

5. The role of the state

The historical development of the pulp and paper sector cannot be explained without reference to the role of the South African state. Gelb notes that most Fordist states have intervened strongly in the economy in order to influence the wage relation and the labour market. He argues that the South African state has used apartheid policies to manage the wage relation and the labour market, but that it has gone further than most Fordist states because of the way in which it has participated directly in manufacturing intermediate goods. The state thus shaped the manufacturing sector through the provision of goods and services to industry via the parastatals. Gelb notes that the state's manufacturing activities were closely related to the development of the mining industry.

Gelb does not account for why the South African state has acted in this "unusual" (1991:17) manner, and nor does he tell us why South Africa is an exception to Fordism in this regard. Despite the difference between the South African state and the classic Fordist state, he continues to describe the state in terms of Fordism.

I will demonstrate that in the pulp and paper industry the state played an active and critical role in shaping the sector. This involvement has gone far beyond the management of the wage relation or the labour market, and extended to state involvement in raw material supply and in investment.

The state has influenced the development of the pulp and paper sector both directly and indirectly. It has influenced the sector directly through policies (such as forestry development) which have targeted, or have had an immediate bearing on the sector. Other policies (such as education and training policy) have not targeted the sector specifically but have nevertheless had an important impact.

The most important way in which the state has influenced the sector has been through state forestry development. As we noted above, the state initiated forestry development in the inter-war years, at a time when private capital was unwilling to invest in commercial forestry. Paper companies did not enter commercial forestry until 1950, and until the late 1960s they were almost wholly dependent on state timber supplies. Even by 1970, according to Hocking, less than one tenth of Sappi's timber for example, was supplied from its own plantations (1987:275). This has led van der Zel to comment that the existence of state forests underpinned the development of the pulp and paper industry in South Africa (1989:48).

Van der Zel goes on to say that a number of other industries including sawmilling and mining timber (which supplies underground props for the mining industry), were initially dependent on state forest supplies. Indeed, he claims that in certain cases, the initiative for establishing timber processing industries came from the state itself. With regard to sawmilling, van der Zel writes that:

"In the early 1930's.....private interests were reluctant to enter the new field of sawmilling and other processing of locally grown timber.....It was not only the active participation by the RSA government in commercial afforestation which encouraged the private sector to follow its example, but it was also the same government's participation in sawmilling, the extensive research carried out by its research division, the control of imports, the laying down of standards, the offering of long term contracts as well as the pricing policy connected therewith, which encouraged private entrepreneurs to venture into sawmilling on a large scale.....It was only after the outbreak of World War II that private enterprise showed a growing interest in sawmilling and related industries once the proof was there that sawmilling was a profitable venture" (1989:41,43).

Similarly with regard to mining timber :

"Had it not been for the work of the forester in South Africa, the expansion of the Witwatersrand gold mining industry on its present scale of operations would hardly have been possible" (1989:34).

Van der Zel argues that there were two main reasons that the state embarked on such an ambitious afforestation policy. The first was the state's perception after WWI that South Africa needed to be "self-sufficient" in timber supplies within 50 years, for both economic and strategic reasons. The second motivation was the desire of successive governments to provide employment for "poor whites". Van der Zel notes for example that:

"the great depression of 1928 to 1933 caused further impoverishment and unemployment, which led the State to establish more white labour settlements and to employ the inhabitants for establishing new plantations.....this gave great impetus to the country's afforestation programme" (1989:12).

What is evident therefore is that the state's priorities with regard to forestry were developmental (the desire to promote local economic development), strategic (the desire

to attain self sufficiency), and ethnic (the desire to create employment for whites). Whatever the motivations, the actions of the state in the inter-War period and the period from 1948 did facilitate industrial development in the timber processing industries in general. This led to the growing availability of timber supplies and laid solid foundations for the development of a local pulp and paper industry.

Similarly, the development of the industry has been facilitated by the supply of relatively cheap electricity even in far-flung rural areas, from state-initiated electricity supplier Eskom. Hockings notes for example, that when Sappi expanded the Tugela mill to include the production of (energy intensive) newsprint in 1966, "a key element in the project was power from Eskom" (1987:148). In this way the actions of the state provided the context in which companies like Sappi, and later Mondi, were able to develop.

Similarly the state has played a role through the provision of preferential capital and investment incentives to companies in the industry. The Industrial Development Corporation (IDC) which was set up in order to provide public capital for industrial development at preferential rates, has contributed on a number of occasions to pulp and paper projects. The IDC contributed capital for Sappi's Tugela project in 1950, for the expansion of the Enstra mill in 1975 and the expansion of the Saiccor dissolving pulp plant in 1992. Favourable investment incentives (including tax rebates) have encouraged large projects like Sappi's Ngodwana expansion and Mondi's Richards Bay mill. As a result of these incentives, effective tax rates in the industry have been low. Sappi's effective tax rate for example, has been below 1% for over a decade.

Export incentives have also played a part in encouraging investment, particularly in the establishment of the large export-oriented pulp mills in the mid-1980s, and the expansion of dissolving pulp production in 1992. Although figures measuring the monetary value of the General Export Incentive Scheme (GEIS) to companies like Sappi and Mondi is unavailable, one of companies has conceded that GEIS payments have accounted for up to half of their profits in recent years. The cumulative effect of the IDC loans, investment and export incentives has been to use public funding to encourage the establishment of the local industry. Many of the projects supported by public funding have been highly capital

intensive and export oriented. In this way the state has played a further role in shaping the development of the sector.

Another significant role has been the protection of the local industry through tariff barriers and import quotas. Tariffs on paper were first established after World War Two and remain in place today, although import quotas have been abolished. The provision of import control has undoubtedly encouraged the development and growth of the local industry.

In a more general sense, the broad policy of apartheid also played an important role in shaping the sector, and the nature of the labour market in particular. We have seen that wages remain low in the forestry sector and that this has been facilitated by the exclusion of forestry workers from the Labour Relations Act until 1993. Similarly, relatively cheap land has been available for afforestation partly as a result of forced removals and apartheid land tenure arrangements. Van der Zel notes that "between 1925 and 1939, when acquisitions on a large scale were made, the price of land never rose above R6,50 per hectare". Although prices rose after WWII, they were still at the level of R75 per hectare in 1966. The fact that much afforestation took place on state land also artificially lowered the price.

Some of the consequences of apartheid have, however, had long-term detrimental effects on the sector. This is particularly so with regard to consumption patterns and education and training. With regard to consumption, the fact that consumption levels among black South Africans have been so depressed, has deprived the pulp and paper industry of the benefits of domestic mass consumption norms. The low per capita consumption of paper has particularly restrained the development of the printing and writing paper segment and paper products including tissue products, newspapers, magazines, books and scholastic materials.

Apartheid education and training policies have also had a depressive long-term impact on the sector. Policies which excluded black South Africans from educational opportunities in general, and from scientific and technical training in particular, have led to severe

shortages of skilled and qualified workers. Low levels of training among workers who occupy key positions in pulp and paper mills has created a constraint on productivity growth. The capital and technology-intensive nature of the industry creates a requirement for skilled, flexible workers who are able to solve problems rapidly, undertake preventative maintenance, reduce waste and downtime and initiate improvements. There is a serious shortage of such workers in the industry today.

I argue therefore, that the actions and policies of the apartheid state have both facilitated and constrained the development of the sector. The state has taken certain direct actions to encourage the development of pulp and paper industry, often at the expense of rural (black) landowners and workers. At the same time, the priority that the state has placed on the establishment and maintenance of white supremacy has ultimately hamstrung the growth of the sector.

Based on the experience of the pulp and paper industry I conclude that Gelb is correct in saying that state intervention has gone beyond the management of the wage relation and the labour market, and has extended to direct involvement in manufacturing. However, I argue that Gelb has underestimated the state's involvement in developing and sustaining manufacturing, through the provision of key raw materials and investment capital. Gelb's analysis does not suggest the extent of state involvement that we have seen in the industry. The state's involvement in shaping the pulp and paper sector is a far cry from the actions of the classic Fordist state which concerned itself with macro-economic demand-management, but which was not directly involved in manufacturing.

Conclusion

In this chapter I have tested the notion of racial Fordism against the experience of the pulp and paper industry. I have found that the concept is of limited value in accounting for the development of the sector. In the following chapter I will summarise the problems with racial Fordism and then go on to propose an alternative conceptualisation of industrialisation based on the work of Alice Amsden.

Chapter four: Racial Fordism or a new model? The development of the pulp and paper industry and the theory of industrialisation.

In chapter two I presented my reading of Gelb's notion of racial Fordism and various responses to his work. I noted that Gelb's analysis of racial Fordism is conducted at the macro-economic level, although it includes references to specific industries. I showed that Nattrass has criticised the analysis using alternative evidence of macro-economic indicators. I then went on to argue that my approach to assessing the value of Gelb's concept is not to engage at the level of the macro-economic debate, but to examine racial Fordism in light of sector-level industrialisation. This approach is consistent with the development of the concept of Fordism, based as it was on an initial analysis of particular sectors.

In chapter three I analysed the usefulness of racial Fordism in analysing the development of the pulp and industry. In the course of that analysis I found certain key weaknesses with the concept of racial Fordism. They can be summarised as follows:

* The growth of the industry between 1945 and 1975 was facilitated by the growth of domestic demand coupled with import substitution, which is what Gelb's analysis would suggest. However, from the mid-1970s, the development of the industry was driven by greater availability of raw materials and by the dramatic growth of exports. Gelb's framework takes insufficient account of the influence of supply-side factors as well as the impact of exports. Gelb's account focuses too narrowly on the role played by the extension of mass consumption in the domestic market.

* Gelb takes insufficient account of the problems associated with a small and fragmented consumer market which has been created by the exclusion of the majority from consumption of consumer goods. The small market for products such as printing and writing papers prevents the attainment of the economies of scale associated with Fordist economies. This finding is similar to that of Maller and Dwolatsky and suggests that

Gelb's notion of mass production and mass consumption is misplaced with regard to South African manufacturing. To simply assume as Gelb does, that the racially limited extension of consumption and production in South Africa is equivalent to the creation of truly mass production and consumption markets in the USA is mistaken. What Gelb calls racial Fordism, really cannot be Fordism at all since the Fordist production-consumption match which facilitated productivity gains based on economies of scale was not in achieved South Africa.

* Gelb frames his approach in terms of **underconsumption** rather than in terms of **productivity and competitiveness.** This leads Gelb to pay insufficient attention to the dynamics which determine the capacity of a manufacturing sector to grow through participation in international markets. The failure of Fordist analyses in general to cast the problem in terms of productivity has been noted by Amsden. She has suggested that a weakness of Lipietz's notion of Global Fordism is that it failed to recognise that the core problem facing developing countries is a lack of competitiveness and low levels of productivity, rather than underconsumption or a lack of domestic demand. Amsden argues that where local markets are small and fragmented mass export markets can be found if production is sufficiently competitive. Like Lipietz, Gelb does not raise the issue of competitiveness, and nor does he account for South Africa's failure to export greater quantities of manufactured products. In this sense the Fordist pre-occupation with issues of consumption have obscured the underlying problem of manufacturing productivity and competitiveness. If we apply this issue to the analysis of the pulp and paper industry, we find that without focusing our attention on the issue of competitiveness, it would be impossible to explain the sources of growth and constraint in the development of the industry.

* When I analysed the pulp and paper industry in terms of productivity and international competitiveness I found that South Africa's raw material base is critical to the industry's ability to compete in three ways: (a) cheap timber is a critical source of competitive advantage (b) cheap energy, which is generated from coal resources contributes to a competitive performance in pulp, newsprint and kraft papers and (c) capital which has been accumulated in the mining sector has been transferred from mining to paper

manufacturing in the form of investment capital. This indicates that racial fordism (and indeed Global Fordism) fails to direct our attention to the linkages between mining, agricultural and manufacturing sectors. In fact the whole premise of the Fordism paradigm is based on the development of manufacturing - the attainment of productivity growth in manufactured goods through the regulation of production and consumption of consumer goods. As we have seen in the South African pulp and paper industry, the linkages between agriculture (in the form of forestry), mining (in the form of cheap energy and investment) and manufacturing (pulp and paper manufacture itself), are crucial. We cannot understand the development of the sector simply by analysing the manufacture of paper. The roots of the sector's performance are to be found in the inter-relationship between conditions in agriculture, the mining sector, and manufacturing. Gelb is not completely insensitive to the links between the different sectors. He points to the fact that the mining industry served as a source of demand for manufacturing, and established the prototype wage relation. However, this does not sufficiently explain the importance of the (mining and agricultural) raw material base of South African manufacturing, and nor does it indicate the complex interaction between the sectors, such as the investment transfer.

A number of authors including Ally (1993), Bloch (1980), and Fine and Rustomjee (1993) have focused on the link between the various sectors. Fine and Rustomjee conceptualise the South African economy in terms of what they call the 'Mineral Energy Complex' (MEC). The notion of the MEC places the resource base at the centre of the analysis. By contrast, Gelb is unable to widen his analysis sufficiently to take account of the linkages between the sectors. This is largely because he is framing his analysis in terms of a concept which focuses exclusively on manufacturing. As a result he fails to demonstrate the way in which the links between the sectors shape the nature of manufacturing itself.

Perhaps the Fordism paradigm concentrates so unwaveringly on the dynamics within manufacturing rather than the linkages between manufacturing and other sectors, because western industrialisation has not depended on agricultural and mineral raw materials to the same extent as industrialisation in South Africa.

* The competitive position of the industry shows that it is important to disaggregate our analysis of the competitive status of a manufacturing sector. In the pulp and paper industry, the most competitive performance is found upstream of the pipeline. Competitive performance has been more difficult to achieve downstream, particularly in the manufacture of final consumer goods. The idea of differentiating between upstream and downstream performance is contrary to Gelb's tendency to treat manufacturing in aggregate terms. Gelb fails to point to the important differences between upstream manufacture, which is about raw material processing, and downstream manufacture which is about the production of complex consumer products. A failure to recognise this distinction results in an inability to identify the different sources of growth in manufacturing. Gelb does not point to the importance of raw material advantages in South African manufacturing, or contrast this to classic Fordist industrialisation which was more dependent on technology that on raw material endowments. The pulp and paper industry for one, however, can only be understood by distinguishing between raw material processing and the manufacture of complex consumer products. An insensitivity to the upstream/downstream dynamic will severely compromise any analysis of this sector.

* The performance of the pulp and paper industry cannot be explained without reference to the competitive regime. The conditions for import parity pricing have been created by the existence of import protection combined with distance, isolation and limited internal competition. The limited nature of internal competition is in turn created by the particular corporate structure which is characterised by concentration and centralisation. Import parity pricing is inflationary and limits the passing on of raw material advantages downstream. Gelb does not mention the effects of import protection and nor does he deal with the question of corporate structure and competitive relations. As we have seen in the pulp and paper industry, oligopolisation combined with import protection gives rise to pricing practises which constrain the performance of downstream industries. The Fordism framework simply does not direct attention towards issues of competition (or indeed co-operation) or to the role played by the corporate structure. Thus a key feature of the South African economic landscape is overlooked by the lens provided by racial Fordism.

* Distorted **human resource development**, poor work organisation and **racial domination in production** combine to limit productivity growth especially at the more skilled manufacturing end. Although Gelb is aware of racial domination in production, he underestimates the ways in which racial domination has combined with taylorism to profoundly shape the experience and efficiency of manufacturing. He also underestimates the role of despotic management practises in sectors such as forestry.

* Some aspects of the **apartheid state's policies** have facilitated and shaped industrialisation in ways that have encouraged the growth of the pulp and paper sector. Although Gelb is aware of extensive state intervention, he has underestimated the way in which the state has facilitated and shaped manufacturing development through provisions of raw materials and investment capital. Gelb does not account for why the South African state's involvement in industrialisation was more ambitious than state involvement in the classic Fordist industries. He notes the state's role but does not integrate it into his analysis. He does not explore cases (like that of Korea) where extensive state involvement was more common. Since Gelb is working with the notion of Fordism he is forced to analyse local state intervention in terms of what it is not (hence he speaks of 'unus[illegible] state intervention) rather than in terms of what it tells us about local industrialisation. Gelb's analysis of the state is therefore incomplete.

My assessment of racial Fordism suggests that Gelb's model of South African industrialisation is inadequate when considered against the experience of the pulp and paper sector. The notion of racial Fordism is unable to account for key elements of the industry's development, and the framework obscures our understanding of important factors in the sector's development. I therefore conclude that the notion of racial Fordism is of limited value in explaining the process of industrialisation in South Africa.

This conclusion leaves me with an analytic dilemma. Should I conclude with Ally that "to try and establish a set pattern of industrialisation is a hopeless task" (1993:17)? Should I abandon the idea of a framework which allows us to explain the pattern of industrialisation in South Africa altogether? I argue that it is possible to make use of an overall framework which will allow us to capture the essence of industrialisation in South

Africa, and compare South Africa's experience to that of other countries. While I agree with Ally that South Africa's industrialisation path was "sometimes planned, often reactive and contained many paradoxes" (1993;17), I argue that it is possible to develop overall concepts and frameworks which enable us to grasp at least some of the key characteristics of industrialisation. However, given the limitations of Gelb's work, I need an alternative framework for this task. I will now demonstrate that a more useful framework is provided by Alice Amsden's work on 'late industrialisation' and that her framework can be successfully applied to the South African experience.

An alternative conceptualisation of South African industrialisation

As noted in chapter two, Amsden contrasts the position of initial or early industrialisers (those countries which industrialised early on the basis of novel technology and innovation) with the position of late industrialisers (countries which industrialised late and had to do so on the basis of imported or 'borrowed' technology). According to Amsden, late industrialisers like Korea succeeded through competing vigorously in the international trade of manufactured goods. Amsden attributes their competitive performance to the process of 'industrialisation through learning'. This process embodied a new path of industrialisation based on borrowing foreign technology (the source of advantage for early industrialisers) and using it to out-compete the sellers of that technology in their own markets. For Amsden, Korea's success in following this path was dependent on four factors:

i) Korea's 'developmental state' which 'got prices deliberately wrong' and 'disciplined' big business in order to promote competitive exports ii) Korea's conglomerates (chaebol) which succeeded in penetrating export markets in a wide variety of products iii) a strategic shop-floor focus which involved non-taylorist forms of work organisation designed to overcome the impediments of importing rather that inventing technology and iv) a labour force which was highly skilled and educated, at the same time as being 'disciplined' by the state and therefore relatively cheap.

Amsden's analysis of Korea's success as a late industrialiser creates a compelling basis

for a comparative analysis of South Africa's industrialisation. I will argue that it is fruitful to regard South Africa as a 'late industrialiser' which failed where Korea succeeded partly because it failed to make the strategic choices that Korea made, and partly because it had a different economic and social structure.

'Late industrialisation' in South Africa?

Amsden provides an interesting starting point for coming to terms with South Africa's process of industrialisation. Her argument is that countries which industrialise 'late' suffer "the penalties of lateness" (1990:16) which have to do with competing on the basis of borrowed technology, rather than being able to rely on the rents and benefits which flow from inventing and exporting technology. This argument can be applied to South Africa where large-scale industrialisation occurred much later than it did in the West, and where manufacturing processes have been largely dependent on imported technology. The description certainly fits for the paper sector which only developed a real presence in the local market after 1945, and which broke convincingly into export markets only in the 1980s. The technology which has been, and continues to be employed in the sector is overwhelmingly imported. The label of 'late industrialisation' therefore fits at a purely descriptive level. But how helpful is this concept at a deeper more analytic level? I will argue that pulp and paper industry can be analysed in terms of the categories of 'late industrialisation' but that it differs from Korea (and other successful late industrialises) in two important ways i) South Africa failed to follow the 'learning' path and thus failed to compete internationally in manufactured goods; and ii) South Africa has been overly dependent on its natural resource base at the expense of developing a competitive position in manufactures.

In order to expand this analysis, I will briefly compare the path of industrialisation in the paper sector with Amsden's four key points about Korean industrialisation.

i) The developmental state

Amsden argues that the state in Korea was developmental in that it set out to establish a competitive position for Korean companies in the export of manufactured goods, and that it succeeded in using fiscal and industrial policy instruments to facilitate the achievement of this goal. Amsden argues that the Korean state succeeded not only because it acted deliberately to 'distort' prices in order to promote manufactured exports, but also because it had the power and strategic vision to discipline big business and compel it to perform. While this power was based on an authoritarian social structure and "pervasive corruption", the Korean state was able to dispense political favour "*in exchange for performance standards*" (1990: 22 emphasis added). In other words, Amsden suggests that authoritarian power and political favour were used in a 'constructive' way in the sense that they resulted in positive long term competitiveness in Korea's manufacturing sector.

How does the South African state compare? As I have noted above, the effects of the state's policies on the pulp and paper sector (and perhaps on manufacturing more broadly) were contradictory. On the one hand, the state (both before and after 1948), facilitated the development of the pulp and paper industry through a far-sighted decision to establish state forests, even at a time when private capital was reluctant to invest in forestry. Without the state forests, the pulp and paper industry could not have developed as and when it did, and at best would have taken a longer period to enter the international arena. Similarly the development of the large capital-intensive pulp and paper mills have taken place with the direct and indirect financial assistance of the state. This assistance took the form of preferential finance from the Industrial Development Corporation and from the application of state investment incentives that were particularly favourable for capital-intensive projects. Similarly broad state repression of the working class (what Amsden calls the 'disciplining' of labour) in the inter-War and post-War periods resulted in a cheap labour force which was crucial for the development of the commercial forests. In these three ways then, the state displayed the power, the vision and the willingness to actively develop manufacturing in the form of the pulp and paper sector. Its tools were not unlike those of the Korean state in that they included the use of subsidies and the

widespread repression of labour.

But can the South African state be described as a 'developmental state' with regard to the paper sector? I argue that this term would be misleading because the state's preoccupation with white power and privilege meant that it actions centred on attaining white domination. This foreclosed the option of a national development strategy of the sort that emerged in post-War Korea or Japan. The priority given to maintaining white domination ultimately undermined the success of the industrialisation strategy.

As noted above the main negative consequences of state policy for the paper sector have been a small and fragmented consumer market, a shortage of skilled (black) workers, and racial domination in production. These can be seen as a consequence of the primacy attached to white domination as against the long term interests of developing a base in manufactured goods. In this sense, the effect of the apartheid state on the paper sector has been contradictory.

But there is also a second reason why the South African state cannot be considered to be a 'developmental' state in the same way as the Korean state. The reason is that state policies tended to rely on and entrench the centrality of raw material processing as opposed to more complex manufacturing operations. There is a sense in which state policies not only privileged whites over blacks, but also, at least in this sector, implicitly privileged capital-intensive raw material processing over the manufacture of consumer goods. This is partly perhaps, an unintended consequence of racial domination. Since raw material processing is less sensitive to the fragmentation of the consumer market, and to skill levels, it is affected to a lesser extent by the consequences of racial domination. But there have also been explicit policies which have favoured upstream processing. The most important of these is finance from the Industrial Development Corporation which has focused strongly on funding capital-intensive, upstream processes (Lewis 1993a). In the pulp and paper sector the enormous concentration on upstream raw material processing is not only a consequence of state policy, but it is partly so. The fact that upstream products like pulp and kraft paper are less sensitive to the structure of the consumer market and to the skills constraint, mean that the manufacture of these products

has been relatively unaffected by racial inequality. In addition the manufacture of the upstream products has been facilitated by state finance policies which have facilitated the large pulp and kraft paper projects.

The idea that state policies have had a contradictory effect on the development of industry is not new. Indeed the view taken here is similar to that of Nattrass (1989) and Posel (1983) in that the effects of state policy (and particularly racial policy) are seen as contradictory with regard to capital accumulation. Nattrass has argued that in the wake of the race-class debate there is a need to "investigate....how South Africa's rapid but highly unstable contradiction ridden process of economic and social development is best analysed" (1989:12). In adopting the idea that state policies have had a contradictory impact on the paper sector I am accepting the notion that state policies in the apartheid era did not facilitate a smooth and uncomplicated process of accumulation. In this sense I differ from Gelb who argues that state policies facilitated accumulation for a long period, before reaching crisis, at which point they became antithetical to further development. At least in the case of the pulp and paper industry, state policies, and apartheid policies in particular, must be understood as contradictory throughout the apartheid era, rather than as initially facilitative but later constraining.

I have argued that the policies of the apartheid state were indeed beneficial to aspects of the industry's development, and especially to its need for cheap capital, labour and inputs. At the same time however, apartheid policies disfavoured other aspects of the industry's development, and particularly the long term interests of the manufacturing end of the pipeline, that is, closer to the consumer-products stage. In this sense I have extended Nattrass's original concept in that I have argued that state policies were contradictory not only as a consequence of racial domination but also as a result of over-reliance on raw material processing.

I would conclude then that the South African state cannot be seen as a 'developmental state' in Amsden's terms, because it failed to act in a strategic manner to facilitate the long-term success of industry as a whole, and the manufacturing sector in particular. Rather, the state's 'strategic' concerns have been centred on maintaining white

domination, and on making South Africa self-sufficient in the face of international isolation.

ii) Corporate structure

Amsden argues that Korea's corporate structure facilitated the success of manufacturing because the conglomerates (chaebol) were able to penetrate international markets across a wide range of industries. Amsden argues that diversified business groups are not only important in Korea however, but are "a phenomenon general to late industrialisation" (1990:17). Diversified business groups or conglomerates are certainly a feature of South Africa's corporate landscape, but their effects here are more contradictory (Savage 1987; Lewis 1993). In the paper sector, the concentration of ownership and power has been double-edged. Both the large companies, Sappi and Mondi, (as well as a number of paper merchanting and paper converting companies), are controlled by South Africa's two largest conglomerates - Sanlam (Gencor) and Anglo American (AMIC). This ownership pattern undoubtedly facilitated the transfer of accumulated capital between mining and manufacturing, and may have also eased the process of raising finance for investment in lumpy capital-intensive projects. However, the concentration of ownership has also contributed to high domestic prices for intermediate and consumer goods through the limiting of competition. As we have seen above, the fact that there is a single local supplier of certain paper grades means that there is limited competition in the domestic market, and that the supplier is therefore able to charge higher prices or supply goods of a lessor quality than may otherwise be the case. It is extremely significant that Sappi and Mondi choose to compete only in certain segments of the paper market. This leaves other segments (notably cartonboard and fine papers) to one of the companies only. This may be a result of what Lewis has termed conglomerate forbearance[53]" (1993:12). While Finance Minister Derek Keys sees competition between Sappi and Mondi as evidence that

[53]Lewis defines 'conglomerate forbearance' as "a decision by Conglomerate A to restrain a subsidiary active in a given market from vigorous competition against the subsidiary of Conglomerate B, lest B support retaliation by another subsidiary in a market in which A's subsidiary is vulnerable.....The most extreme form of conglomerate forbearance is a decision not to compete at all, to cede a given market to the subsidiary of a competitor conglomerate in exchange for similar consideration in another market. This effectively results in single firm dominance" (1993:12).

conglomerates can and do "compete the hell out of each other" (Lewis and von Holdt 1993), I argue that Sappi and Mondi compete selectively - they compete vigorously in certain markets and not at all in others. Similarly, Lewis concludes that "Sappi and Mondi do compete with each other in important markets.....but certain markets are dominated - in fact monopolised - by one or other of these firms. It is impossible to know whether this is the result of explicit collusion. What is certain however is that to characterise the paper and pulp industry as an example of competing oligopolies is an oversimplification" (1993:11).

In relation to corporate structure then, I conclude that the strong conglomerates do not simply promote competitive performance in South Africa, as Amsden suggests they have done in Korea. Rather, the conglomerate structure has double-edged effects. The behaviour of conglomerates has limited competition in the pulp and paper sector and this has created the space for inefficiency and inflationary pricing.

iii) Strategic shop-floor focus

Amsden argues that Korea was able to overcome the penalties of lateness through a strategic shop-floor focus. She argues that precisely because Korean companies imported technology with which they were unfamiliar, they developed a strong focus on "making borrowed technology work" (1990:17). Amsden shows that Korean firms developed an emphasis on "improving the performance of each piece of equipment" (1990:27) through ongoing worker training, preventative maintenance and tight process control. This was achieved on the basis of participatory forms of work organisation which encouraged teamwork and worker initiative, and discouraged steep hierarchies. This is the antithesis of taylorist forms of work organisation which emphasise deskilling and top-down management. For Amsden the strategic focus on the shop-floor grew out of the fact that Korean companies had to borrow technology and compete with countries which generated that technology. In this way an initial disadvantage was turned into a key advantage, since the net result was that Korean companies were able to extract higher productivity from the imported equipment than the countries which originated that technology.

How does South Africa compare? I argue that although South Africa, like Korea, has had to import or 'borrow' technology from the West, local companies have failed to develop a 'strategic shop-floor focus'. In fact, on the contrary, companies in the paper sector have displayed anything but a strategic focus on the shop-floor. Rather, as we have seen above, integrated worker training, preventative maintenance and participatory forms of organisation are in their infancy in the pulp and paper industry, and even where they exist they tend to clash with entrenched racial hierarchies. Long hierarchies, top-down management and illiteracy are the order of the day, even in the more modern capital-intensive mil . Racial domination and conflict have moulded work organisation in ways that restrict productivity growth. Racial divisions have combined with taylorist structures to promote ongoing conflict, and to retard communication and co-operation on the shop-floor. As a result the tacit skills of production workers have not been harnessed, and their potential to improve the efficiency of production has been under-utilised.
This is in sharp contrast to the flat structures and participatory work practices in Korea which have succeeded in promoting continuous improvement and maximising the productivity of imported capital equipment.

iv) Labour

Amsden argues that one of the factors influencing Korea's success has been the nature of the labour market. She argues that not only has the workforce been 'cheap' and 'disciplined' (which, she claims is the case in every late industrialising country), but critically, it has been highly educated and skilled. The Korean state has followed a policy of ensuring that skills and disciplines which emanate from traditional sources have "assumed economically appropriate forms" (1990:19)[54].

Again, this stands in sharp contrast to South Africa where, as we have seen, the state has followed a policy of denying education to black people in general and the black working class in particular. The low education and skill levels in the pulp and paper industry

[54]Amsden's view of the role of traditional skills is in sharp contrast to that of Lipietz. Lipietz has argued that one of the reasons that sub-Fordist countries failed to achieve Fordist productivity gains was that they "never dispense[d] completely" with "pre-existing skills" (1987:61). In other words, Lipietz considers it imperative to remove traditional skills rather than incorporating them into the realm of manufacturing.

were noted in chapter three and these undoubtedly limit productivity growth. Again, the manufacture of complex consumer products is especially affected by skills shortages. The stunted and distorted nature of human resource development thus places South Africa at a distinct disadvantage -whereas according to Amsden, positive human resource development strategies in Korea fuelled that country's competitive performance.

In conclusion, a brief application of Amsden's schema to our case study suggests that whereas Korea is a late industrialiser with a developmental state, a helpful conglomerate structure, a strategic focus on the shop-floor and a highly educated workforce, South Africa is a late industrialiser with a non-developmental state, a distorting conglomerate structure, a lack of strategic focus on the shop-floor, and a poorly educated workforce. In this light it is unsurprising that South Africa has failed to compete in the production of manufactured goods.

What accounts for these differences in approach to industrialisation? Why did South Africa follow such a radically different path to that of Korea when faced with the common dilemma of late industrialisation? One part of the answer undoubtedly lies in the pursuance of racial domination which prevented a national development strategy from emerging. But another part of the answer lies in South Africa's mineral and raw material base. Since Korea has limited raw material endowment, the clearest development strategy lay in manufacturing, an area that was also being developed by Korea's regional neighbours. South Africa on the other hand, was able to rely on cheap raw materials, and minerals in particular, to form the backbone of the economy. As a result there was little pressure to develop a competitive performance in manufacturing, particularly given the extensive protection of consumer goods industries from foreign competition.

This can be illustrated in the pulp and paper sector, where cheap raw materials and cheap energy have formed the cornerstone of the industry's growth. But as we noted in chapter three, the cheap raw material advantage has shielded the industry from the need for efficiency improvements. In fact the depth of the raw material advantage has alleviated pressure for companies to concentrate on productivity and efficiency on the shop-floor. They have been able to compete internationally at the upstream end squarely on the basis

of raw material advantage. Thus management as well as the state have averted their gaze from the shop-floor and looked hard at the forests. This over-reliance on cheap raw materials has combined with import protection and limited local competition to dull the efficiency imperative. And so for as long as raw material advantage has been paramount, manufacturing efficiency has taken a back seat.

The notion of over-dependence on the resource base may also help to explain the despotic aspects of the industrialisation process, and the distortions in human resource development. Mineral extraction as well as labour-intensive activities such as forestry have been well served by a supply of cheap and relatively unskilled labour. Despotic or authoritarian forms of control are also associated with extraction or plantation activities. In this sense the labour requirements of the dominant raw materials sector have been met by a strategy which has emphasised the need for cheap, servile and relatively unskilled labour. The effects of this are however keenly felt in the skills shortages evident in manufacturing.

The idea that industrialisation has been overly dependent on the raw material base may be applied beyond the paper sector in a broader analysis of South Africa's industrialisation path. The mining sector has, for many years been the dominant feature of the economy, and has provided a stable basis for accumulation. Until significant long-term decline became evident in the mining sector, there was relatively little pressure to compete more vigorously in manufacturing. The extent of import protection and sanctions have intensified this tendency.

I have not argued that South Africa is similar to Korea. Rather I have noted the very significant differences between industrialisation in the two countries. And yet, despite these differences, it is useful to consider South Africa's development in terms of the concept of late industrialisation because it sheds light on factors which influence the success of countries attempting to break into international markets for manufactured goods. Indeed, it is precisely the contrast between the two countries that makes the comparison so compelling. If Amsden's analysis of why Korea succeeded is correct, it would suggest that South Africa will be unlikely to develop a successful manufacturing

sector unless we take account of the 'penalties' of late industrialisation, and act to overcome the associated obstacles. Amsden suggests that a number of factors, including the presence of a strong and skilled 'developmental state' as well as a strategic focus on the shop-floor can facilitate the success of late industrialisers. Such a perspective may help to inform the process of formulating industrial strategy in South Africa[55].

There are, however, aspects of Amsden's work which should be used with caution. Her view of the state and of labour raise certain difficulties. With regard to the state, she takes a rather uncritical view of the authoritarian nature of the state in Korea. She argues that although the state has acted in a repressive manner, and in ways that have shielded "pervasive corruption" (1990:22) among officials, it has nevertheless played a positive role as an agent of industrial development. Indeed, she argues that the state has required substantial power in order to be able to 'discipline' big business as well as labour. However, Amsden does not discuss the negative spin-offs of such abundant state power which would include limitations placed on democracy and the repression of dissent. She argues that repressive state actions can be defended on the grounds that the absence of a strong state allows big business to "hold a society to ransom with its investment decisions". She writes that "if democracy means power by the people over their lives, then the antithesis of democracy is the power of business to decide if and when to invest. To the extent that the Korean government has disciplined big business.....Korea has exacted a measure of public accountability greater than that of many other late - and even early - industrialising countries" (1990:23). While it may be true that unbridled power in the hands of big business is anti-democratic, the presence of an authoritarian government is equally dangerous. Indeed, South Africa's experience of authoritarian government and state repression highlights the costs of sacrificing democracy to some higher cause. Amsden's case for some kind of benevolent dictatorship is unlikely to find support in the context of post-Apartheid South Africa.

Similarly, Amsden's view of the role of labour must be questioned. She argues that a

[55]Elements of Amsden's framework are already in evidence in recent analyses of South African industry. The work of the Industrial Strategy Project (ISP) for example, concentrates on issues of productivity and competitiveness rather than domestic demand. The work of the ISP is also concerned with developing a focus on the shop-floor and its influence on productivity. The ISP does not however, use Amsden's overall framework in an explicit manner.

'disciplined' labour force is critical to the success of late industrialisers. She writes that part of Korea's effective shop-floor focus was the "successful repression of any labour organisation or labour practises hostile to higher productivity - that is, industrial unions and their associated work rules" (1990:26). This suggests that trade unions should not be afforded the opportunity to shape the organisation of production or to defend the interests of workers where these conflict with those of management, or with the goal of productivity. Amsden implies that productivity growth must be achieved at all costs - even if it means preventing workers from expressing and defending their interests. Amsden's rather heavy-handed approach is not only at odds with a more democratic approach to work organisation, it is also unlikely to work in a country like South Africa where trade unions have developed a strong shop-floor presence. More importantly perhaps, Amsden's approach denies the possibility of trade unions playing a more strategic role in shaping the workplace. Amsden does not consider that industrial unions may be a source of productivity improvement in certain circumstances. Rather, she regards them as a threat to productivity. Recent experiences in South Africa and Australia however, suggest that trade unions can play a strategic role in industrial development[56].

Despite these problems, Amsden provides an important starting point for tackling the task of understanding industrialisation in South Africa. This is not because Amsden's analysis of Korea can simply be transferred to South Africa. Indeed, we have noted the stark differences between the two countries, as well as the problems with Amsden's work. But the notion of late industrialisation is useful - largely because of the questions it asks. It is valuable to consider the impact of 'lateness' and to cast our analysis in terms of productivity rather than underconsumption. More specifically, it is valuable to examine the developmental role of the state; the corporate structure; the nature of shop-floor organisation and the role of labour. It is for drawing our attention to these categories that Amsden's work is so valuable. The issues to which she directs our attention are critical in understanding industrial development, and for this reason her framework can be fruitfully applied to South Africa.

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[56]For discussions of the role of trade unions in facilitating industrial development see Joffe (1993), Higgins (1987) and Patel (1993).

Conclusion

My analysis of the development of the pulp and paper industry has raised a series of problems with the notion of racial Fordism. I have found that Gelb's conceptualisation of South African industry has been unable to explain key aspects of the paper sector's development. On the basis of this case study I have concluded that the notion of racial Fordism obscures important elements of industrialisation and is a limited framework of analysis. I have therefore turned to an alternative framework provided by Alice Amsden's notion of 'late industrialisation', which she uses as an alternative to Lipietz's 'Global Fordism'. I have found that Amsden's categories and concepts can be fruitfully applied to an analysis of the paper sector, and that late industrialisation may be a useful concept for analysing South African industrialisation as a whole. I have stressed however, that South Africa's path has been very different from that of Korea, and that South Africa's industrialisation has been shaped by apartheid priorities and by an over-dependence on raw material processing. In this sense I argue that South African industrialisation could be characterised as 'resource-dependent late industrialisation'. Any firm conclusion about South Africa's overall industrialisation path however will have to rely on a wider study of South Africa's industrial base.

Chapter five: Conclusion

Summary of the argument

In chapter one I set out to explore the origins and meanings of Stephen Gelb's notion of racial Fordism. I sought to evaluate Gelb's understanding of industrialisation in South Africa both at a conceptual level and through a case study of a manufacturing sub-sector.

In chapter two I explored the theoretical basis of racial Fordism. I showed that racial Fordism is a derivative of Lipietz's concept of sub-Fordism, which in turn, is part of his theory of Global Fordism. Lipietz uses the idea of Global Fordism to explain patterns of economic development within countries, as well as to explain why some countries have experienced more rapid economic development than others. He uses the notion of sub-Fordism to argue that countries which attempted to industrialise on the basis of manufacture using imported capital equipment, but in the absence of a mass domestic market, were bound to fail. This is because they were unable to enter the virtuous circle provided by a match between mass production and domestic mass consumption. Such economies therefore forfeited both the production efficiencies associated with standardised mass production, and the social stability associated with mass consumption norms.

I argued that there are two key conceptual problems with the idea of racial Fordism. The first is that although Gelb has based his notion of racial Fordism on sub-Fordism, he fails to acknowledge Lipietz's point that a sub-Fordist economy is one which is substantially different from Fordism because it fails to achieve a match between mass production and consumption. Gelb argues that a (racially) limited form of the mass production-mass consumption match was achieved in South Africa. Despite the limited nature of this match, Gelb argues that it was sufficient to replicate the Fordist model of development and to drive the growth of manufacturing through the expansion of the domestic market in the post-WWII period. Gelb does not acknowledge the way in which the limited nature of the mass production-mass consumption equation constrained the process of

industrialisation. He does not account for the fact that the limited nature of the consumer market prevented the attainment of economies of scale because of their small size and great fragmentation.

The second conceptual problem with racial Fordism is that it poses the problem of industrial development as one of underconsumption rather than productivity. This problem is rooted in Global Fordism which, as Amsden has shown, ignores the problem of international competitiveness.

In chapter three I evaluated racial Fordism in the context of a case study, in order to determine whether the concept is in fact helpful in explaining the development of a sub-sector of manufacturing. I examined each of the major propositions of racial Fordism in relation to the development of the pulp and paper industry. I found that many of the theory's assumptions were not borne out by the process of development in that sector. I demonstrated that Gelb is not sufficiently sensitive to the impact of the export market on local manufacturing, and nor does he account for why sub-sectors may be more or less able to compete in the international market. By failing to cast his analysis in terms of productivity or international competitiveness, he falls into the traps of underconsumptionist theory identified by Amsden. An analysis of the pulp and paper industry through the lens of international competitiveness reveals that there are important dynamics within manufacturing that influence the development of the sector. These include the impact of South Africa's raw material base, the problem of production inefficiency and the impact of the competitive regime. An appreciation of the importance of these factors in influencing South Africa's process of industrialisation is missing from Gelb's work largely because he concerns himself with consumption rather than the internal dynamics of manufacturing.

An examination of the sector's competitive performance also indicates that Gelb takes insufficient account of the linkages between agriculture, mining and manufacturing. These linkages are crucial in explaining the development and performance of the pulp and paper sector.

The case study also reveals that Gelb's understanding of labour control and class structure is problematic. His use of the term Fordism to describe the nature of class and control, obscures the repressive nature of the society and the exclusion of the bulk of the workforce from the industrial relations system for a long period of time. He does not account sufficiently for the low comparative level of wages, and he underestimates the despotic nature of control. Although the use of the term Fordism is applicable to the white working class, it cannot be seen as the defining feature of the class structure as a whole. Similarly, although Gelb acknowledges the impact of racial control on the shop floor he does not theorise the nature of work sufficiently. He underestimates the way in which racial inequality has combined with a taylorist mode of organisation to shape the experience of work and the productivity of manufacturing. Similarly, Gelb's analysis of the state is incomplete. He recognises that the degree of state intervention in South Africa sets it apart from Fordist economies. However, he does not account for why this should be the case, and nor does he compare the role of the South African state with other deeply interventionist states such as Korea.

Given the limitations of the concept of racial Fordism in explaining the development of the sector, I turn to Amsden for an alternative framework. I apply her notion of 'late industrialisation' to the development of the pulp and paper sector and conclude that it provides a useful framework of analysis. Although South Africa is very different from Korea (Amsden's case study of late industrialisation), Amsden's framework is helpful in directing the analysis. The categories of enquiry and the questions that Amsden asks provide a valuable springboard from which to launch an explanation of the sector, and possibly, the path of industrialisation as a whole.

Implications of the analysis

In chapter one I noted that the sectoral case study method is limited in that the experience of a single sub-sector cannot be generalised for all sub-sectors. The experience of a single sub-sector cannot explain South Africa's path of industrialisation as a whole. Nevertheless, the fact that Gelb's analysis has not been borne out by my case study does raise questions which may be applicable to the process of industrialisation more broadly.

The findings of this study suggest that Gelb's framework fails to direct our attention to key aspects of South Africa's industrial development.

Gelb underestimates the impact of the fragmented nature of demand. This blinds his analysis to a key source of inefficiency in production and undermines his insistence on the centrality of domestic mass consumption in the development of manufacturing. He fails to account for the relative competitiveness of South African manufacturing and therefore cannot explain trade performance adequately. He is not sufficiently cognisant of the linkages between manufacturing and other sectors, and of the ways in which an over-reliance on the raw material base has blunted the pressure for firms to improve their efficiency. Similarly he fails to incorporate an analysis of the competitive regime or the corporate structure into his framework. He also provides a limited understanding of the nature of state involvement in manufacturing and of the effects of racial domination on production.

Although I have only tested the importance of these factors in the pulp and paper sector, it is likely that at least some of these aspects of industrialisation are important beyond the experience of this sector. If that is indeed the case, then Gelb's notion of racial Fordism should be questioned as a basis for understanding South Africa's path of industrialisation as a whole.

Appendices

Appendix one: Semi-structured questionnaire

A. Company level questions

1. what is your view of current government policy on:
* Tariff protection on paper
* Tariff protection on capital equipment
* The General Export Incentive Scheme
* Company taxation
* Environmental legislation

2. Has your company participated in paper industry associations over the years? What is your view of such associations and their role?

3. What is the impact of being part of a conglomerate on the day-to-day running of your company? What advantages and constraints arise from the structure of ownership of your firm and how has this changed over time?

4. Do you have a group training program? If so, how is it organised and what proportion of the company turnover is devoted to training?

5. What are your overall objectives for the next five years? What is your expected investment program?

B. Divisional information

6. How many workers are employed in your division and what is the race, gender, age and skill profile of your employees? What is the managerial structure of your division, and what is the wage structure?

7. What is the output of the division and how has it changed over the last ten years?

8. What are the major constraints and competitive questions faced by the division? What is the balance of local and export demand for your products?

9. What governs the choice of technology in the division and from where do you source your capital goods? What is the average age of your capital equipment?

10. What environmental issues do you face and how do you respond to them?

11. What research and development is done in the division?

12. Do you face any infrastuctural constraints (e.g., transport)?

C. Plant level information

13. How is work organised and how does the production process work? Have nay new ways of organising work been introduced lately? What are the major production problems that you experience?

14. Are there any worker participation schemes in the plant? How do they work?

15. How does payment operate? (e.g. bonus schemes)

16. What is the extent of absenteeism?

17. Has there been any industrial conflict over the last five years? If so, please describe.

18. What is the extent of subcontracting in the plant?

Appendix two: Structured Questionnaire - Comparative measures of efficiency

Section 1: Operating Efficiencies

1a: Overall utilisation:

- Plant utilisation: what is your average running time as a percentage of all possible hours in the week?

=

- Mill/machine utilisation: what is your operating time less planned downtime (including planned maintenance time, planned grade change time)?

=

- Mill/machine utilisation: what is your operating time less unplanned downtime?

=

1b: Overall yield

- What percentage of your principal raw material (wood or paper) is converted into prime saleable product (ie: product which meets the highest specifications and is not discounted, culled or repulped)?

=

1c: Materials management

- What is the cost of your non-product materials (eg consumable maintenance spares) per ton of saleable product?

=

1d: Labour productivity

- How many person hours are used per ton of saleable product (full employment complement including management)?

=

- How many maintenance person hours are used per ton of saleable product?

=

- How many production person hours are used per ton of saleable product?

Section 2: Cost structure:

Please break down your cost structure per ton of delivered product as follows

Item	Percentage
Wood/fibre/paper	
Other materials	
Personnel	
Energy	
Freight and sales (local)	
Freight and sales (export)	
Overheads	
Total	100

Total monetary cost per delivered ton: = _____

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Author: Bethlehem Lael Irene.
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