

electrical machinery. The only industries with an even distribution of output over the country are, the machinery, base metal, chemical, transport equipment and miscellaneous manufacturing industries.

As the majority of firms in the region are metal product manufacturers it is worth looking at these in greater detail. It is seen that these have the greatest output linkage with the local area, 37.1 %, reflecting the number of small firms in this group who do 'jobbing' for the larger manufacturing firms in the area, and also produce for firms in the P-W-V. Other large firms in this category producing products such as springs, fans, hard metals, and steel structures for pylons, have a wider market, in other provinces and overseas.

Table 18 showed that to several industrial groups of the region the gold mines still form an important market. Their output to the gold mines is further broken down in Table 20, to see its spatial distribution by value. It shows that only a small percentage of the products are sold to the local gold mines, the majority going to the new gold mining areas in South Africa and the P-W-V (to mine houses for redistribution). To some metal product firms the closure of the local gold mines led to serious problems and the need to search for new markets. These difficult times have largely receded with the 'jobbing' available from large industries, and the increasing trend for engineering firms to take on a small production line. Only one firm in the East Rand today is entirely dependent upon the gold mining trade, and that is largely orientated towards the Orange Free State.

/ Table 20

TABLE 20

MANUFACTURING OUTPUT TO GOLD MINES
% BREAKDOWN OF DESTINATIONS BY VALUE
: INDUSTRIAL SURVEY

	<u>% Output by Value</u>	<u>Destinations</u>		
		<u>E.Rand</u>	<u>P--V</u>	<u>Rest of S.A.</u>
Food	2.5	10.0	10.0	80.0
Textiles	20.0	10.0	60.0	30.0
Metal Prod's	15.0	19.4	26.2	54.4
Machinery	25.0	-	5.0	95.0
Transport	2.4	5.0	95.0	-
Misc.	0.4	10.0	60.0	30.0

Transportation Media. The firms were further questioned on the transportation media utilised for inputs and outputs, to analyse the importance of the provision of rail facilities which many large firms emphasised. Indeed, as Table 21 shows, in analysing the industries by size, whereas the input transportation pattern is virtually identical for all size of firms, the importance of rail transport for outputs increases with the size of the firm, with the larger product produced, and the wider market served.

TABLE 21

TRANSPORTATION MEDIA FOR MANUFACTURING INPUTS AND OUTPUTS
% DISTRIBUTION BY VALUE BETWEEN ROAD AND RAIL
BY SIZE OF FIRM : INDUSTRIAL SURVEY

<u>Size of Firms</u>	<u>Inputs</u>		<u>Outputs</u>	
	<u>Road</u>	<u>Rail</u>	<u>Road</u>	<u>Rail</u>
I - 100	80.0	20.0	80.5	19.5
100 - 300	72.0	28.0	77.5	22.5
300 +	71.2	28.8	52.0	48.0
All Firms	74.5	25.5	74.9	25.1

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The survey has shown that although almost every single category of the Industrial Classification is represented in the East Rand, there is a predominance of metal and machinery producing industries, and especially a large number of small metal producing industries serving other industries in the region.

For these small industries the presence of large firms 'jobbing out' contracts has been one of the main locational advantages, whilst for the larger firms, within the broad factors of proximity to market and availability of raw materials which have brought them to the Witwatersrand, site factors have been predominant in their actual location in the East Rand. The East Rand is industrially well suited for both small and large firms, having close enough contact with the P-W-V for small firms, and through rail facilities having ready access to the South African market for larger firms.

The study of spatial relationships has shown the importance of the P-W-V in the flow pattern of goods for the industries, demonstrating the integration of manufacturing in the East Rand into the P-W-V. Whereas up till 1950 the East Rand was a gold mining area within the increasingly industrialised P-W-V, it now forms an integral part of this industrial region, which is especially seen in the interrelationships of the metal product industries in the East Rand and P-W-V.

CHAPTER 6

THE STRUCTURE AND PATTERNS OF MANUFACTURING IN THE P-W-V REGION

The examination of the industrial base of the East Rand in Chapter 5 has shown the locational and manufacturing integration of the region into the greater regional context of the Southern Transvaal. It is hence appropriate and necessary to examine the Southern Transvaal region in greater detail, if conclusions are to be forwarded on the future growth of the East Rand. This will involve, firstly, an examination of the linkages between the component zones of the region, and secondly, an examination of the post-war developments in the structure and spatial expression of manufacturing in the region, and through consideration of the factors influencing this, the likely future manufacturing developments in the region.

Employment Structure in the Zones of the P-W-V

The Southern Transvaal region, or as it is more commonly termed, the P-W-V (Pretoria-Witwatersrand-Vereeniging), has been an accepted and delimited 'economic region' by South African geographers and planners since the early 1950's, and became the subject of many preliminary reports to a never completed regional plan (N.R.D.C. 1954, 1957, 1960). As the name of the region implies it consists of three main zones. The northernmost zone of the region surrounds Pretoria, a small metropolitan region which has developed outwards from a single nucleus. As the Republic's capital its administrative function is overwhelmingly important, although industry and commerce are also significant employers. In contrast to Pretoria to the far south of the region is Vereeniging, comprised of

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the industrial areas of Vereeniging and Vanderbijl Park, an area dominated by heavy industry built around the iron and steel works, and the chemical complex at Sasolburg. Between these two areas lies the Witwatersrand, having developed spatially according to the underlying geology of gold seams. Today it forms a continuous conurbation of closely spaced towns, stretching over 50 miles, from Randfontein to Nigel. It is a zone which can be divided into four sub-zones ; the West Rand, the Central Rand, the East Central Rand, and the thesis subject, the East Rand. ^I The different employment structures of the zones and sub-zones is shown in Figure I7. It shows the predominance of the service sector in the employment structure of Pretoria, in contrast to the manufacturing dominated employment structure of Vereeniging. In the four sub-zones of the Witwatersrand the contrast can be seen between the gold mining dominated employment structure of the outer zones of the West and East Rand (as was still the case in 1960), and the more 'balanced' employment structures of the Central and East Central Rand.

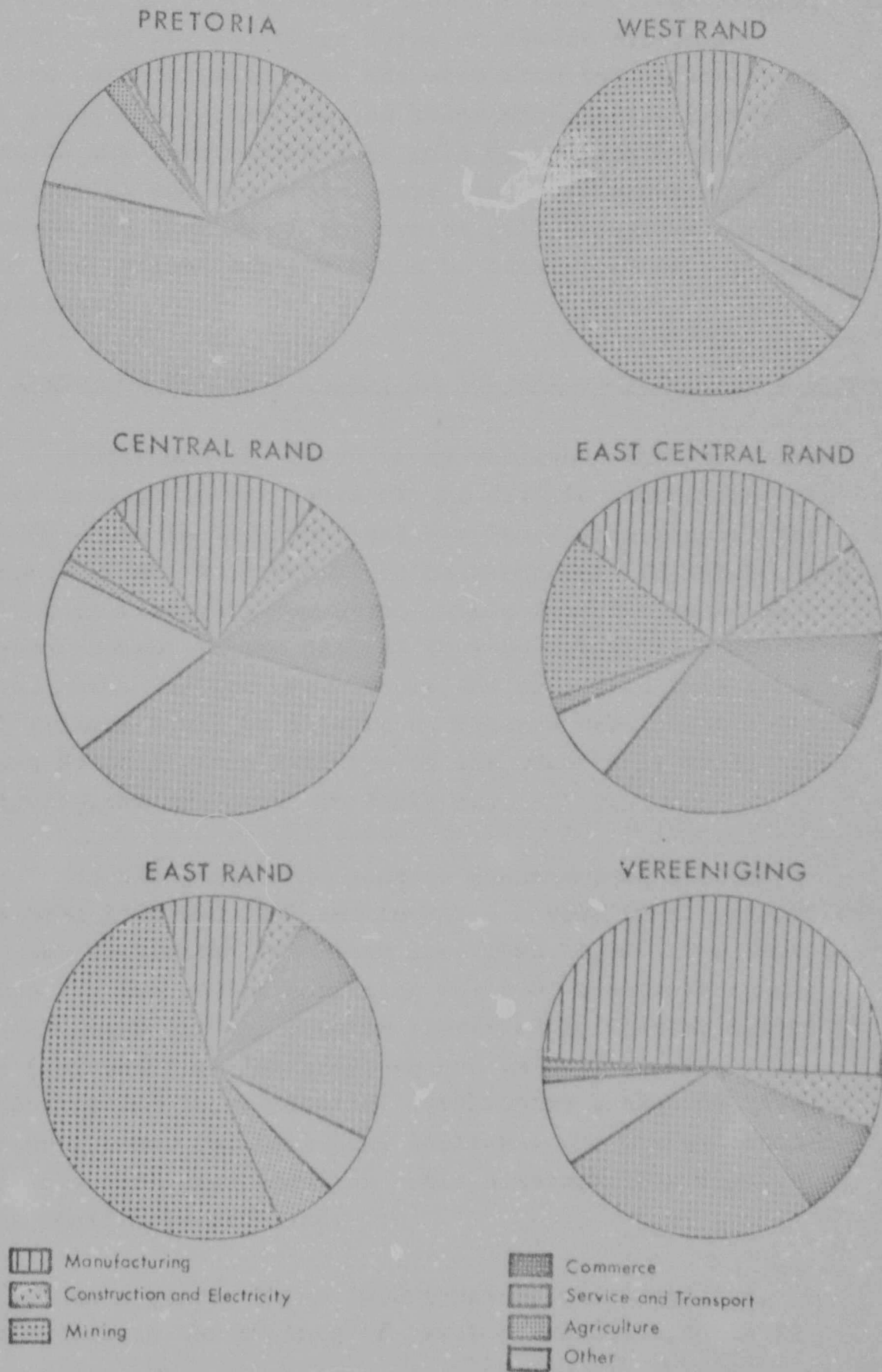
The P-W-V contains distinctive sub-regions (in terms of employment structure), with the dominant sectors being service, manufacturing, and gold mining, in different zones. In all zones however manufacturing is an important employer, and in only the West Rand did manufacturing employ less than 10 % of the economically active population in 1960, (see Table 28, Appendix 4), whilst for the whole region it employed 19 % (263,000).

Before analysing the manufacturing structure of the P-W-V region, the extent of intra-zone linkage in terms of

/ employment

-
- I. Component magisterial districts of zones :-
West Rand - Roodepoort, Krugersdorp, and Randfontein.
Central Rand - Johannesburg and Kempton Park.
East Central Zone - Alberton, Germiston, Boksburg and Benoni.
East Rand - Brakpan, Springs, and Nigel.

Figure 17 PERCENTAGE IN EMPLOYMENT SECTORS IN ZONES OF THE P-W-V
1960



Source : Statistical Year Book 1968 and unpublished statistics from Bureau of Statistics

employment must be gauged. Pretoria and Vereeniging are separated by over 40 miles from the core of the region, whilst the Witwatersrand forms an almost continuous urban agglomeration east and west from the central core of Johannesburg, linking the towns whose establishment and growth has been governed by gold mining and subsequent industrial and commercial development. The extent of intra-zone linkage of employment will determine whether or not the defined sub-zones can be considered as separate entities.

Commuting Ratios of Zones in the Witwatersrand to Johannesburg

Unfortunately there is no published work on intra-zone linkage in the zones of the Witwatersrand. The only study which has incorporated any quantification was the Report of the Marginal Mines Research Unit (M.M.R.U., 1964), which derived rail commuting ratios from the zones to Johannesburg. It was decided that by obtaining comparative statistics for the present-day, the trends in this form of linkage could be discerned. Figures were hence obtained from South African Railways on the same basis as the 1963 figures, and are shown in Table 22.

In all zones commuting to Johannesburg declined between 1963 and 1969, and involves a very small proportion of the population, totalling less than 50,000. The East Rand has the lowest commuting ratio of the three zones, which bears out the premise expressed in Chapter I, that it is isolated from Johannesburg and is unlikely to be incorporated in residential development linked to the Central Zone. The West Rand still has the highest numbers of commuters, and commuting ratio, although this figure has similarly declined.

As a guide to the importance of, and trends in, commuting, in the absence of exact information, Table 22

/ shows

Table 22
COMMUTING RATIOS OF MUNICIPALITIES
TO JOHANNESBURG 1963 & 1969

Municipality	Mls. from Jo'burg	1963			1969		
		Tickets Issued	Pop'n.	Ratio	Tickets Issued	Pop'n.	Ratio
Nigel	33	-	34,016	-	66	38,342	0.01
Springs	30	3,383	135,911	0.02	2,983	153,198	0.02
Brakpan	23	3,980	74,347	0.05	3,412	83,803	0.04
East Rand		7,363	244,274	0.03	6,461	275,343	0.02
Benoni	20	5,888	127,300	0.05	5,172	143,492	0.03
Boksburg	16	9,196	71,029	0.13	4,609	80,063	0.05
Germiston	8	6,868	139,407	0.06	5,897	157,139	0.04
E. Central Rand		23,952	337,736	0.07	15,678	380,694	0.04
Roodepoort	12	19,204	95,570	0.20	16,328	107,726	0.15
Krugersdorp	20	6,482	91,450	0.07	5,395	103,082	0.05
Randfontein	28	3,035	41,312	0.07	2,912	46,566	0.06
West Rand		28,721	228,332	0.13	24,635	257,374	0.09

N.B. Figures for population of municipalities for 1969, extrapolations from 1963 figures (using South African ratios between these years).

Source : M.M.R.U. Report, statistics from S.A.R. for August 1963, and S.A.R. prepared statistics on the same basis for August 1969.

shows the declining significance of the Central Zone as a source of employment to other zones of the Witwatersrand, and the distinctiveness of the individual sub-zones in terms of employment.

Manufacturing in the P-W-V Region

Manufacturing has provided the basis of growth for the P-W-V post-war, with the simultaneous decline of gold mining, and growth and increasing 'maturity' ^I of industrialisation in the region. The relationship between the growth of manufacturing industries and the development of specific regions has been shown by Marais in relation to South Africa (Marais, 1963). It is this growth of manufacturing which will ensure that the P-W-V remains the economic heart of South Africa for many years to come (Marais, 1969).

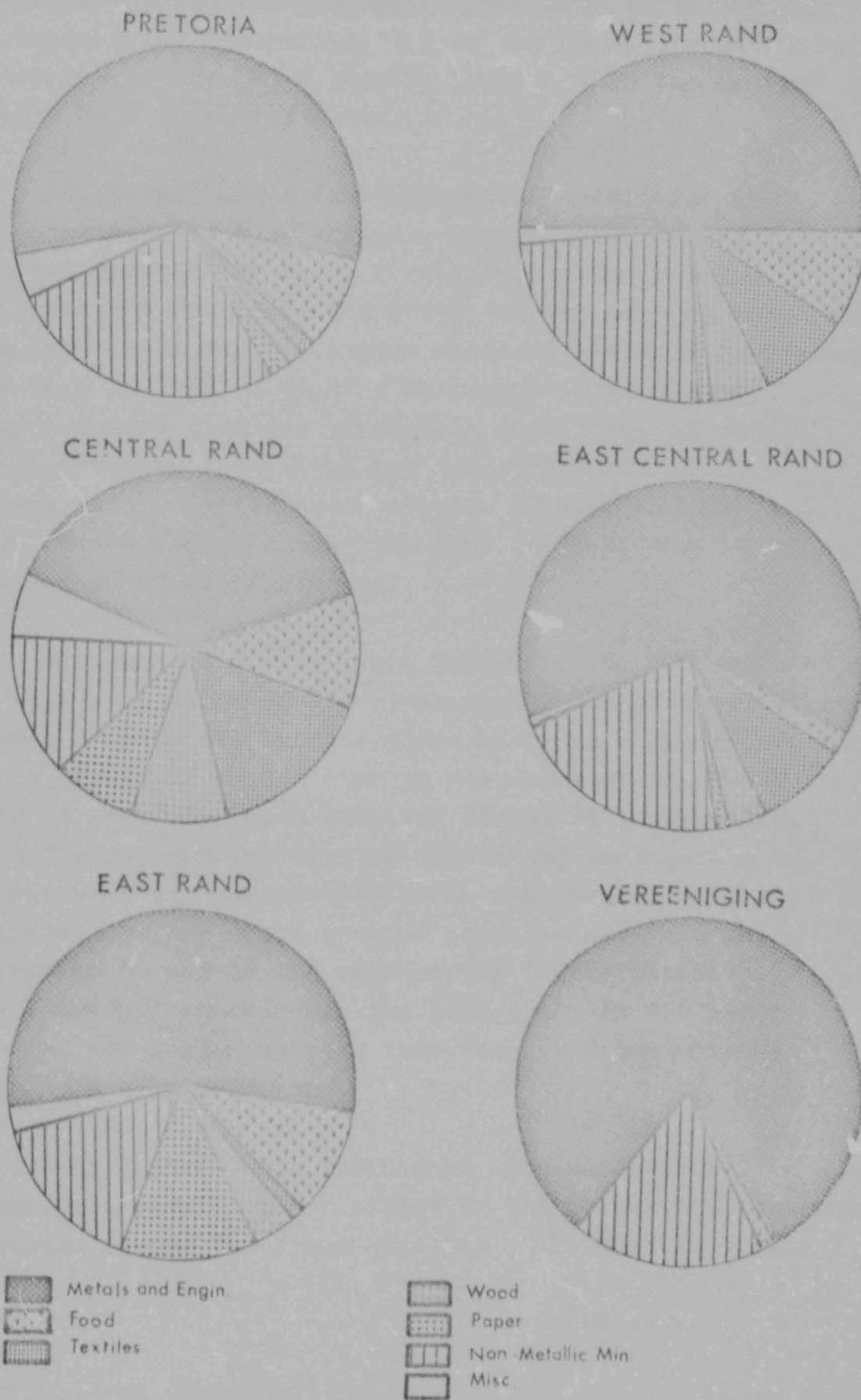
Manufacturing encompasses many different types of firms with different growth rates, and linkages with other local industries. Figure 18 shows the breakdown of manufacturing employment for 1963/64 for the zones of the P-W-V. The industries are divided into seven forms of manufacturing, (grouped according to the Industrial Classification - see Table 29, Appendix 4 footnote, for the groupings of industry types), and are presented as a percentage breakdown of total manufacturing employment. The East Rand has the highest percentage employment in paper and printing industries, Pretoria and the West Rand in chemicals - non-metallic minerals class, whilst the Central Rand, as would be expected, the highest percentage employment in the city manufacturing functions of food,

/ furniture

I. 'Maturity' . Reflected in the number of basic and intermediate processors.
see Rostow, 1960.

Figure 18

% BREAKDOWN OF MANUFACTURING EMPLOYMENT
BETWEEN DIFFERENT SECTORS IN THE ZONES OF
THE P-W-V REGION
1963/64



Source: Industrial Census 1963/64 (Unpub.)

furniture and miscellaneous manufacturers. In all zones however the predominant manufacturing type is the metal and engineering industries, 52 % of the total manufacturing employment in the P-W-V, ranging from, 36 % in the Central Rand, to 84 % in Vereeniging.

It is this metal and engineering industries that have provided the base and main growth component of manufacturing in the P-W-V (Sadie, 1966). The P-W-V dominates the South African metal and engineering industries, even increasing its percentage share of national employment from 64 % in 1949/50 to 70 % in 1963/64. The strong inter-industry linkages present in most types of metals and engineering industries has tended to lead to the importance of agglomeration factors in location and growth, hence consolidating the importance of the P-W-V in this sphere of manufacturing.

Although of almost equal importance to all zones of the region, in terms of the percentage share of manufacturing, between 1949/50 and 1963/64 there has been a great disparity in the growth of this sector in the zones of the P-W-V. Table 23 shows in tabulation, and Figure 19 graphically, the different growth rates of metals and engineering in the P-W-V in the period 1949/50 to 1963/64. In only one zone, Pretoria, has there been an absolute decrease in employment in metals and engineering industries, with only a minimal increase in the West Rand. In the other zones of the region however there has been an increase of over 50 % in each zone.

What factors have influenced this differential growth, and how will these affect in the future the patterns of growth in the P-W-V, and especially the East Rand zone ?

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Figure 19 EMPLOYMENT IN METALS & ENGINEERING IN THE P.W.V.
1949/50 & 1963/64



Sources NRDC Report 1954 and Industrial Census 1963/64.

NB Magisterial District Boundaries.

Table 23
EMPLOYMENT IN METAL AND ENGINEERING FIRMS
IN ZONES OF THE P-W-V. 1949/50 & 1963/64

	No. Estabs.	1949/50 Av. size -employ.	Employ.	No. Estabs.	1963/64 Av. size -employ.	Employ.	% change in employ.
PRETORIA	138	162	22441	156	131	20518	- 9
Kruger's.lorp	31		3518	45		4845	
Randfontein	15		2478	13		2176	
Rodepoort	27		2971	29		2157	
WEST RAND	73	122	8967	87	105	9178	2
Johannesburg	623		32746	1007		52359	
Kempton Park	623	52	32746	32		1934	
CENTRAL RAND				1039	52	54293	65
Germiston	112		16741	235		32591	
Alberton	38		5079	34		3240	
Boksburg	59		8603	70		11982	
Benoni	202	145	30423	72		12517	
EAST CENTRAL RAND				411	146	60230	97
Brakpan	21		2733	30		2870	
Springe	48		5723	72		9247	
Nigel	5		811	12		1821	
EAST RAND	74	125	9267	114	122	13938	50
Vanderbijl Park	38		13150	15		16807	
Vereeniging	38	346	13150	64		16553	
VEREENIGING				79	415	32860	149
P-W-V	1155	101	116994	1886	101	191017	63
SOUTH AFRICA	2309	79	182717	3425	78	269924	40

Source : Industrial Censuses 1949/50 and 1963/64.

The contrast is shown in Table 23 between the average size of metals and engineering firms in the zones of the P-W-V, with, at one end of the scale the Central Zone of the Witwatersrand with an average of 52 employees, and at the other, Vereeniging, with an average of 415 employees in 1963/64. The dissimilarity in average size reflects the difference between heavy and light industrial firms in the two zones. In the Vereeniging zone the attraction is to heavy metals and engineering firms capitalising upon the proximity to the heavy base metals industries in the region. By contrast locational advantages in the Central Zone are for smaller, light industrial firms, growing as a result of the 'seedbed' effect of agglomeration in Johannesburg (Marais, 1969). These differing locational advantages have resulted in high percentage growth rates in both zones. In zones with intermediate average size of establishments, the growth rates have considerably varied, Pretoria with a decrease, the West Rand with an increase of 2 %, whilst the East Rand and East Central Rand with growth rates of 50 % and 97 % respectively.

The differential spatial growth patterns of metals and engineering firms has been a result of the locational advantages of agglomeration and flat land, present in the East Rand and East Central Rand.

The 'seedbed' of Johannesburg provides the economic environment for the growth and development of small metals and engineering firms. When first established these are often manufacturing-service industries, or produce unstandardized products. With an increase in city size and market, these industries form a bigger component of total manufacturing and, as they change their production processes to produce manufactured standardized products, they tend to move to the outskirts of a city or to neighbouring

/ towns

towns where land is relatively cheap.

In addition to this factor, the changes in technology and the organization of manufacturing have drastically altered the land requirements of industry in post-war years. Structural changes in the modern factory have given rise to a growing need for more space, resulting from four space requirement factors ; floor space per worker, floor area per unit of building ground area, site coverage ratio, and the ratio of manufacturing to total floor area (Marais, 1969). Especially important to a firm seeking a location, or a new site, in the P-W-V, are large areas of flat land and acreage which can be bought to accommodate future expansion. The agglomeration factor has tended to act against growth in the Pretoria zone, whilst the land factor has tended to retard growth in the West Rand, with its shortage of large flat land sites. The East Rand and East Central Rand have been able to benefit from the out-movement of firms, still requiring close contact with the Central zone and the availability of flat sites in these areas.

Future Patterns of Growth

Other things being equal, the spatial pattern of manufacturing growth in the P-W-V is likely to be consolidated, especially with the release of more mining land in the East Rand and its availability for municipal planning. As Marais has pointed out, as long as Johannesburg continues to grow, so will the rest of the P-W-V (Marais, 1969), with the out-movement of firms from the Central zone to other zones of the Witwatersrand.

Although many industries in the P-W-V are suited to border area development (e.g. textiles, furniture, car assembly), few of the component industries of the metals and engineering sector (the growth sector of the P-W-V),

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could be located in these areas without a serious decline in their economic efficiency, as a result of the loss of the advantages of agglomeration.

Similarly, the refusal to grant permission for new industrial townships in the P-W-V will only lead to inflated land values, followed by a 'slow choking to death' of the main industrial centre of South Africa (Marais, 1969). The growth of existing industry is anyway bound to lead to the demand for new industrial townships.

It is likely therefore that even if government policy does try to retard growth in the P-W-V by 'negative' planning, it will alter only the absolute amount of growth, not its spatial expression, and hence further manufacturing development especially in the East Central Rand and East Rand seems assured.

CHAPTER 7

THE PERMISSIVE FACTORS FOR ECONOMIC GROWTH
IN THE EAST RAND

The development of a manufacturing base in the East Rand, and the integration of the region into the P-W-V industrial region, have hence provided the implemental determinants for future economic growth in the region. One of the dangers of economic base prediction however has always been its inability to include, what can be considered as the permissive ingredients for regional economic growth, those factors determining the physical ability of a regional economy to grow by increasing its stock of resources (land, labour and capital) (Lane, 1966). Only if these resources can be expanded will the implemental factors cause the growth of basic activities in the region, if not, they will merely result in a transfer from non-basic activities, and no economic growth.

This chapter therefore aims at examining the pertinent permissive factors for growth in the region, the water and power supplies, the transportation network, and the two main determinants, land and labour, to see to what extent these factors can be increased to meet the demands of economic growth.

Water and Power Supplies

Water. All the regions water supplies are derived from a
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- I. Lane cites the example of this situation occurring in Seattle, Washington, where the Boeing Aeroplane Company, the city's major basic industry, decided to employ an extra 15,000 persons. The labour resources of the region were limited, but the high wages offered attracted these persons largely from the non-basic activities, hence solely leading to a decrease in the ability of the Seattle economy to produce for the local market, and no economic growth.

single water supply authority, the Rand Water Board, for whom the major source of supply is the Vaal river. Although there has been a very substantial increase in demand, from 1.3 million gallons per day to 11.2 million gallons per day, between 1945 and 1967 (Municipal Year Book, 1968), the resources have managed to meet this, with only occasional shortages, as in the past winter of 1969. These shortages have at times given rise to concern over the ability of the Vaal to meet future demand, although in the light of planned developments to increase supply to the P-W-V ('The Star', 10.11.69), and the proportionally small amount of water used by manufacturing industry, growth of this sector is unlikely to be hampered by water shortages.

In the East Rand only two paper and pulp firms, and two bottling firms, use large amounts of water in the process of manufacture. All these firms were located prior to the 1956 Water Act, which made siting of industries requiring large quantities of water subject to control by the Minister (N.R.D.C., 1957), and although these firms are likely to expand, because of the Act no new water-intensive firms are expected to be sited in the region.

The other industries in the region, especially the 'growth industries' of metals and engineering, use very little water in their processes. Of this group the importance of water in terms of cost gives an idea of their water consumption. For machinery firms, water represents 0.15 % of net output, electrical machinery, 0.07 %, whilst metal products, 0.13 % (figures for South Africa). Further, the Water Affairs Committee of the Transvaal Chamber of Industries has estimated that direct consumption of secondary industries, besides Sasol and Iscor, is only 1.8 % of the total assured supply from the Vaal Dam, whereas industrial workers in their homes use a

/ further

further 3.5 %, which together gives a total of 5.3 % (Marais, 1969). It is obvious that manufacturing industries in the region use very little of the total water consumed in the Witwatersrand complex.

Both in the East Rand and in the Witwatersrand, manufacturing industries use very little of the total water supply, and water will therefore be available for the forecast expansion in manufacturing.

Electricity. Electricity provides less of a potential problem to the expansion of manufacturing in the East Rand, the continual expansion of demand having been easily met by an expansion of plant capacity in the region. As with the supply of water, the provision by a central body, in this case Escom, has enabled coordinated development of the region to its water and power supplies.

Communications

For industry one of the main advantages of the East Rand has been its good rail and road linkages to the Central zone of the P-W-V, and by its central position, to export markets outside the P-W-V.

The position of commuting to Johannesburg is not so satisfactory however, as was reflected in the rail commuting ratios presented in the last chapter, whilst commuting by road in peak travelling hours takes even longer than by rail. The Johannesburg-Benoni-Mitbank freeway proposed by the Transvaal Provincial Roads Department ('The Star', 19.9.69), will benefit the East Rand, as it passes through the region to the south of the townships of Brakpan and Springs, with interchanges linking the region to Johannesburg and the East via this freeway. The other road developments proposed (seven new

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