

# SHIFT-SHARE ANALYSIS OF MANUFACTURING AS A MEASURING INSTRUMENT FOR HUMAN RESOURCE MANAGEMENT

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## ABSTRACT

Shift-share analysis of employment as a measuring instrument for human resource management is proposed by this study. The results obtained through this technique can assist human resource management on the macro-level in making informed and strategic decisions regarding future employment practices and trends. This technique is often applied to studies of economic geography, and is illustrated in this article through its application to the estimation of future employment potential of manufacturing industries of South Africa's Southern District Municipality. The economy in this region is mainly dependent on gold mining, which is declining as gold reserves are becoming depleted. As a result, a large section of the area's population will be unemployed in future, causing adversity and other development needs. Shift-share analysis provides insight into the shifts of employment in the various sectors over time, as well as insight into the national share effect on employment in the region, including the regional-industrial mix and the competitive share effects. It was found that the sectors with the highest employment creation potential are: transport equipment, wood and paper products, metal products, and furniture. Some suggestions are also made regarding the ways that this information can be utilised in human resource management.

**Keywords:** Manufacturing, job creation, economic geography, shift-share analysis, industrial development

The creation of job opportunities is a constant problem in modern economic systems, especially in economies that are declining. When the economy closes down, or when certain industries close down, it leads to crises on a macro-level. The ability to determine which industries have the potential for future development and creation of employment opportunities is important, but unfortunately not an easy task. In this regard, shift-share analysis of employment can be implemented with ease as a measuring instrument for human resource management. In an attempt to create employment in a sustainable fashion and ensure future growth and development, the results offered by this technique can assist human resource managers and policymakers on a macro-level in making informed and strategic decisions regarding future employment prospects and tendencies.

The technique of shift-share analysis is illustrated with a focus on the development, structure and dynamics of employment in the manufacturing industries of South Africa's Southern District Municipality. This methodology is often applied to studies of economic geography (see for example the Office of Social and Economic Trend Analysis (SETA)'s website - <http://www.seta.iastate.edu/takecharge/shiftshare.aspx?state=IA&fips=19001&cityfips>). The Southern District Municipality of South Africa is located on the south-eastern border of the North West Province and consists of the five local municipalities of Klerksdorp (Matlosana), Potchefstroom, Ventersdorp, Merafong City and Maquassi Hills (Wolmaransstad). Its economy relies mainly on mining and to some extent on agriculture and manufacturing (StatsSA, 2006:12). As gold mining is declining in the area, other sectors have to be developed in order to answer to the future pressures of unemployment and other developmental needs in the area. This study wishes to contribute to the identification of

industries that offer potential and suggest some implications that the results might offer for human resources management.

This paper is structured as follows: The next section discusses the decline of employment in the mining industry and reasons why manufacturing might be a solution to the problem, as well as a literature study that focuses on some of the relevant findings with regard to the subject matter. This provides a problem statement and some motivation as to why this study is necessary. Then attention is directed to the research design, concentrating on the research approach, the database used and the research methodology that centres primarily on shift-share analysis. Thereafter, the results of the study are presented. Here an empirical decomposition of employment within the region is made, distinguishing between the national share effect, industry mix effect, competitive share effect and total regional employment changes, and shifts over time are determined for the various manufacturing industries. Growing and declining sectors are identified to predict employment changes and to analyse the sectors that contribute most to employment creation and growth. Finally, a comparison between the national and provincial analysis was done to ensure that the results were significant and to determine the implications of the results for the Southern District Municipality. The last section provides a summary and discussion of the implications of this study, especially with regard to the management of human resources.

## Declining employment in the mining industry

In 2005, the Chamber of Mines (2005:25) reported that gold production was steadily declining in South Africa, even at a time when the country experienced an economic growth rate of

5.8% (StatsSA, 2008:3). Since 1996, gold production has declined at a steady rate, decreasing by 60.1% during the last decade and, with that, South Africa's contribution as a percentage of total world production of gold has also decreased. "The impact of the low rand gold price, costs and restructuring in certain operations affected the viability of a large proportion of the sector, especially in the first half of 2005. Gold production declined by 13.1% to 297.3 tons, the lowest level of production since 1923" (The Chamber of Mines, 2005). According to Statistics South Africa (2007:6), gold production decreased by 5.2% during July 2007 when compared to July 2006.

The Southern District Municipality (SDM) is a mining-dominated area, but mines have a limited lifespan and most of them are closing down, thereby negatively affecting employment in the region. This is confirmed by Dyason (2005:81) who asserts that the negative GDP growth rate in Klerksdorp (a city in the SDM with the highest number of economically-active people) is mainly due to the decrease in mining activity and the diminished role that mining is beginning to play in the South African economy.

As gold production deteriorates, employment is also declining. The number of workers decreased from 342 439 in 1996 to 137 611 in 2005, representing a decline of 40% (Chamber of Mines, 2005:28). An example is the closing of two mines in Stilfontein, located in the Southern District Municipality, during 2005, where 6 500 miners lost their jobs. Later that year the mines reopened after Simmer & Jack Mines Ltd bought them, but reemploying only 3 000 people (Jansen, 2007:30).

Downscaling and retrenchments in a region lead to anxiety, stress, demotivation, demoralisation and a general decline in productivity and efficiency of workers within the company, as well as in the community (Spector, 2006:351). This may also lead to unrest among trade union members. Badly managed downsizing efforts can easily spill over into a negative image of the company in the eyes of the community in which it operates (Grobler, Wärnich, Carrell, Elbert & Hatfield, 2006:241), obstructing human resource strategies. A large number of unemployed people is also to the detriment of companies and may lead to criminal activity and public unrest.

Conflict management, as well as change management, are therefore essential. According to Grobler *et al.* (2006:246), section 189 of the Labour Relations Amendment Act 12 of 2002 requires a joint consensus-seeking approach. This also makes sense. It is important that companies pay special attention to employees who lost their jobs, and assist them in finding alternative employment (Grobler *et al.*, 2006:241). Communication in an understanding manner and also within a company's external network is important.

It would be to the advantage of the mining and other supporting companies, as well as to the government, if solutions can be found in time. It would be ideal if employees retrenched from one company could be strategically redeployed in other companies with future growth potential. If human resources predictions and future estimates could be carried out timely and action plans, retraining and infrastructure could be conducted in such a way that employees might experience the change as part of their career development (Grobler *et al.*, 2006:249), without any reduction in their quality of life (Grobler *et al.*, 2006:24), it may enhance companies' human resource strategies.

Organisational change and development is not easy to implement (Spector, 2006:352). Insight into the way that industries are going to develop and what their future needs are going to be are necessary beforehand. Addressing these challenges successfully requires accurate, concrete and measurable predictions of the future, and it is in this regard that shift-share analysis offers an effective tool for human resource managers. It provides research instruments that can present quantified, reliable and valid information that is also internally

consist and content viable (Spector, 2006:33-37).

The following section illustrates the value of shift-share analysis, illustrating case examples from literature, and also discuss the reason why manufacturing is regarded as an opportunity for future employment creation.

### Manufacturing as an engine of growth: literature study

To compensate for job losses, some researchers see manufacturing industries as a possible engine of growth, especially with regard to employment opportunities (Kleynhans, 2003:3). In his research of the south-eastern provinces of China, Golley (2002:780) found that above-average performance in manufacturing led to industrial agglomeration and growth. This led to higher growth rates of GDP and *per capita* GDP. Manufacturing in Mexico between 1990 and 2002 did not respond to other economic variables, except chains of industrial clusters and location-specific initiatives (Mollick, Cortez-Rayas & Olivas-Moncisvais, 2006:114).

Currently only 3.2% of the workforce of the Southern District Municipality (SDM) works in the manufacturing sector. In order to improve the economic outlook of the region, diversification of its economic structure should occur (Dyason, 2005:81). Labour force growth is, according to Armstrong and Taylor (2000:114), one of the determinants of output growth in manufacturing and since some industries have more growth potential than others, the particular mix of industries in which a region specialises has an effect on the region's employment and growth performance.

Knowledge concerning growth trends will assist in the understanding of employment patterns at regional level. According to Shearmur and Polèse (2007:454), smaller and more specialised regions need employment opportunities in order to survive. There is no evidence to suggest a straightforward and unique approach to employment creation and retention at local level. However, research has shown that slow-growing areas are usually more specialised in declining industries that are often primary and first-transformation manufacturing (Shearmur & Polèse, 2007:453-461). Shift Share analysis can indicate what specific labour and training facilities might be required for future growth.

Graham and Spence (1998:516) consider shift-share analysis as a most widely-used methodology in regional and urban research. The Social and Economic Trend Analysis Office (SETA) in the USA, for example, has a shift-share calculator, which can analyse chosen data on their website for any state, city or county in America, for use in community and regional planning and management (SETA, 2008). Kobayashi and Roper (2004:430) regards shift-share analysis as a method to measure the effect of the industrial mix and regional share between the growth of a region and the national growth rate. Shift-share analysis is a method used in economic geography to analyse and examine, among others, employment changes and it is a simple tool for disaggregating the components of employment growth (Peh & Wong, 1999:322).

Patterson (1991:211), Bendavid-Val (1993:68) and Ray (1995:21) state that shift-share analysis is a technique of disaggregating regional employment growth into three components, which are the national share, industry mix and regional competitive share. Bendavid-Val (1993:67) takes the point further and regards shift-share analysis as a tool in identifying opportunities for altering the composition of regional economies in order to find a means to improve their performance.

The following section pays attention to the empirical study that was conducted on the various manufacturing industries in the Southern District Municipality (SDM) of South Africa.

## RESEARCH DESIGN

### Research approach

The traditional and static shift-share analysis method was utilised in this study to conduct an empirical investigation and to determine employment patterns and potential in the Southern District Municipality's manufacturing industry. Both the country (South Africa) and the province (North West Province) were used as reference areas. Shift-share analysis was the preferred method for this study because it provides reasonable and easily-interpretable results due to its simple logic, analytical clarity and relatively accessible data requirements (Dinc & Hayes, 2005:375).

### Research methodology

#### Database

The Rex-Database of Global Insight (2007) was utilised in this study. The database provides adequate data series for this study as it provides not only national figures of indicators, like employment and gross value added, but also detail on provincial, municipal and magisterial level, including a breakdown of the various industrial sub-divisions, for example, electrical machinery, basic metals, and food and beverages. To conduct this study the totals of the managerial districts that are located in the Southern District Municipality (SDM) were compiled and used as a single area.

#### Shift-share analysis methodology

Shift-share analysis is defined by the Macmillan Dictionary of Modern Economics (Pearce, 1986:386) as a technique used to analyse regional employment and/or economic growth. The region's actual growth is compared with the national growth rate, showing the growth that would have occurred at the regional level if each industry in the region were growing at the same rate as the national growth rate of that industry. According to Muskens and Koops (2006:3), the "shift" is the differential growth due to the difference between the actual or observed growth and the expected structural growth, while the "share" is the structural growth that would have been observed if each industry in the region grew at the national growth rate. If employment in the region actually grew at a rate of  $G_R$ , the growth that would have been observed if the region grew at the national rate is  $G_E$  and the growth rate of the national economy is  $G_N$ , then the components of regional growth can be calculated as follows: Structural component equals  $G_E - G_N$  - this is an indication of the effect of the region's industrial structure on the growth performance. If this component is positive, then the regional industries are growing faster than the national average economic growth rate, and if this component is negative, then the regional industries are growing slower than the national average economic growth rate and losing jobs.

Shift-share analysis can, according to Lann (2007), be used to show, among others, a region's competitiveness, how well a region's mix of industries is performing, how individual industries and sectors are doing and to analyse the individual industry or the economy as a whole. The residual component,  $G_R - G_E$ , is the "unexplained" part of regional competitive growth that contains region-specific factors. If it is positive, the region is growing faster than its industrial structure would predict. When this component is negative, industrial growth is below the industrial structure's potential.

Dinc and Hayes (2005:376) made the following assumptions regarding the traditional static shift-share model:

- Regional technology is similar to the reference area
- Regional labour is as productive as the reference area
- Regional demand patterns are similar to reference area averages
- The traditional model ignores international and interregional trade

These assumptions are criticised for being too idealistic and remote from real life situations. Mayor and Pérez (2007:545) and Wilson, Chern, Ping and Robinson (2005:165) are in agreement about the inability of the static shift-share analysis to capture changes in the intermediate stages between the initial and the final periods of analysis. This problem is alleviated to some extent by dividing one's research period into more time periods and comparing these intervals, like 1995-2000 and 2000-2005. Graham and Spence (1998:516), Ray (1995:26) and Patterson (1991:214) criticise shift-share analysis for being atheoretical and unable to demonstrate causality. It decomposes employment changes into various components, but cannot determine the cause of regional employment growth and it cannot guarantee or test the separation of the national, industrial and regional variables into statistically-independent variables. The authors of this paper do not necessarily agree with these points of criticism, as the analysis is based purely on averages of location.

Van der Merwe (2006:7) criticised various studies on shift-share analysis for lacking consistency in notation, definitive equations and terminology. However, shift-share analysis remains a useful tool for supplying data to policymakers in order to interpret, among others, changes in the industrial structure of their economies (Wilson *et al.*, 2005:164). Restrictions on the availability of data, especially on a municipal level, make the application of shift-share analysis ideal for this study using the Rex database. Although the shift-share analysis method has some drawbacks, it was preferred in this study as it summarised and identified specific factors that answered the research question.

This study employs a combination of the notation, equations and approaches of Lann (2007), Van der Merwe (2006) and Bendavid-Val (1993). The notation and equations used were adjusted to suit the conditions of this study. Employment growth in the region is disaggregated into three components: national share effect ( $N$ ), industry mix effect ( $M$ ) and the regional competitive share effect ( $S$ ). The sum of these three components gives the total change in regional employment ( $R$ ), thus  $R = N + M + S$  (Mayor & López, 2008:125).

Variable  $R$  represents the total number of employment opportunities added or lost in the region as a net effect of national growth, industry mix and regional components. The region's potential employment growth is represented by  $N$ , assuming that the region's employment is growing at the national average growth rate, while  $M$  is the proportion of regional employment among faster and slower growing regional sectors relative to the national average growth rate, and  $S$  describes how sectors in the region perform relative to the national averages of the same sectors.

The next section considers changes in national employment, the national share effect ( $N$ ), the industry mix ( $M$ ), the regional competitive share ( $S$ ) and the total change in regional employment ( $R$ ). The specific methodology that was followed at each step will be explained as the results unfold.

## RESULTS

### Changes in national employment

The changes in national employment for 1996 to 2006 are summarised in Table 1. The third column of the table gives the total change in employment values. These  $E(V)$  values are the differences between national employment in the final and initial periods of analysis. Where  $E(V)$  is the employment change in absolute terms,  $E^f$  is the total employment in the final period and  $E^i$  is the total employment in the initial period. In Table 1,  $E(V)$  is -30 373, which indicates the total number of employment lost during that time (as the sign is negative in this instance). National average  $E(\%)$  is defined as the growth rate of employment expressed as a percentage.

During the research period, national average growth in employment declined by 2% as indicated in Table 1. However, there were some sectors that experienced positive growth on a national level, namely wood and paper products, metal products, transport equipment and furniture at 26%, 12%, 40% and 13% respectively. In the period under review, these sectors added among them a total of 125 366 new employment opportunities to the economy. Job creation through training on a national front in these industries, for example, might be most efficient.

The total national employment did, however, decline by 30 373 jobs, which implies that the remaining sectors (food and beverages, textile and clothes, fuel and petroleum products, other non-metal minerals, electrical machines and electronic equipment) declined by a total of 155 739 jobs. The largest decline in employment was 44% in electrical machines, while the lowest was food and beverages at -13%. Fuel and petroleum recorded no significant change during the research period, resulting in a national average growth in employment of 0%.

The change in regional employment is considered in the following section.

**Total change in regional employment (R)**

The total change in regional employment (R) is the difference between the total regional employment in the final and initial periods. According to Table 2, R equals -2 345. A negative total employment change (R) suggests a loss of 2 345 job opportunities in the Southern District Municipality region. Total percentage change in regional employment R (%) is the growth rate of employment expressed as a percentage.

According to Table 2, R (%) is -24%. This figure represents a decline in the region's employment. Comparing this figure to the national average growth rate of -2% (Table 1), it can be observed that the region's employment growth rate in manufacturing is declining twelve times faster than the national average. Specific interventions with regard to job creation in this municipal district is therefore necessary.

The changes in regional employment for the Southern District Municipality for the period 1996 to 2006 are summarised in Table 2. The data in Table 2 indicates that employment declined for all sectors, except the transport equipment sector, which increased by 6%. The highest decline, 56%, is in electrical machines, while the lowest decline, 5%, is recorded in the wood and paper products sector.

The following section considers the difference in regional and national employment growth.

**National share effect (N)**

The national share effect shows the extent to which regional employment would have grown had each of its sectors and, therefore, the total region, grown at the same rate as the national average employment growth. The national share effect (N) is estimated as:

$$N = e^{t_1}[E \%] + e^{t_2}[E \%] + \dots + e^{t_n}[E \%] \quad (\text{eq. 1})$$

Where N is the national share of the manufacturing industry, e is the regional employment in sectors 1, 2 . . . up to n in the initial period t<sup>i</sup> and E % is the national average employment growth rate.

Table 3 shows the values of the national share effect (N) of the Southern District Municipality for 1996 to 2006. The internal composition of the various industrial sectors within a region also has an effect on the shifts in the labour figures and is considered in the next section.

**TABLE 1**  
Changes in national employment in South Africa

SECTOR	Employment		Employment Change	
	1996	2006	Value E(V)	Percentage E %
Food & beverages	221426	192355	-29071	-13
Textile, clothes & leatherworks	260112	189571	-70541	-27
Wood & paper products	165959	209605	43646	26
Chemical fuel & petroleum products	177349	177137	-212	0
Other non-metal minerals	75687	61187	-14500	-19
Metal products	276446	310322	33876	12
Electrical machines	86689	48533	-38156	-44
Electronic equipment	24090	20831	-3259	-14
Transport equipment	96274	134385	38111	40
Furniture	73105	82838	9733	13
<b>TOTAL</b>	<b>1457137</b>	<b>1426764</b>	<b>-30373</b>	<b>-2</b>

Source: Rex Data, 2007 (Raw data used in our calculations to derive these figures)

**TABLE 2**  
Changes in regional employment in the Southern District Municipality

SECTOR	Employment Numbers		Employment Change	
	1996	2006	R	R (%)
Food & beverages	3051	2096	-955	-31
Textile, clothes & leatherworks	532	311	-221	-42
Wood & paper products	610	581	-29	-5
Chemical, fuel & petroleum products	1589	1194	-395	-25
Other non-metal minerals	786	470	-316	-40
Metal products	1978	1748	-230	-12
Electrical machines	147	64	-83	-56
Electronic equipment	169	105	-64	-38
Transport equipment	382	406	24	6
Furniture	635	559	-76	-12
<b>TOTAL</b>	<b>9879</b>	<b>7534</b>	<b>-2345</b>	<b>-24</b>

Source: Rex Data, 2007 (Raw data used in our calculations to derive these figures)

From Table 3 the total national share effect is -198. Thus, the region would have lost 198 jobs in the period under review if it grew at the national average growth rate of -2%. However, the actual decline in the region is 2 345, which is approximately twelve times the total national share effect of 198. Therefore, something in the regional manufacturing happened that resulted in a total difference of minus 2 147 [-2 345-(-198)] between the national and the regional sectors. According to the methodological section of the research design above, this difference is captured in the last column of Table 3 and is accounted for by the industry mix (M) and the regional competitive shares (S), as:

$$R = N+M+S$$

then  $R-N = M+S$   
but  $R-N = -2147$  therefore  $M+S = -2147$  (eq. 2)

The extent to which the region deviates from the national average growth rate is attributable to the fact that the regional manufacturing industry includes sectors that are growing faster and slower than the national growth rate. This is illustrated in Table 4 and is considered in the next section.

**Industry mix effect (M)**

The industry mix effect (M) of the Southern District Municipality from 1996 to 2006 is summarised in Table 4. The industry mix component shows how the region's industrial structure factors into its overall employment growth performance (SETA, 2008:2). When local employment is concentrated in the fast-growing sectors, the rate of local employment growth would exceed the national average. If the regional employment was concentrated in slow growing sectors, the growth rate of regional employment would be lower than the national economy-wide average.

The industry mix effect is calculated as a product of the region's sectoral employment in the initial year and the marginal rate of growth. The marginal rate of growth (MR) is the difference between the national sectoral growth and the national average growth (third column in Table 4).

The total regional industry mix (M) equals 51 according to Table 4. This positive figure suggests that the region's industrial structure is such that there is a high concentration of employment in sectors that are growing faster than the national average growth rate. The region's industrial structure is contributing positively to the overall employment growth by offsetting the loss of 198 jobs due to the national share effect by 147 (-198 + 51) (see Table 5). In this way, the industry mix had a soothing effect by minimising job losses in the region.

Sectors that have a positive industry mix are growing faster than the national average growth rate and those that are negative are growing more slowly. Table 4 indicates the fast-growing sectors as wood and paper, fuel and petroleum, metal products, transport equipment and furniture. The province has some advantage in this regard and human resource managers should capitalise on these industries, strengthening their human capital. The slow-growing sectors, according to Table 4, are food and beverages, textile and clothes, other non-metal minerals, electrical machines and electronic equipment.

Every region has specific characteristics, which presents it with a particular competitive edge and this has an influence on the employment trends and changes of that region. The regional competitive share effect of the industries in the region therefore influences the employment dynamics of the region and this is considered in the following section.

**Regional competitive share effect (S)**

The regional competitive share effect describes how sectors in a region perform relative to the national averages of the same sectors. This is calculated by multiplying the base year employment in each regional sector with the margin between the regional sector's growth rate and the national average growth rate of that sector (SETA, 2008:2).

This is simply the difference between R, N and M. A positive regional competitive share effect suggests that the region increased its share of employment in that industry, while a negative competitive share component suggests that the region's employment share eroded during the period under investigation (Mayor & López, 2008:125).

According to Table 5, the negative total regional competitive share effect suggests that the region's employment declined by 2 198 job opportunities (as -2 345 - (-198) -51 = -2 198). All the sectors indicate negative figures, implying that all sectors experienced job losses due to the regional competitive share effect, except for transport equipment, which has a positive

**TABLE 3**  
National share effect (n) in the Southern District Municipality

SECTOR	1996	N	R	R - N
Food & beverages	3051	-61	-955	-894
Textile, clothes & leatherworks	532	-11	-221	-210
Wood & paper products	610	-12	-29	-17
Chem., fuel & petroleum products	1589	-32	-395	-363
Other non-metal minerals	786	-16	-316	-300
Metal products	1978	-40	-230	-190
Electrical machines	147	-3	-83	-80
Electronic equipment	169	-3	-64	-61
Transport equipment	382	-8	24	32
Furniture	635	-13	-76	-63
<b>TOTAL</b>	<b>9879</b>	<b>-198</b>	<b>-2345</b>	<b>-2147</b>

Source: Rex Data, 2007 (Raw data used in our calculations to derive these figures)

**TABLE 4**  
Industry mix effect (m) in the Southern District Municipality

SECTOR	Employment Growth %				
	National Sector	National Average	MR	e <sup>n</sup> (1996)	M
Food & beverages	-13	-2	-11	3051	-336
Textile, clothes & leatherworks	-27	-2	-25	532	-133
Wood & paper products	26	-2	28	610	171
Chemical, fuel & petroleum products	0	-2	2	1589	32
Other non-metal minerals	-19	-2	-17	786	-134
Metal products	12	-2	14	1978	277
Electrical machines	-44	-2	-42	147	-62
Electronic equipment	-14	-2	-12	169	-20
Transport equipment	40	-2	42	382	160
Furniture	13	-2	15	635	95
<b>TOTAL</b>				<b>9879</b>	<b>51</b>

Source: Rex Data, 2007 (Raw data of the database used to derive these figures).

regional competitive share of 192, which translates into 192 new jobs to the region. In fact, the SDM- region has a very large competitive disadvantage and human resource managers have to focus on measures that could improve the competitiveness of the industries by improving the efficiency of their human capital, through improvement in productivity, ergonomics and further training, for example.

Next to the regional competitive share effect, Table 5 also summarises the national share effect, industrial mix effect and the total change in employment, as well as the shift-share effects on employment in the individual sectors, on which the following section is based.

**TABLE 5**  
Regional competitive share (s), industry mix (m), national share (n) and total change in regional employment (r) in the Southern District Municipality

SECTOR	1996	2006	R	N	M	S
Food & beverages	3051	2096	-955	-61	-336	-558
Textile & clothes	532	311	-221	-11	-133	-77
Wood & paper products	610	581	-29	-12	171	-188
Chemical, fuel & petroleum products	1589	1194	-395	-32	32	-395
Other non-metal minerals	786	470	-316	-16	-134	-166
Metal products	1978	1748	-230	-40	277	-467
Electrical machines	147	64	-83	-3	-62	-18
Electronic equipment	169	105	-64	-3	-20	-41
Transport equipment	382	406	24	-8	-160	192
Furniture	635	559	-76	-13	95	-158
<b>TOTAL</b>	<b>9879</b>	<b>7534</b>	<b>-2345</b>	<b>-198</b>	<b>51</b>	<b>-2198</b>

Source: Rex Data, 2007 (Raw data of the database used to calculate these figures)

### Sectoral analysis

Analysis of the individual manufacturing sectors of the Southern District Municipality was done in this section, with reference to Table 5, which resembles the equation  $R = N + M + S$ . For example, the transport equipment sector has a positive total change in regional employment of 24.

The transport sector did, however, lose some jobs due to the national share effect (-8) and a lot due to an unfavourable industrial mix (-160); but due to its strong regional competitive share effect (+192) it was able to enjoy a net growth in employment. This increase in employment is determined as:  $24 = -8 + (-160) + 192$ ; hence the number of job opportunities in this sector in 2006 was:  $406 = 382 + 24$  as compared to 382 during 1996. The other individual sectors are analysed in a similar manner.

Investigating the various industrial manufacturing sectors of the SDM municipal district individually, it can be inferred that the sectors with the highest employment creation potential are transport equipment, wood and paper products, electronic equipment, electrical machines and furniture. These sectors experienced the lowest decline in employment during the decade investigated.

When the relative size of the individual sectors is taken into consideration, the top performers are still important, except for electronic and electrical machinery and equipment, which performed far worse, while metal products and fuel and petroleum products move up to the third and fifth spaces, respectively (see Table 6). This does not mean that other sectors are less important, but that the above-mentioned sectors are outstanding and deserve special attention because they are capable of enhancing the much-needed industrial growth and development in a region that was previously dominated by mining, which is declining at an alarming rate.

Table 6 illustrates the size of job creation or losses relative to the particular sector. This enables *per capita* comparisons between sectors. Table 5 might give the wrong impression when a very large sector experiences some growth in absolute terms. For example, furniture and electrical machinery lost approximately the same number of workers (76 & 83) during the past decade

(see Table 5), but the furniture sector is approximately four times larger than the electrical machinery sector. Table 6 therefore shows a decline of only 12% in furniture employment, but electrical machinery lost 56.5% of the jobs in that particular sector. Table 6 also shows the growth rate share that each effect (N, M & S) has on the whole (R). This also enables ranking of the various industries in terms of the various effects.

It can be seen from Table 6 that the sector for transport equipment experienced the highest job creation rate, both in total figures, as well as in the share, relative to the size of the particular sector (6.3%). Training and other measures improving the productivity of human capital and supply of artisans to this sector should therefore be a priority for human resource managers to ensure employment and resettlement opportunities in the future.

On the other hand, the non-metallic metals sector experienced an absolute job loss of 316 jobs, which implies that it lies in the eighth place of these ten manufacturing sub-sectors. However, Table 6 shows that this sector ranks best in the SDM-region when it comes to the national share effect, as well as the regional competitive share effect.

In relation to the industrial mix in this region, transport was second best, with electronic equipment in the first place and chemicals, fuel and petroleum products third. This is probably due to the university, colleges and other educational and research institutions in the region.

With regard to the effect of the national share, the transport sector was the worst of all sectors with its competitive share effect only in the sixth place. If this sector is to be favoured in future, these challenges will have to be addressed.

In relation to all the other effects, the electronic equipment sector is wanting when it comes to the creation of employment, and does not deserve much attention in the region.

The wood and paper products sector was identified as the second strongest job provider, but its national share and industrial mix both ended in seventh place. The industrial mix and regional competitive share of the sector for metal products also deserve attention. When the size of the sector is taken into consideration, electrical machinery has a very low job creation potential with regard to all the various share effects. Leading sectors in the region, with regard to the regional competitive share effect, are non-metallic minerals, wood and paper, and textiles and clothing. In conclusion, it seems that with regard to absolute figures or in relation to the size of particular sectors, the sectors with the highest future employment creation potential are transport equipment, wood and paper products, metal products, and furniture, in order of merit, although non-metallic products also has some advantages in its favour.

### Other aspects of the study

A similar study was conducted using the gross value-added or gross regional products of the various sectors in the SDM-region and similar results were obtained.

The study also considered the shift-share analysis changes of manufacturing in the Southern District Municipality by comparing the industries in the region to national and provincial data. As with the case where value-added data was concerned, it also confirmed the findings above.

## DISCUSSION

In this study, shift-share analysis of employment was proposed as a measuring instrument for human resource management. The results obtained through this technique can assist human resource management on the macro-level in making informed and strategic decisions regarding future employment practices and trends.

**TABLE 6**  
Percentage contribution to the relevant sector

SECTOR	1996	2006	R	R-growth rate from 1996	N%Δ	M%Δ	S%Δ	R=N+M+S %
Food & beverage	3051	2096	-955	-31.3	-2.00	-11.0	-18.3	-31
Textile & clothes	532	311	-221	-41.5	-2.07	-25.0	-14.5	-42
Wood & paper	610	581	-29	-4.8	-1.97	28.0	-30.8	-5
Chemical & petroleum	1589	1194	-395	-24.9	-2.01	2.0	-24.9	-25
Other non-metal	786	470	-316	-40.2	-2.04	-17.0	-21.1	-40
Metal products	1978	1748	-230	-11.6	-2.02	14.0	-23.6	-12
Electrical machines	147	64	-83	-56.5	-2.04	-42.2	-12.2	-56
Electronic equipment	169	105	-64	-37.9	-1.78	-11.8	-24.3	-38
Transport equipment	382	406	24	6.3	-2.09	-41.9	50.3	6
Furniture	635.0	559.0	-76.0	-12.0	-2.05	15.0	-24.9	-12.0

Source: Rex Data, 2007 (Raw data used in our calculations to derive these figures)

As an illustration the structure and dynamics of employment in the manufacturing industries of the Southern District Municipality (SDM) of South Africa were investigated, using the methodology of shift-share analysis.

Alternatively, productivity or competitiveness indexes could have been estimated for the various sectors in the region (e.g. Kleynhans, 2006:61), or viable clusters could have been identified (e.g. Suleman, 1998), or micro-economic optimal location estimates could be determined. This might be advisable for further research, especially if those indexes are based on information obtained from new industrial surveys. Shift-share analysis was, however, preferred for this study because it disclosed spatial shifts of employment in the context of the economic geography over time. It also broke it down to the individual sub-sectors and revealed specific effects that explain these dynamics. It indicated the national effect on labour in the region, as well as the effects of the region's industrial mix and competitive share on the creation of labour.

The results obtained can be utilised in human resource management. They enable managers to predict future trends and potential of industries. Conflict and change management can be eased if employees can be redeployed after retrenchment to sectors where there is a demand for their skills. This would be to the benefit of the workers and is fair to them. It may be regarded as a continuation of their careers, and even promotion (Grobler *et al.*, 2006:303). It will also enhance the motivation, productivity and efficiency of the remaining employees in the company (Spector, 2006:351).

When large numbers of workers start losing their jobs, as is the case in the mining and related industries in the Southern District Municipality (SDM), government has a responsibility to assist these people and the companies involved, in order to create employment and evade criminal activity and public unrest. In co-operation with companies in the region government can, for example, disseminate information regarding investment opportunities in the industries that have been identified using shift-share analysis, and provide supporting infrastructure, finance, vocational and industry related training and training facilities. This will also alleviate the shortage of trained artisans and technical personnel in the country (Kleynhans, 2006:60). This will also be an investment for government as the funds spent on the improvement of human capital resources will later be saved by social support services, and will lead to larger returns to government, through taxes on the income of those workers that gained alternative employment in the

identified industries. It will also motivate workers, increasing productivity, and will improve the image of government.

The rationale for this study was based on the fact that the SDM-region is highly dependent on gold mining, and production is declining as their gold reserves are becoming depleted. This trend has persisted over a long period: as Spadavecchia (2007:44) reports, the total mining production for the three months ending in July 2007, after seasonal adjustment, decreased by 1% compared to the previous three months. According to StatsSA, this was owing to a decrease of 1.7% in the production of gold and a decrease of 0.9% in the production in non-gold minerals. In 2005, nine mines employing 69 061 workers and producing 125 tons annually, were in a marginal or loss-making position. This means that a large section of the people in the area will be unemployed in the near future if this and other accompanying development needs are not addressed in time. This study aimed at identifying industries that offer potential for future employment growth.

To summarise, this study found that the sectors with the highest employment creation potential in the SDM-region are transport equipment, wood and paper products, electronic equipment and electrical machines, and furniture, and they merit attention in future development initiatives. When the relative size of the individual sectors are taken into consideration, these top performers are still important, excluding electronic and electrical machinery and equipment, which did far worse, while metal products, as well as fuel and petroleum products rise in importance.

The transport equipment sector experienced the highest job creation rate, both in total figures as well as in the share, relative to the size of that particular sector. On the other hand, the non-metallic metals sector experienced the worst absolute job losses in relation to most sectors, but this sector ranked best in the SDM-region when it comes to the national share effect, as well as the regional competitive share effect. In relation to the industrial mix in this region, transport was second best, with electronic equipment in the first place and fuel and petroleum products third. With regard to the national share effect, the transport sector was the worst of all the sectors with its competitive share effect only in the sixth place. If this sector is to be favoured in future, these challenges will have to be addressed. In relation to all the other effects, the electronic equipment sector is wanting when it comes to the creation of employment, and does not deserve much attention.

Finally, wood and paper products was the second strongest job provider, but with regard to the national share and its industrial mix, employment opportunities were lost in both. The industrial mix and regional competitive share of the sector for metal products also deserve attention. In relation to the regional competitive share effect, the leading sectors in the region are non-metallic minerals, wood and paper, and textiles and clothing. In conclusion, it seems that with regard to absolute figures and in relation to the size of particular sectors, the sectors with the highest future employment creation potential are transport equipment, wood and paper products, metal products, and furniture, in order of merit, although non-metallic products also has some advantages in its favour. These findings have clearly illustrated the value that shift-share analysis can offer to human resource management and future strategic planning formulation.

#### AUTHORS' NOTE

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