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## A PERSPECTIVE ON PARTIAL AND TOTAL PRODUCTIVITY AS MEASURED AT TSB - AGRICULTURAL DIVISION

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### Abstract

Productivity measurement techniques can be categorized in partial and complete measurements depending on the technique used. Complete measurement requires the use of both physical and financial data in analysis and the possibility to reconcile back to the financial statements of the organisation. At farm production level partial measurements are normally used to measure the productivity of certain aspects in the production process. The danger exists that interpretation from partial measures may be biased and consequently lead to sub-optimum decisions. This may be the case where labour is substituted with machinery where the gain in labour productivity is not offset against the productivity loss in capital. The relevant importance of the available measurement techniques at the different hierarchical levels in the organisation, is indicated. From the discussion it will be evident that complete productivity analysis enhances a holistic approach towards business decision making. It is also important to follow a longer term orientation towards productivity measurement and improvement. Uncontrollable factors may have a negative effect on productivity in the short term. A trend line over time will indicate the success or failure of the organisation to reach productivity improvement.

### 1. Introduction

To reach the goal of continuous productivity improvement a comprehensive view of the business and the environment it operates in are necessary. Factors from the internal and external environment that will effect the probable outcome of profits must be recognised and considered when referring to productivity measurement and improvement.

At the operational level it may be possible to increase productivity over relative short periods until the optimum phase is reached. It is however the actions and decisions taken by top management that contribute to a much larger extent to productivity improvement over the longer term. To illustrate this point, consider the increase in cane production per hectare over the past hundred years. From the graph shown in Figure 1, it is evident that production has increased by leaps rather than gradual over the period. This is recognised as periods when some external factors were introduced into the industry. For example the introduction of new cane cultivars, or an improved method of cane crushing or advanced extraction methods of sugar from cane, the introduction of mechanised farming, inorganic fertilizers, mechanisation of the irrigation process, etcetera. Decisions to implement new technology into the production process, or to restrict increases in spending in correlation with the increase in turnover, are some of the major contributors towards productivity improvement. In the end it will be the operators that must ensure efficient utilization of measures and technology introduced.

From the above it is evident that there are more contributors towards productivity improvement than only the operations department. Each layer of management has their own obligation towards productivity improvement.

Complete (total) productivity measurement enhances objective management decision making and provides a more holistic approach towards the organisation. A productivity problem area can only be effectively solved

after all factors influencing the subject were investigated and the common denominator isolated.

The aim of this paper is not to extend on figures of productivity measured in the agricultural division at TSB, but rather to enhance perception on the importance of a holistic approach towards the business measured to ensure :

- objective measurement;
- that productivity improvement is the duty of everybody (not just the lower hierarchy workers); and
- different measurement techniques, measure different things in the organisation.

### 2. Materials, methods and procedures

The theory of financial ratio analysis, partial productivity measurements and complete productivity will be briefly discussed. Financial ratio analysis used by organisations measure the optimal use of capital. Through the intelligent interpretation of the numerous ratios available it is possible to develop insight into some important shortcomings in the organisation. Financial ratios are divided into basically four categories of measurement, i.e. to measure liquidity, solvability, activity and profitability in the organisation. The theory of financial ratio analysis can be best explained when applied to a practical situation as it will be discussed under the next heading. In financial ratio analysis all aspects of productivity and price recovery are included. It is thus not possible to isolate productivity alone. The separation of the relevant physical's and value's is necessary to properly deal with productivity. Productivity in an analysis deals with the physical aspects of production.

Farm production level measurements for example, ton cane harvested per man day, diesel used per ton sucrose and fertilizer used per ton cane, are all partial productivity measurements.

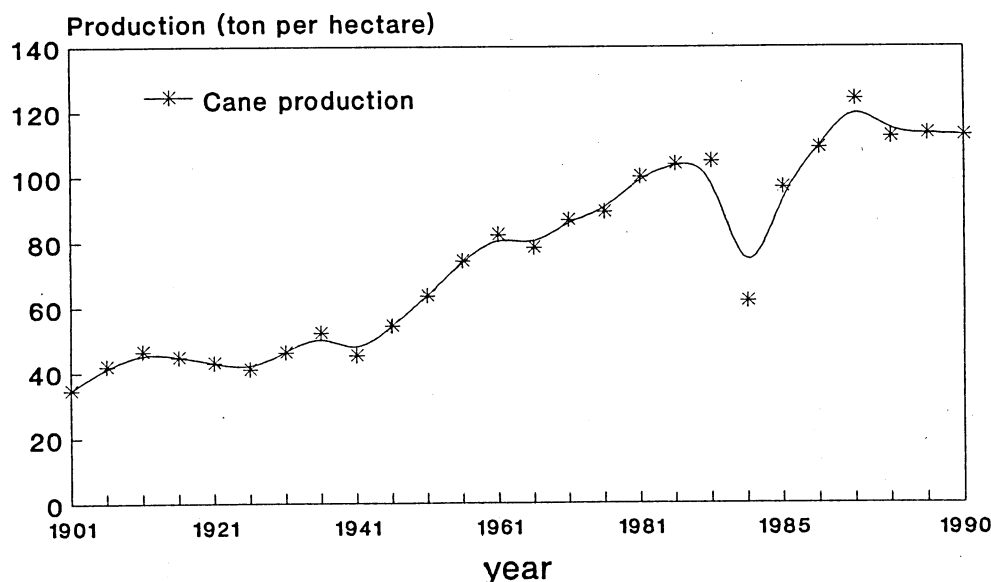


Figure 1: Sugar cane production

The objective matrix developed by the National Productivity Institute (NPI), an example of a partial measurement technique, provide the possibility to combine the individual measurements. By attaching weights to the individuals a more comprehensive and objective measurement is possible. After some experimentation to determine the correct measurement criteria in a specific industry, the matrix is relatively easy to use. A practical exercise will be discussed under the next section.

Complete measurements are considered when the productivity measurement technique used will reconcile back to the income and balance sheet statements of the organisation. A technique developed by the NPI, The Resource Allocation Strategist (REALST) provide the tools to combine financial, physical and price changes from one financial year to the next. The REALST model also contribute towards strategic management decision making analysis. Complete productivity measurement can be best explained by two illustrations developed by the NPI. The first illustration in Figure 2, the nine block model, emphasize the separation of physical's and values from the revenues and costs in financial statements. The five block model in Figure 3 explains that productivity have two sides, ie. the change in capacity utilisation on the one side and efficiency on the other side. Capacity utilisation applies to the scale of economics utilised at organisation level and by efficiency to complete repetitive actions faster and better in future.

The profitability ratio, "return on investment" (ROI) can be seen as a measure of the overall productivity of the firm, ie.  $ROI = \text{Profits} / \text{Assets used} = \text{Output} / \text{Input} = \text{Productivity}$ .

This now provides the link between the financial statements in the organisation and productivity. Thus, like most tactical and strategic decisions, pricing decisions can influence the productivity of a firm. This is clearly

illustrated via the REALST model. This shows that profits not only comes from the normal financial relationship between sales revenues and costs, but also from the relationship between productivity and price recovery (the relationship between the prices you pay for labour, materials, etc. and the price you charge for your goods or services). Profit (and possibly return on investment) can thus be increased by increasing productivity or by over-recovering on prices. However price over-recovery has numerous negative implications. It promotes inflation and from a strategic viewpoint it encourages new competitors to enter your market.

### 3. Results

For a full interpretation of financial ratio's a separate paper will be necessary. In this paper only very brief explanations will be given to put ratio analysis in perspective to the productivity concept. To enhance interpretation a regression line is drawn for each ratio. The results must be read together with Figures 4 to 7 and Annexure 1.

#### Liquidity Ratio's

Gives an indication of the ability to pay back current liabilities. The trend shows a positive increase in liquidity.

#### Solvability

Indicates the extent of external capital used. Total and long term debt is decreasing, while interest bearing debt is increasing.

#### Activity Ratio's

Indicates stock turnover, debtor's and creditor repayment periods.

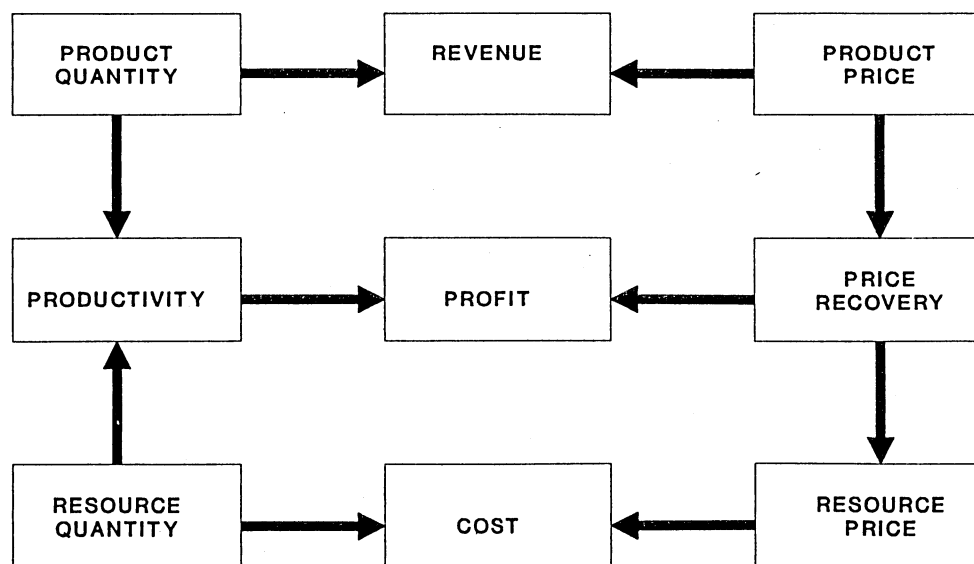


Figure 2: REALST model (Nine block model)

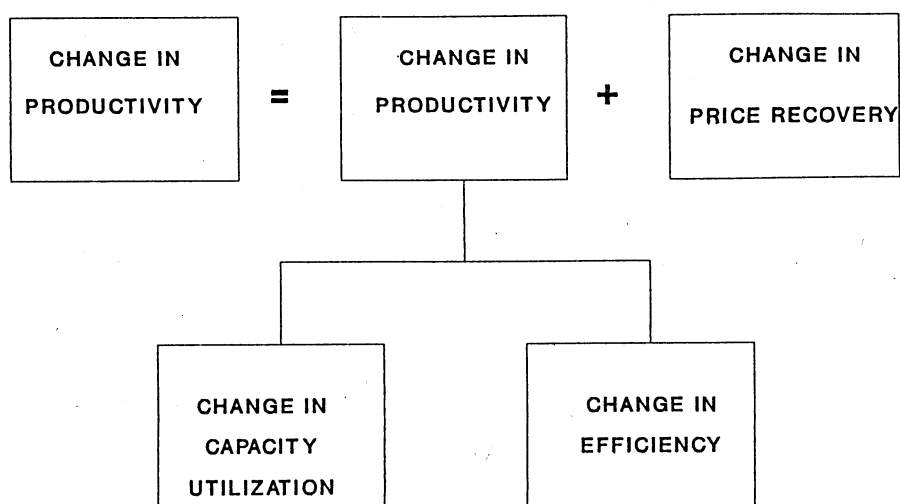


Figure 3: REALST model (Five block model)

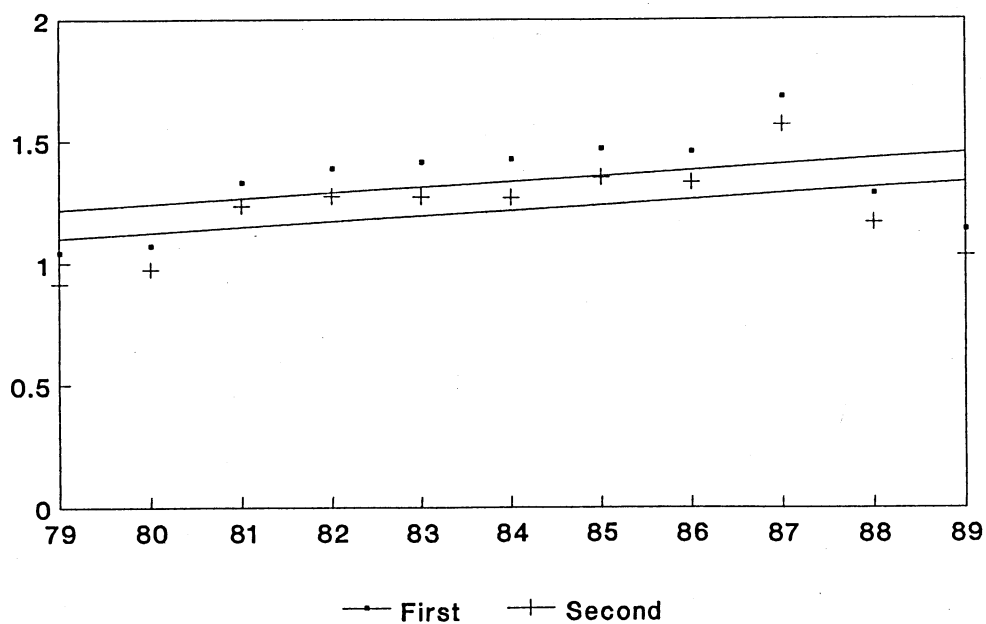


Figure 4: Transvaal Sugar Limited liquidity ratio

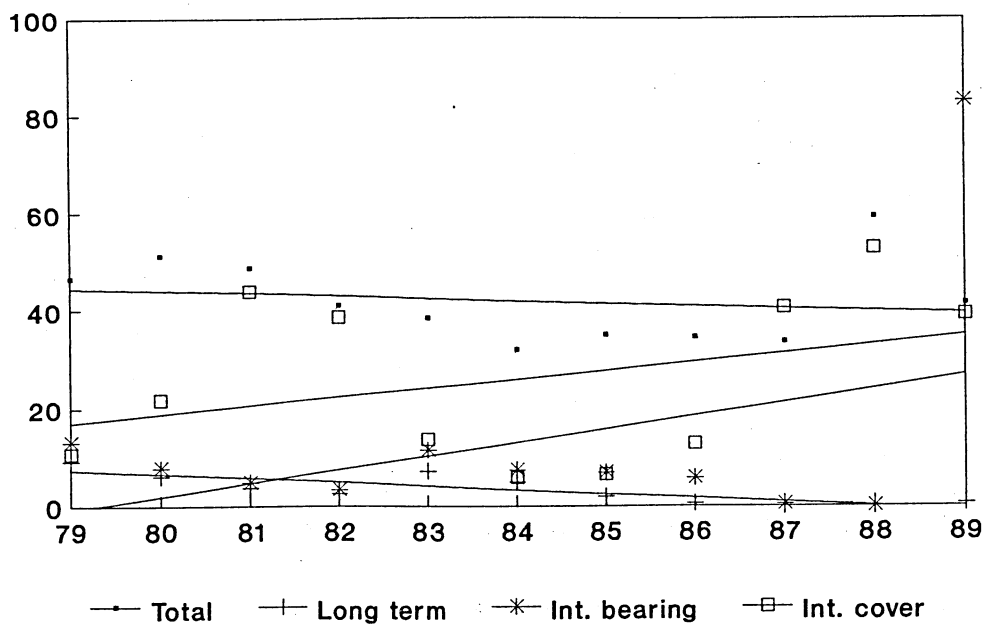


Figure 5: Transvaal Sugar Limited solvability

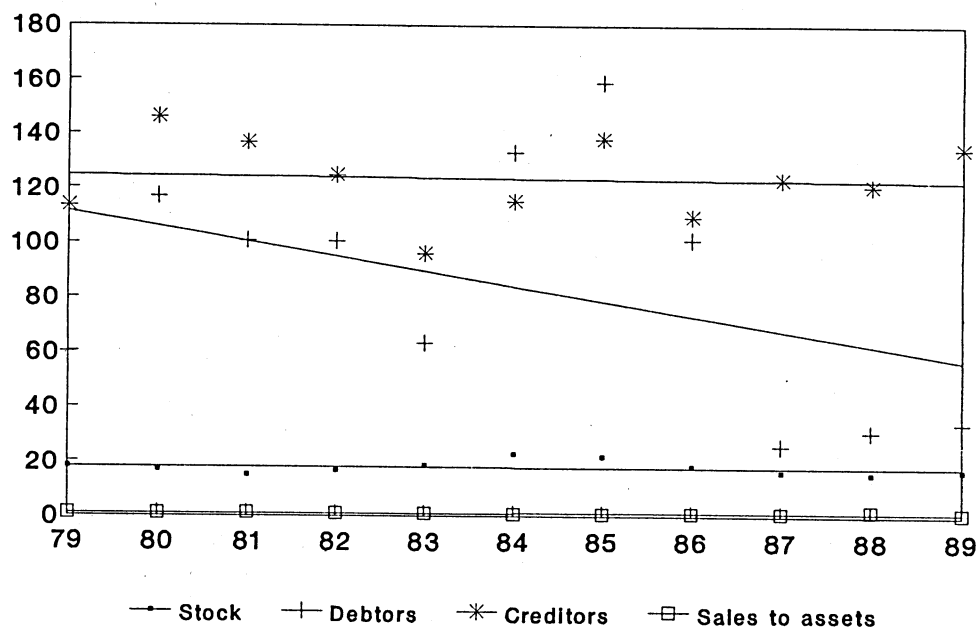


Figure 6: Transvaal Sugar Limited activity ratio

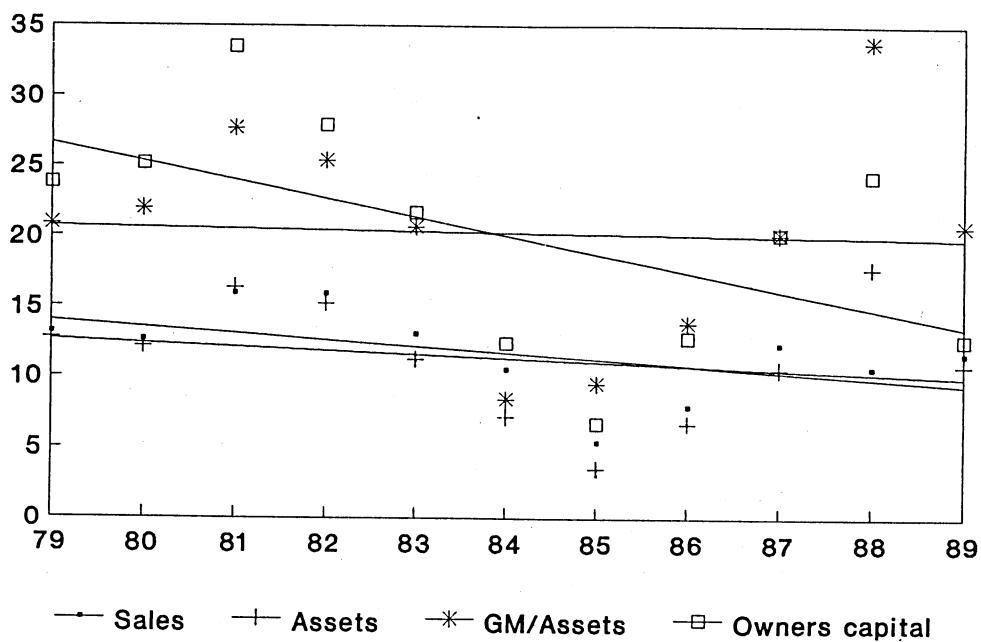


Figure 7: Transvaal Sugar Limited profitability

In this case stock turnover are very constant over the period. Debtor's repayment are decreasing. Creditor's are constant but highly variable.

### Profitability Ratio's

Indicates the value of profits earned on investment for the various interest groups involved. The most general ratio is return on investment. In this case Net income over Total assets indicates a downward trend.

Partial productivity matrixes are used to determine the productivity of certain aspects of production. Separate matrixes can be completed for different sections or divisions of an organisation. To discuss an objective matrix, results (Table 1) from the 1989/90 actual and 1990/91 forecast for TSB agriculture will be explained. In this matrix the important factors isolated to be measured were cane and sucrose production, total citrus and citrus exported, total dry beans and dry beans sold as seed. To identify a fallacy in this measurement it is important to note that the definition of productivity is the ratio of output to input. In the measurements completed the correct way will be for example to measure the ton cane cut per man day. However if this is considered correct for the moment, the matrix indicate a productivity increase in sucrose and total citrus produced and exported, as well as total bean production. Although some factors measured indicate a decrease in productivity, the overall index indicates a productivity increase of 1.22 from the 100 line.

The REALST model was applied to the agricultural division at TSB comparing the 1988/89 and 1989/90 financial years. The model were structured to measure the contribution of the major crops produced, ie. sugar cane, citrus, dry beans and productivity increase in citrus (1.43%), litchis (191.4%) and a decrease in sugarcane (1.43%) and dry beans (121.7%). The overall productivity increase were 0.32%. To explain this model in full is a subject for another day.

It must be clear by now that each method has it's own application relevance in the organisation. Financial ratio's may be of relevance to top management, but will be of little use to the production manager who tries to run his plant as efficient as possible. To them partial measures will be the most appropriate. The REALST model stands in a category of it's own and depending on the detail of data input and structure of analysis used it can provide answers to all layers of management at the same time. The major advantages of this model is that:

- all inputs and outputs are measured simultaneously;
- productivity changes that may be beneficial to one department may be detrimental to another. This can now be determined and calculated. In agriculture this is especially the situation where labour is substituted to machinery.
- All layers of management can be involved at the same time to discuss the organisation productivity strategy.

### 4. Conclusion

The purpose of this paper was to give a broad outline on the techniques available and the use of the relevant techniques at the different levels of management. The techniques all have limitations and do not provide clear cut answers. It is very important however to measure on a regular interval and be continuously aware of technological or other changes that will influence the results. The role of management to choose and evaluate the relevant techniques and data used can not be underestimated and it may be necessary to involve external communication from outside the organisation to ensure continuous objective measurement.

Table 1: Objective matrix for TSB Agricultural Division (89/90 actual to 1990/91 forecast)

Cane ton per hectare	Sucrose ton per hectare	Citrus ton per hectare	Citrus ton per hectare	Beans ton per hectare	Beans ton per hectare		
140	16.10	53	2100	2158	1795	130	
131	16.00	51	2000	2108	1740	125	
129	15.90	49	1900	2058	1685	120	
127	15.80	47	1800	2008	1630	115	
125	15.70	46	1700	1958	1575	110	
123	15.60	45	1600	1908	1520	105	
121	15.50	44	1500	1858	1465	105	
119	15.40	43	1400	1808	1410	104	
117	15.30	42	1300	1758	1355	102	
115	15.20	41	1200	1708	1300	101	
112.51	15.14	39	1136	1658	1272	101	ACTUAL
110	15.00	37	1100	1600	1200	99	
109	14.95	35	1050	1500	1145	98	
108	14.75	33	1000	1400	1090	97	
107	14.55	31	950	1300	1035	96	
106	14.35	29	900	1200	980	95	
105	14.15	27	850	1100	925	90	
104	13.95	25	800	1000	870	85	
103	13.75	23	750	900	815	80	
102	13.55	21	700	800	760	75	
101	13.35	19	650	700	700	70	
100	102	101	105	105	96		SCORE
20	60	2	6	2	10	100	WEIGHT
20	61.2	2.02	6.3	2.1	9.6		VALUE
						101.22	INDEX



**Annexure 1: Formula's for financial ratio analysis****Liquidity ratio's**

First ratio:	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$
Second ratio:	$\frac{\text{Current Assets Less Stock}}{\text{Current Liabilities}}$

**Solvability ratio's**

Total debt ratio:	$\frac{\text{Total Debt} \times 100}{\text{Total Assets}}$
Long-term debt ratio:	$\frac{\text{Long-term Debt} \times 100}{\text{Total Assets}}$
Interest bearing debt ratio:	$\frac{\text{Long-term Debt} + \text{Bank Overdraft} + \text{Bearing Current Liabilities} \times 100}{\text{Total Assets}}$
Interest cover ratio:	$\frac{\text{Earnings Before Interest and Tax (Ebit)}}{\text{Total Interest Paid}}$

**Activity ratio's**

Stock period:	$\frac{\text{Stock} \times 365}{\text{Cost of Sales}}$
Debtors period:	$\frac{\text{Debtors} \times 365}{\text{Cost of Sales}}$
Sales on assets:	$\frac{\text{Total Sales} \times 100}{\text{Total Assets}}$

**Rentability ratio's**

Nett income over sales:	$\frac{\text{Nett Income after Tax} \times 100}{\text{Total Sales}}$
Nett income over assets:	$\frac{\text{Nett Income after Tax} \times 100}{\text{Total Assets}}$
Gross profit over assets:	$\frac{\text{Earnings before Interest and Tax} \times 100}{\text{Total Assets}}$
Earnings on owners capital:	$\frac{\text{Nett Income after Tax Less Minority Shares Less Dividends on Preference Shares} \times 100}{\text{Owners Capital}}$

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