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Productivity management in the South African civil construction industry – factors affecting construction productivity

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Labour productivity in South Africa is at one of its lowest levels. During 2014 the civil construction industry contributed only 3.5% to the GDP of South Africa. It is faced with challenges such as an industry environment that is increasingly competitive, and organisations in the civil industry that experience financial difficulties, such as low profit margins. An industry-specific survey, using a questionnaire, was conducted to ascertain the perceptions of industry professionals regarding factors which have an impact on productivity. A literature study was done to identify the factors that have an impact on construction productivity, based on a global perspective. From the literature study, 12 studies were identified, and a benchmark was set with which to compare the findings of the research questionnaire.

To obtain the relevant information through the questionnaire, a selective sampling process was used, as the focus of the research required a specific group of individuals who were involved in the management of projects in the civil construction industry. Two civil engineering organisations, the South African Forum of Civil Engineering Contractors and the South African Institution of Civil Engineering, were contacted to assist with the distribution of the questionnaire. The questionnaire consisted of 51 factors which the industry professionals had to rate, based on their experience. These factors had to be rated with the use of a 0–4 Likert scale, based on two specific questions: (1) What impact does the factor have on construction productivity? (2) What is the frequency of occurrence of the factor?

A total of 40 questionnaires were completed by the industry professionals. Thereafter the ranking of the factors was calculated with the use of the relative importance index.

INTRODUCTION

Labour productivity in South Africa is at its lowest in 46 years (Naicker 2014). More alarmingly, South Africa, when compared to its emerging market competitors, is less efficient, and labour productivity here is one of the lowest in the developing world. This contributes to a negative outlook for the economy and the wellbeing of its citizens. The Office for National Statistics in the UK (ONS 2007) states that an increase in productivity is "the key determinant of economic growth".

The civil construction industry contributed only 3.5% to South Africa's GDP during 2014. It is confronted with an industry environment that is increasingly competitive and that experiences perpetually changing conditions (SAFCEC 2014; Langston 2012).

The industry, by nature, is highly labour-intensive, and employs a significant number of unskilled and semi-skilled workers from the communities which are located close to the civil construction projects. The aim of this research, therefore, was to identify the factors which have an impact on the global productivity of the South African civil construction industry and to compare them with international trends. The paper considers a global view of productivity, and not just labour productivity.

FACTORS IMPACTING ON CONSTRUCTION PRODUCTIVITY

Before productivity management can be considered, the concept and definition of both productivity and management have to be understood. Productivity is defined by the Oxford dictionary (2014) as "the state or quality of being productive", and in a general sense is defined as a measure of the output compared to the input. A common mathematical expression for productivity is the output divided by the input (Productivity = Output/Input) (Liou & Borcherding 1986). From this expression it is clear that productivity could

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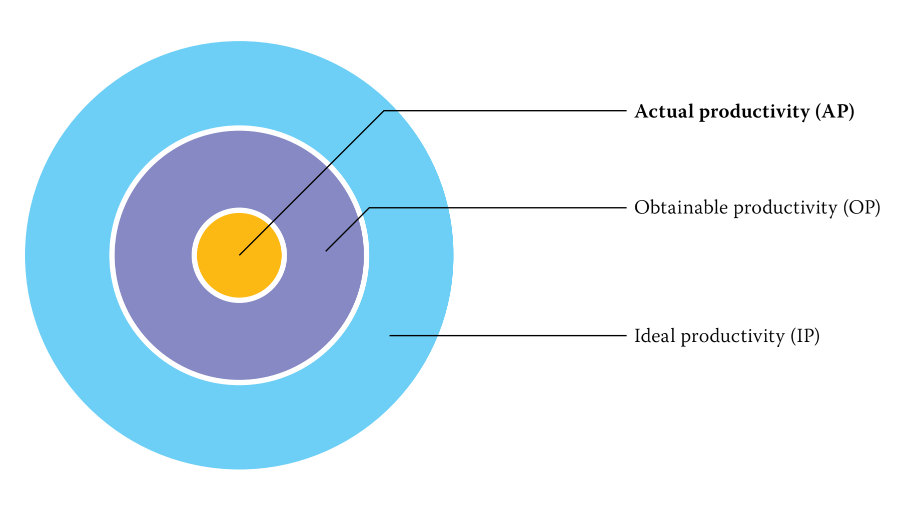

Figure 1 Actual productivity (Kim *et al* 2011)

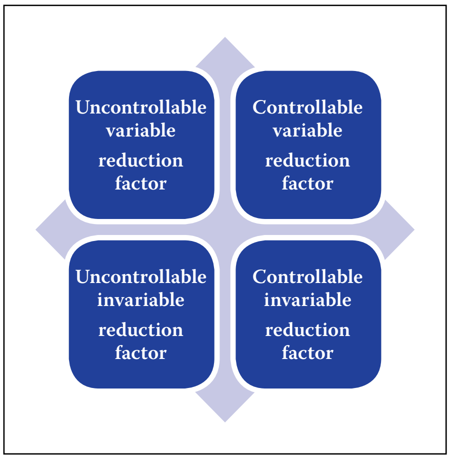

Figure 2 Classification of factors based on controllability and variability (Kim *et al* 2011)

improve if either the output increases with the input staying constant, or if the input decreases and the output remains constant. Management is defined by the Oxford dictionary (2014) as "the process of dealing with or controlling things or people". Productivity management is therefore the process of managing processes and people with the focus on the state of being productive.

Kim *et al* (2011) assume that there are two levels of productivity. On the one hand, they mention productivity that can be achieved in ideal situations, which they call 'ideal productivity' (IP), and on the other hand, realistic productivity which they call 'obtainable productivity' (OP). The productivity that is actually achieved is 'actual productivity' (AP). They further define a reduction factor which represents a factor that inhibits the attainment of a complete IP value. In other words, actual productivity is ideal productivity from which the reduction factor is subtracted. Figure 1 is a graphical representation of the relationship between ideal, obtainable and actual productivity. The aim of improving productivity lies in the actual productivity sector.

Furthermore, Kim *et al* (2011) distinguish between different types of reduction factors, which they call the controlled (C_RF) and uncontrolled (UC_RF) reduction factors. In short, the uncontrolled reduction factors have an impact on ideal productivity, resulting in OP = IP – UC_RF. Optimum productivity is subsequently impacted by the controlled reduction factor so that actual productivity is defined as AP = OP – C_RF. Factors can vary during the project life cycle, while some factors can remain constant; these factors are called variable and invariable, respectively. Figure 2 indicates the relationship of the factors in a matrix format.

The ONS Productivity Handbook (ONS 2007) states that productivity can be seen as the ratio between input and output, and that productivity can be increased through the reduction in input. The labour force is the most common input that is changed to obtain the desired productivity. Unfortunately, this definition of productivity is not suitable in South Africa due to the country's socioeconomic climate where unemployment is a major concern. Moreover, productivity has an impact on several aspects, such as the economy and society in general, and is seen as "the key determinant of economic growth" (ONS 2007). It is therefore critical to identify the factors that have an impact and to fully understand how they can be managed to minimise their effect on construction productivity.

The South African civil construction industry is subjected to fluctuating conditions, such as low turnover, unemployment, erratic tender activities and the liquidation of construction companies (SAFCEC 2014).

Table 1 Factors affecting construction productivity ranked by various authors

Authors	Country	Labour	Management	Site characteristics	Weather	Consultant	Tools & equipment
Abdul Kadir *et al* (2005)	Malaysia		4			2	
Alinaitwe *et al* (2007)	Uganda	2	3		1	1	2
Duryev and Mbachu (2011)	New Zealand	1	5	1		1	
El-Gohary and Aziz (2014)	Egypt	5	7	1	1	1	
Enshassi *et al* (2007)	Gaza Strip	1	3			1	
Horner *et al* (1989)	UK	2	7	1		2	1
Hughes and Thorpe (2014)	Australia	2	10			1	2
Jarkas and Bitar (2012)	Kuwait		2			3	
Kaming *et al* (1997)	Indonesia	1	3				1
Lim and Alum (1995)	Singapore	2	3		1		
Makulsawatudom *et al* (2004)	Thailand	1	6			2	1
Zakeri (1996)	Iran		1		1	1	2
Total		17	54	3	4	15	9

Table 2 Benchmark of top ten factors obtained from literature study

Factor	Category	Ranking
Material shortage	Management	1
Labour experience	Labour	2
Incompetent supervisor	Management	3
Method of working	Management	4
Late issue of drawings	Consultant	5
Poor communication	Management	6
Unforeseen events	Management	7
Poor site layout	Management	8
Constructability	Consultant	9
Rework	Management	10

Table 3 Likert scale used in the questionnaire

Question category	Likert value				
	0	1	2	3	4
Perceived impact	No opinion	No impact	Slight impact	Considerable impact	Great impact
Frequency of occurrence	Never	Seldom	Occasionally	To a considerable degree	Almost always

It is therefore important to identify the factors which have an impact on construction productivity, with the intention of managing their effects.

A literature study was conducted with the purpose of identifying factors that have an impact on construction industries from a global perspective. Twelve studies from the literature were identified that support the research in this article, as indicated in Table 1. The authors studied the impact that certain factors (as identified by industry professionals) have on construction productivity. The factors were grouped into six main categories, i.e. management, labour, consultants, tools/equipment, weather and site characteristics. These factors were categorised to accommodate the factors in the literature, with the aim of setting a benchmark. Three main categories that predominantly occurred in the literature, and which have a perceived impact on construction productivity (as indicated in Table 1), can be identified from the results. The management category is first with the highest number of factors at 54, the labour category is second with 17 factors, and the consultant category is third with 15. These categories were used to create the research questionnaire.

BENCHMARK

The top ten factors of the various authors were combined to set a benchmark that was used to compare the findings of the research questionnaire. The factors were selected according to the findings of the authors, as illustrated in Table 2. They were compared with one another (in the same ranking) and the most dominant factor was selected to represent the specific ranking.

The top ten factors in Table 2 are consistent with the findings in Table 1. There are three main categories, i.e. management, labour and consultants. Management is the dominant category in the list with seven of the ten rankings, which account for 70% of the factors. Consultants constitute 20% of the factors, while the labour category constitutes only 10% of the factors.

RESEARCH METHODOLOGY

The selection of factors was guided by the research that was conducted by the various researchers as per Table 1, as well as the productivity factors that were identified by Arditi (1985). This was done as it considered both the site and head office contribution to productivity. The scope of the study only included the construction phase of the project (start-up to completion and handover); it did not include the inception, design and feasibility study stages of the project. Moreover, the productivity measurements do not consider the impact of the factors on various stages during the construction phase. A holistic approach was adopted to focus the attention of the participants on the overall construction project and not parts of it.

Selection and categorisation of factors

The selection criteria for the factors that were used in the research questionnaire were based on the literature study. Six categories were derived from the literature study, namely management, labour, consultants, tools/equipment, weather and site characteristics. This was done to compare the results from the various authors in the literature study.

Definition of questions and rating scale

The factors in the questionnaire were rated according to a Likert scale, and two categories of questions were asked for each of the factors. The Likert scale was utilised in this research as it is one of the simplest and most widely used scales for research purposes (Othman *et al* 2005). Moreover, as indicated in Table 1, the authors (from the literature study) had also used the Likert scale to conduct their research.

The two questions that were posed to the industry professionals were about, firstly, the perceived impact the factor had on construction productivity, and secondly, how frequently the factor occurred during the project life cycle. A 0–4 Likert scale was used, as indicated in Table 3; the scale for the frequency of occurrence was altered to provide a suitable scale to rate the frequency.

Identification of target audience

Expert sampling was used, as the focus of the research required a specific group of individuals who were involved in the management of projects in the civil construction industry, such as project managers, site agents, engineers, contract directors and managing directors (Salem & Zimmer 2005).

Two industry-relevant organisations were contacted to assist with the distribution of the questionnaire. The first was the South African Forum of Civil Engineering Contractors (SAFCEC), which has a membership of 450 civil construction companies. The second was the South African Institution of Civil Engineering (SAICE), which has 1 460 members in its project management and construction division. The sample distribution in this research only included the industry professionals who were involved in the management of civil construction projects. This therefore excluded design engineers, architects or other industry professionals who operate in the construction industry, but who are not directly involved in the management of a project. Further research should be conducted that would include all industry professionals through the complete project life cycle.

Compilation and distribution of questionnaire

The questionnaire was created using an online survey platform called SurveyMonkey. The online application allowed the participants to access the questionnaire irrespective of their geographical location, and to complete the questionnaire in their own time. A link to the online survey was generated and sent to SAFCEC and SAICE for distribution. The responses to the questionnaire were collected and summarised by SurveyMonkey, generating a summary table with the findings. The data was extracted from the summary table and collated in Microsoft Excel, in which the analysis of the data and the subsequent charts were generated.

Analysis of results

The relative importance index (*Rii*) is used to grade results in terms of severity, and allows different factors to be compared with one another. It was used to compare the scoring of the factors that were captured in the questionnaire by using the Likert scale. The formula for *Rii* is indicated in Equation 1.

$$Rii = \frac{\sum_{r=0}^{4} r * n_r}{4N} \quad (1)$$

where:

r = rating according to Likert scale (0–4)

n_r = number of results of r (Likert scale)

N = number of questions answered in questionnaire

The modified relative importance index (*MRii*), as used in this research, is defined as the average of two *Rii* values which have a linear relationship, as indicated in Equation 2. El-Gohary (El-Gohary & Aziz 2014) modified the *Rii* to calculate the relative importance index for categories based on years of experience, and calculated the category index by taking the average of *Rii* for each factor.

$$MRii = \frac{Rii\ of\ the\ impact + Rii\ of\ the\ frequency}{2} \quad (2)$$

The first stage in analysing the data entailed calculating the *Rii* for each of the factors. This was done for the two main categories of questions. An Excel spreadsheet was used to capture and analyse the data of each of the factors. The second stage entailed establishing if there was a linear relationship between the categories of questions, with the aim of validating the use of the *MRii* (as identified in Equation 2). Bivariate analysis was used to ascertain the relationship. The *Rii* values were plotted on an XY chart, as shown in Figure 3.

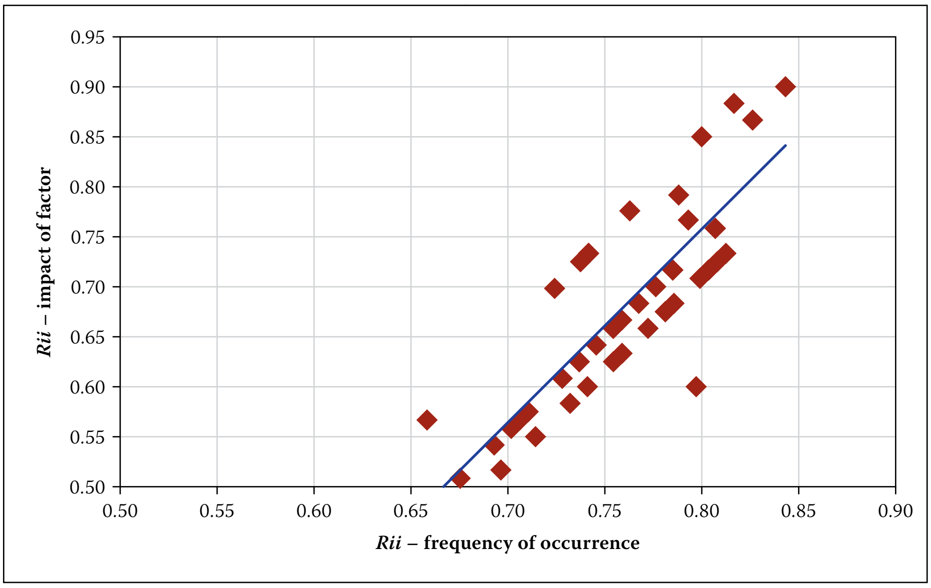

Figure 3 Correlation between frequency and impact of factors

The Y values were selected as the *Rii* of the impact, and the X values were the *Rii* frequency of occurrence. The correlation between the impact and frequency was calculated, and the Pearson's *r* correlation value was at 0.838, with significance at the 0.01 level (two-tailed). This value is close to 1 and thus indicates a strong linear relationship between the impact and frequency (Liu *et al* 2011). In conclusion, the *MRii* can be calculated where the relationship between the impact and frequency is accepted as being linear. The analysis of the results and the subsequent comparison with the benchmark were based on the *Rii* ranking and not on *MRii*; this was done to ensure that the results from the questionnaire could be compared directly with the benchmark. The *MRii* was adopted to introduce a new avenue of thought in which the occurrence frequency of the factors had an additional influence on the impact.

Table 4 Combined top ten findings of questionnaire listed under *Rii* of impact, frequency and *MRii*, sorted based on *MRii*

Factor (combined)	Category	Ranking based on *MRii*	Relative importance index (*Rii*)		
			Impact of factor (A)	Frequency of occurrence (B)	*MRii* (average of A & B)
Late issue of drawings to contractor	Consultant	1	0.900	0.843	0.872
Illegal strike action by project labour force	Labour	2	0.883	0.817	0.850
Delayed reply on RFI (request for information)	Consultant	3	0.867	0.826	0.846
Late issue of specifications and information to contractor	Consultant	4	0.867	0.826	0.846
Civil unrest in vicinity of project	Labour	5	0.850	0.800	0.825
Labour union strike (irrespective of union)	Labour	6	0.850	0.800	0.825
Delayed inspection by consultant	Consultant	7	0.792	0.788	0.790
Management skills of foreman	Management	8	0.758	0.807	0.783
Poor communication between site management and labour force	Management	9	0.758	0.807	0.783
Complexity of design (constructability)	Consultant	10	0.767	0.793	0.780

Analysis of findings

In total, 40 participants (construction management industry professionals) took part in the survey. The combined results, as shown in Table 4, indicate the top ten factors that were perceived to have an impact on construction productivity. However, it is not sufficient to view the results in isolation. The impact, as well as the frequency of occurrence, should be considered. The *Rii* was calculated for both the impact of factor and frequency of occurrence. Furthermore, the *MRii* was obtained by calculating the average *Rii* of the two *Rii* values. Figure 4 indicates the number of factors (based on *Rii*) for each of the six categories.

The results from Table 4 and Figure 4 indicate the following:

- ***Impact of the factor***: The top ten factors fall into only three of the six categories (management, consultant and labour). The main category that is perceived to have an impact on productivity is 'management'.
- ***Frequency of occurrence***: The results are spread in more categories for frequency than impact (five of the six categories). This, however, only indicates the frequency of occurrence and is not a useful measure on its own, and as such was used to calculate the *MRii*.
- ***MRii***: The modified value was obtained as stated above and should be compared to the impact of the factor. The modification to the *Rii* caused a slight increase in the number of factors that were in the management category, while a reduction by almost half in the labour category was also noted. The remainder fell into the site condition and tools/equipment categories.

The results of the study were combined in Figure 5 (see Table 5 for complete list of ranked factors) to represent the relationship between the different *Rii* values. The *Rii* values for the impact and frequency seem to fluctuate, and the *MRii* is a relatively smooth line (this is due to the fact that findings were ranked based on the *MRii*), as shown in Figure 5. The first six factors had a higher *Rii* rating for impact than for frequency. The *Rii* values from factors 7 to 51 indicate trends where the *Rii* for frequency is higher than the *Rii* for impact.

The inclusion of the frequency of occurrence had an interesting result on the ranking of factors. Factors with a low perceived impact had a high frequency of occurrence and would be ranked higher than a factor with a high impact but low frequency. For example, factor 20 (Breakdown of plant) had a lower *Rii* (impact) than factor 21 (Availability of skilled labour …'), which means that the availability of labour should be ranked higher (see Table 5). The frequency influenced the ranking such that the breakdown of plant was ranked higher than the availability of skilled labour. This ties in with the approach of the study whereby a holistic approach was adopted to evaluate the effect of factors on productivity.

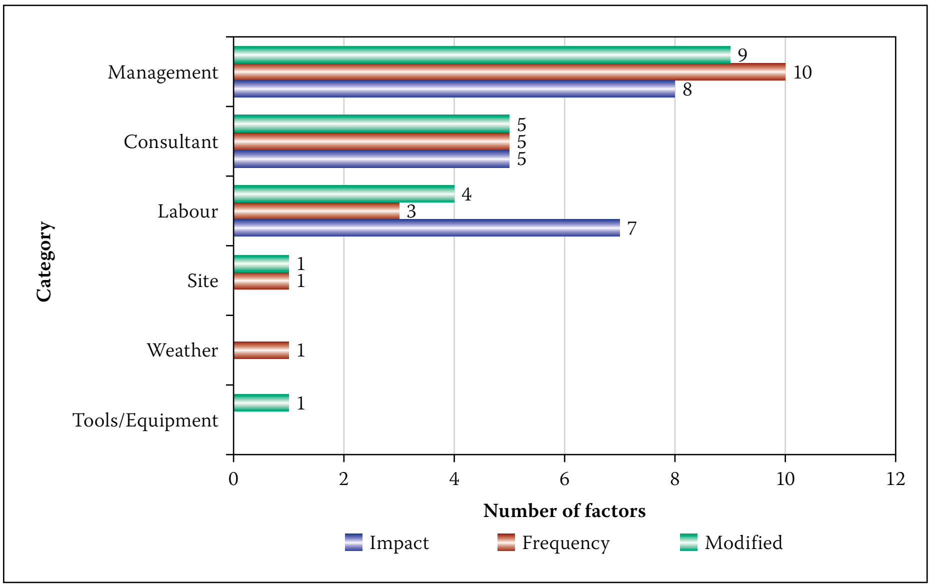

Figure 4 Comparison between the three different *Rii* values for the six categories of factors

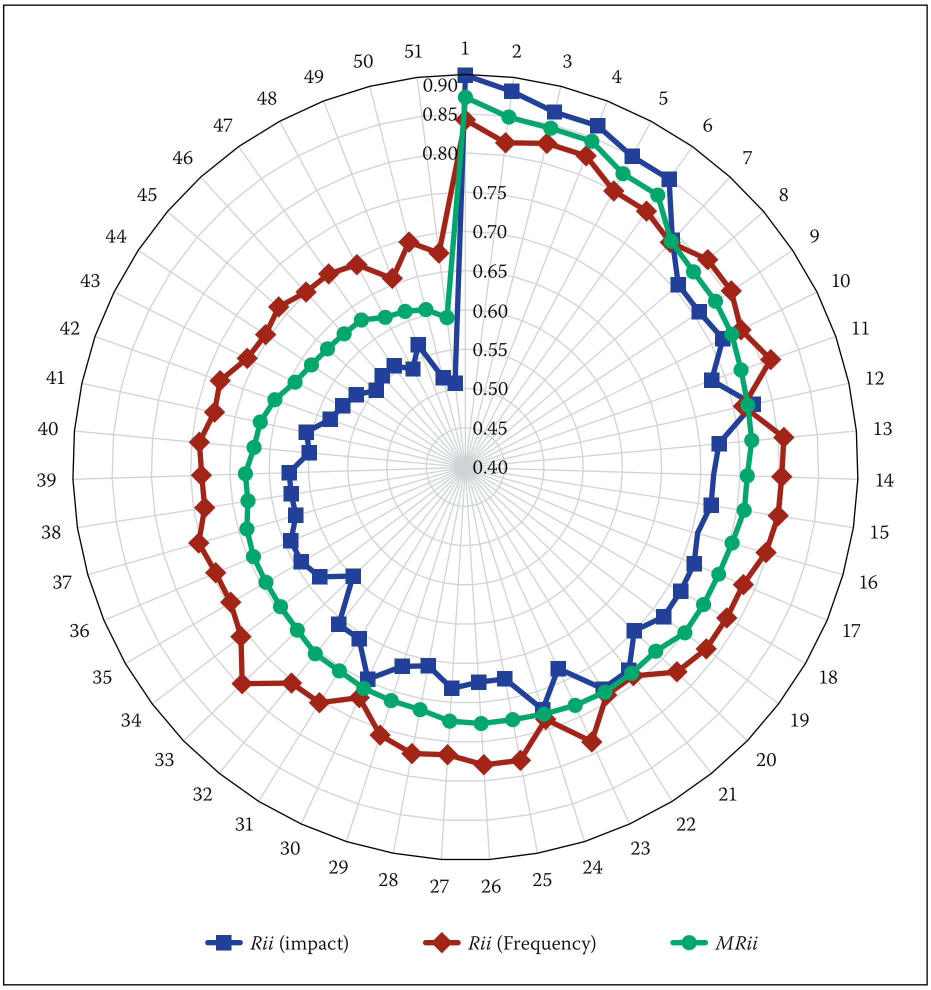

Figure 5 Graphical representation of the findings – a total of 51 factors ranked based on *MRii* (refer to Table 6 for details of each factor)

The ranking of the factor category was done by calculating the average of the *Rii* of all the factors in the category. The average *Rii* values were compared to one another and ranked accordingly. Table 6 indicates that the top three factors are in line with the findings of the literature study. However, the highest ranked factor category is consultants, whereas the literature ranked management as the highest.

Table 5 Ranking of the 51 factors, grouped according to categories of factors (refer to Figure 5 for graphical comparison between $Rii_{(impact)}$, $Rii_{(frequency)}$, and *MRii*)

Ranking based on *MRii*	Ranking of factors in the different categories based on the *MRii*	Category	*Rii* (Impact)	*Rii* (Freq)	*MRii*
1	Late issue of drawings to contractor	Consultant	0.9	0.843	0.872
2	Illegal strike action by project labour force	Labour	0.883	0.817	0.85
3	Delayed reply on RFI (request for information)	Consultant	0.867	0.826	0.846
4	Late issue of specifications/information to contractor	Consultant	0.867	0.826	0.846
5	Civil unrest in vicinity of project	Labour	0.85	0.8	0.825
6	Labour union strike (irrespective of union)	Labour	0.85	0.8	0.825
7	Delayed inspection by consultant	Consultant	0.792	0.788	0.79
8	Management skills of foreman	Management	0.758	0.807	0.783
9	Poor communication between site management and labour force	Management	0.758	0.807	0.783
10	Complexity of design (constructability)	Consultant	0.767	0.793	0.78
11	Lack of planning – foreman daily on site planning	Management	0.733	0.813	0.773
12	Skill level of labour that is sourced in the vicinity of the project	Labour	0.776	0.763	0.769
13	Lack of site management leadership	Management	0.725	0.808	0.767
14	Lack of material on site	Management	0.717	0.804	0.76
15	Poor communication between consultant and contractor	Management	0.717	0.804	0.76
16	Lack of planning – engineer fortnightly planning	Management	0.708	0.799	0.754
17	Management skills of engineers	Management	0.717	0.785	0.751
18	Experience level of site management relating to productivity management	Management	0.717	0.785	0.751
19	Site conditions after inclement weather (rain/snow)	Site	0.717	0.785	0.751
20	Breakdown of plant	Tools/Equipment	0.7	0.776	0.738
21	Availability of skilled labour in the vicinity of the project	Labour	0.733	0.742	0.738
22	Motivation of labour	Labour	0.733	0.742	0.738
23	Inadequate pre-plan	Management	0.683	0.786	0.735
24	Absenteeism of labour	Labour	0.725	0.738	0.731
25	Lack of monthly planning	Management	0.675	0.781	0.728
26	Rework due to poor workmanship	Management	0.675	0.781	0.728
27	Rain	Weather	0.683	0.768	0.725
28	Stop supply from suppliers due to non-payment	Management	0.658	0.772	0.715
29	Breakdown of tools/equipment	Tools/Equipment	0.667	0.759	0.713
30	Level of education of labour	Labour	0.698	0.724	0.711
31	Project team composition in light of productivity management strategies	Management	0.658	0.754	0.706
32	Availability of plant	Tools/Equipment	0.658	0.754	0.706
33	Snow	Weather	0.6	0.797	0.699
34	Frequent change in site management (management turnover)	Management	0.633	0.759	0.696
35	Availability of tools/equipment	Tools/Equipment	0.642	0.746	0.694
36	Strong wind	Weather	0.642	0.746	0.694
37	Site congestion	Site	0.625	0.754	0.69
38	Lack of training provided to labour	Management	0.625	0.737	0.681
39	Safety accidents resulting in work stoppages	Management	0.625	0.737	0.681
40	Unrealistic scheduling and expectations of labour performance	Management	0.6	0.741	0.671
41	Crew size and composition	Management	0.608	0.728	0.668
42	Site layout	Site	0.583	0.732	0.658
43	Geographical location of the site (accessibility)	Site	0.575	0.711	0.643
44	Temperature (high or low)	Weather	0.567	0.706	0.636
45	Work overload and fatigue	Management	0.55	0.714	0.632
46	Labour force turnover	Management	0.558	0.702	0.63
47	Poor communication between head office and project personnel	Management	0.558	0.702	0.63
48	Complex tools/equipment needed to perform work	Tools/Equipment	0.542	0.693	0.617
49	Lack of incentive programme	Labour	0.567	0.658	0.613
50	Proportion of work subcontracted	Management	0.517	0.696	0.607
51	Working hours	Management	0.508	0.675	0.592

Table 6 Ranking of the six categories of factors

Factor category	Average of *Rii* (impact)	Average of *Rii* (frequency)	Average of *MRii*	Factor category
Consultant	0.838	0.815	0.827	1
Labour	0.757	0.754	0.755	2
Management	0.653	0.762	0.708	3
Site conditions	0.625	0.746	0.685	4
Tools/equipment	0.642	0.746	0.694	5
Weather	0.623	0.754	0.689	6
Average	0.684	0.762	0.723	

COMPARING FINDINGS WITH BENCHMARK

The results from the questionnaire and the benchmark are combined in Table 7 in order to compare the findings. The results of the *Rii* (impact) were selected to be compared to the benchmark, since the literature study focused only on impact and not on frequency as identified in this research. In Table 7 there are seven factors that are classified as management, one as labour and two as consultant-related factors. This is in stark contrast to the finding in the questionnaire where the majority of the factors, a total of five, pertained to consultant engineers. The accountability of construction management professionals is brought into question when viewing the results of the questionnaire, as it is apparent that the consulting engineers are blamed for poor productivity. This is a skewed result, as the participants of the questionnaire were only involved in the management of construction projects and not in the design of the project. The inclusion of design engineers in the target audience could have provided a different result, but this paper only considers individuals who are directly involved in the construction management of a project.

A variance column is included in Table 7, which indicates the movement in terms of the ranking of the factors. Only one factor stayed ranked in the same position, i.e. constructability, which is ranked ninth. Furthermore, six factors do not have a match in the list of top ten factors and are marked as 'NA'. The variance was calculated by evaluating the movement of column B (results from questionnaire) in relation to column A (benchmark).

Labour experience and incompetent supervisors moved down six and seven places respectively, compared to the findings in the questionnaire, whereas the late issue of drawings moved up four places. The discrepancy in the factors could mean that the civil construction industry in South Africa is faced with a different set of problems from those which are identified in the global civil construction industry.

The results further indicate that South Africa has a unique set of factors which impact on construction productivity. For instance, the occurrence of labour force strikes (irrespective of legality) is more prominent in South Africa than globally (Odendaal 2014). The recent strike in the mining industry is one example of the challenges South Africans face in terms of labour relations. The construction industry contributed 13.5% of the working days lost within the South African market due to labour strikes as per the annual industrial action report (Department of Labour 2013). The lack of skilled professionals compounds the issue even further. An article in *Engineering News* stated that the engineering skills shortage hampers the growth of South Africa (Cloete 2013). The government has, however, tried to solve the problem by introducing the critical skills work visa (Republic of South Africa 2014). The impact of this initiative on the industry and the perceptions of the industry professionals should be investigated in further studies.

RESEARCH LIMITATIONS

The research focused on a large industry and did not cover all aspects of productivity management. There are therefore limitations in the present research. These include the following:

- **Population of study:** In this research the population was defined by membership of SAICE and SAFCEC. The individual responses did not give an indication of the respondents' designation, e.g. project manager. Further research is required that will include a section where the respondents identify their designations. By obtaining this information, the responses between the different designations (at various management levels) can be compared, and it will also indicate if there is an overall

Table 7 Comparison between the benchmark and the findings of the questionnaire (top ten ranked factors)

Ranking	Literature benchmark		From questionnaire based on *Rii* (impact)		Variance (A-B) ranking
	Factor (A)	Category	Factor (B)	Category	
1	Material shortage	Management	Late issue of drawings to contractor	Consultant	NA
2	Labour experience	Labour	Illegal strike action by project labour force	Labour	–6
3	Incompetent supervisor	Management	Delayed reply on RFI (request for information)	Consultant	–7
4	Method of working	Management	Late issue of specifications/information to contractor	Consultant	NA
5	Late issue of drawings	Consultant	Civil unrest in vicinity of project	Labour	+4
6	Poor communication	Management	Labour union strike (irrespective of union)	Labour	NA
7	Unforeseen events	Management	Delayed inspection by consultant	Consultant	NA
8	Poor site layout	Management	Skill level of labour that is sourced in the vicinity of the project	Labour	NA
9	Constructability	Consultant	Complexity of design (constructability)	Consultant	0
10	Rework	Management	Management skills of foreman	Management	NA

agreement or a discrepancy between the opinions and experiences of different management levels.

- **Industry:** The research only focused on contractors active within the civil construction industry. The opinions of consulting engineers were not considered in this study, and further research is required to obtain their opinions and to compare these with those of contractors. The expected end result will prove convergence or divergence of the opinions of both contractor and consultant.
- **Factors:** The factors that were selected for the questionnaire were obtained through a literature study, but did not include a review of these factors by the respondents or industry professionals. The approach that should be adopted in future research should include a review by the population to verify if the factors are relevant to the South African civil construction industry. The respondents in the population could also identify other factors that are not on the list of factors that they have reviewed.
- **Engineering Council of South Africa (ECSA):** Two institutions were contacted to assist with the distribution of the questionnaire (SAICE and SAFCEC). For further research it is suggested that ECSA be contacted to assist with the research. This could also lead to productivity studies in other engineering fields, such as electrical and mechanical engineering.
- **Stage-wise ranking:** The study only considered the factors during the construction phase of the project. Further research should be done which identifies the factors during the design phase of a project. Furthermore, the design and construction phases should further be broken down into sub-phases, e.g. site start-up, mobilisation, execution, completion and handover.

CONCLUSION

The literature study clearly proved that the construction industry is faced with a fluctuating environment and tough economic conditions. This industry also plays an important part in the growth of the economy of a country. Moreover, the productivity of a country has an impact on the standard of living of its citizens. From this it is clear that the long-term sustainability of the civil construction industry and the sustainable growth of a country can be achieved by improving productivity.

A global perspective of the factors that have an impact was obtained, and it indicated that the construction industry in each country is unique in terms of the factors that have an impact on construction productivity. Furthermore, three categories of factors were identified that occur in the industry. They are management, labour and consultant-related factors. The results of the questionnaire in this research produced a similar outcome. However, the consultant-related factors were the most highly ranked factors that have a perceived impact on construction productivity. This has led the authors to believe that the management framework should be customised to suit the industry within a specific country. In addition, the factors that were identified should form the basis of the management framework, in that the main focus should be on managing the said factors, although it is also important to incorporate other factors, even though they do not have an immediate impact on productivity.

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