Challenges facing projects due to a lack of resources

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Abstract

One of the major challenges facing many Engineering companies today is a lack of sufficient resources to staff all projects concurrently. The objective is to understand the challenges that Engineering projects experience due to a lack of resources. All projects require human resources because they play an important role in any project. These resources may contribute to either a projects success or failure. That is why having the correct people for the project is extremely important. The most common and widely experienced challenge on a project is insufficient team skills. Organisations should consider leadership's skills, human management and skills management to ensure a projects success. Engineers are required to have technical knowledge and skills, understand standards of engineering practice and have intellectual skills. The findings revealed that a projects success is achievable by complying with the planned budget, time lines and performance criteria

Keywords: Lack of resources, skills shortages, brain drain, project success

1. Introduction

One of the greatest challenges today, is the delivery of basic services to meet an expanding population. Innovation in Engineering is fundamental to address these challenges. A major issue facing many Engineering companies is the lack of sufficient resources to staff all projects concurrently. Therefore, projects compete with each other for resources and people are often assigned to several projects at the same time. Engineers with special expertise of scarce skills may be in high demand due to constraints. In South Africa, a shortage of key skills is affecting business growth and this requires government intervention. Research conducted in 2016, Green revealed that Engineering was on the list of the top three of the ten most prolific job titles being recruited.

According to Marks, organisations rely on projects to ensure their business needs. Therefore, projects rely on the effective employment of finite resources, whether these are people, equipment or facilities, anything required to complete a project activity or task and has a financial implication. According to Ford and Bennet the most common and widely experienced challenge is insufficient team skills. Therefore, organisations experience the challenge to ensuring that they make the most of these available finite resources. According to Dubber, changes in management, either resignation or transfer, has a negative effect on a projects performance. The root cause of limited resources identified with South Africa is a brain drain [Hopply] and this leaves the country short of the skills needed to meet the challenges of economic development [Benidict]. Many Engineering companies find it difficult to fill Engineering posts because Engineers with 10 to15 years of experience are required [Rambaran], while on the other side, many newly graduated Engineers are struggling to find employment. With Local Government and Municipalities in South Africa facing an unhealthy position, one finds few or in some instances no civil engineering professional in their employ.

In South Africa, one Engineer services 3 166 people of the population, compared to Brazil's 227 and Malaysia's 543 per engineer [Rambaran]. The discrepancy in the benchmark highlights that South Africa has a dire shortage of competently qualified Engineers. All projects require human resources, because people are

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the most important resource to a project, irrespective of the size and complexity of the project. Understanding and interpretation of the triple constraint (scope, cost and time) is crucial to any projects success [Mokoena] and failure to any component affects the other two components. Projects require specific expertise to run efficiently and effectively. Procuring and coordinating these human resources in tandem with managing the time aspect of the project, is critical to its overall success. There are even cases when a project is not achievable [Rajkumar] because there are insufficient resources allocated to the project It is common for different projects to require certain resources at the same time.

According to the Project Management Body of Knowledge (PMBOK), a project team comprises of people with assigned roles and responsibilities for the completion of a project. The objective of the study is to understand the challenges facing Engineering projects in South Africa because of the limited resources to carry out Engineering related projects. The aim is to assess the situation in South Africa, develop a suitable strategy and implement goals to manage this challenge of limited engineering resources.

2. Research Methodology

The method used was a mixed method, because it is an integration of quantitative and qualitative data within a single investigation. Qualitative research method provides information from a human side and the responses are more complex than a yes or no answer, thereby allowing participants to respond freely in their own words [Mack].

Quantitative methods seek confirmation on the hypothesis. The questions are closed-ended and this allowed for a comparison of responses from the target population. It also considers the relationship between the variable and testing of the theory. The selection of the mixed method provided a realistic worldview [Creswell] and expanded on the research in a way that a single approach cannot. By collecting varied types of data, it provided a validation for each other and created a solid foundation for drawing up conclusions of the intervention. In order to get an unbiased opinion of Engineers and Project Managers, the self-administered questionnaire was anonymous and confidential, thus ensuring accurate answers.

3. Results

The questionnaire targeted a group of 700 people from a large South African owned consulting Engineering organisation. After checking the online survey data for errors, a final sample size of n = 77 was obtained (Response Rate of 11%). Figure 1 shows the split between Technical (70%, n = 54) and Non-technical (30%, n = 23) personnel at the organisation. Technical staff consists of Engineers, Technicians and Project Managers. Non-Technical refers to the support services (Finance, Human resource, Admin, IT, etc.).

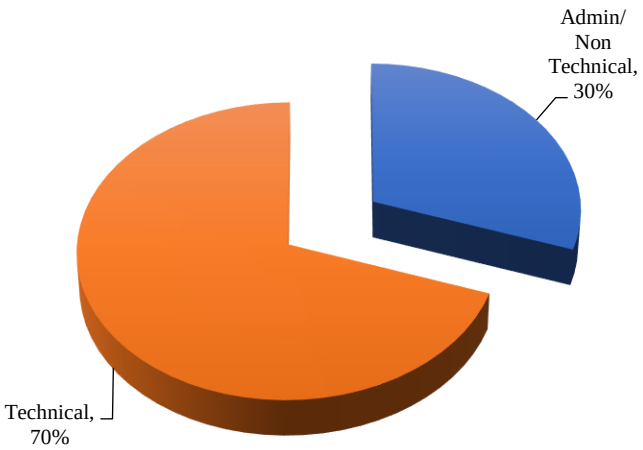

Figure 1. Non-Technical and Technical Staff

As illustrated in Figure 2, majority of the respondent's ages varied from 35-49 years (49%), while the percentage of respondents in their early adulthood (Ages 20-34) was 27%. Responses from senior staff (ages 50-64) were 20% and respondents over the age of 65 were 4%.

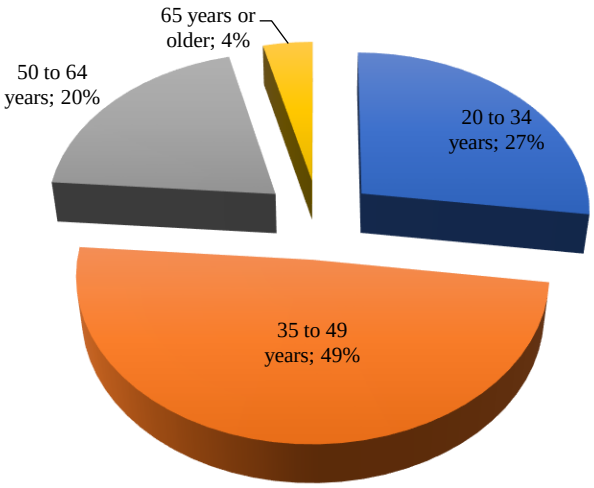

Figure 2. Age Categories

Majority of the respondents were Engineers (26%), followed by Seniors Managers (13%), Technologists (13%) and Technicians (13%), as illustrated in Figure 3. Assistant Project Managers (1%) and Graduate Engineers (5%) were the least of the respondents. Respondents with other job titles included, Project Planners, Project Administrators, Resident Engineers and Draughtspersons.

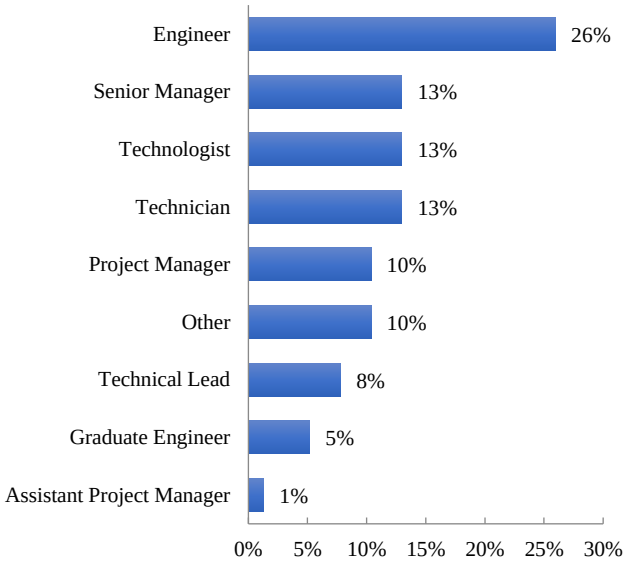

Figure 3. Job title

Figure 4 indicates the percentages of responses from the various age groups and their years of experience. The highest responses (17%) were between the ages 35 and 49 years with 15 to 20 years of experience. 14% of the respondents between the ages of 35 and 49 years had 21 to 30 years of experience. Also 14% of the respondents between the ages of 20 - 34 years had up to 5 years of experience. There were 13% of the respondents between the ages of 50 and 64 years with more than 31 years of experience.

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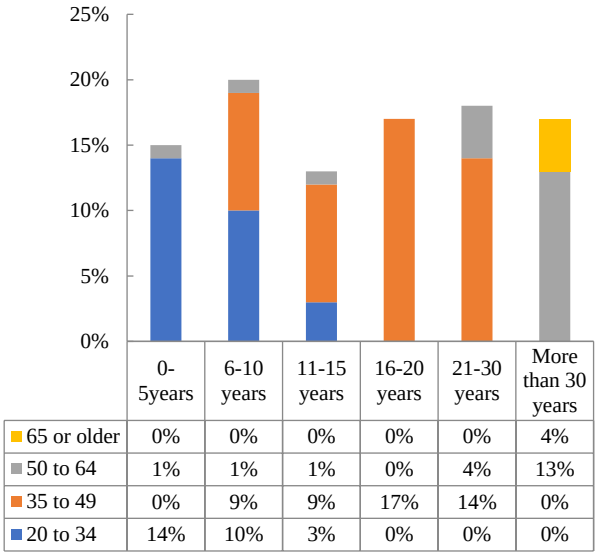

	0-5years	6-10 years	11-15 years	16-20 years	21-30 years	More than 30 years
65 or older	0%	0%	0%	0%	0%	4%
50 to 64	1%	1%	1%	0%	4%	13%
35 to 49	0%	9%	9%	17%	14%	0%
20 to 34	14%	10%	3%	0%	0%	0%

Figure 4: Various age groups and the years of experience

3.1 Challenges with Project Failure

Respondents, considered the lack of planning (49%) to be the greatest challenge, as shown in Figure 5. This was followed by change requirements and specifications (48%). 44% of the respondents felt that unrealistic expectations was challenge when working on projects. The lack of resources was the fourth highest (39%) challenge associated with project failure.

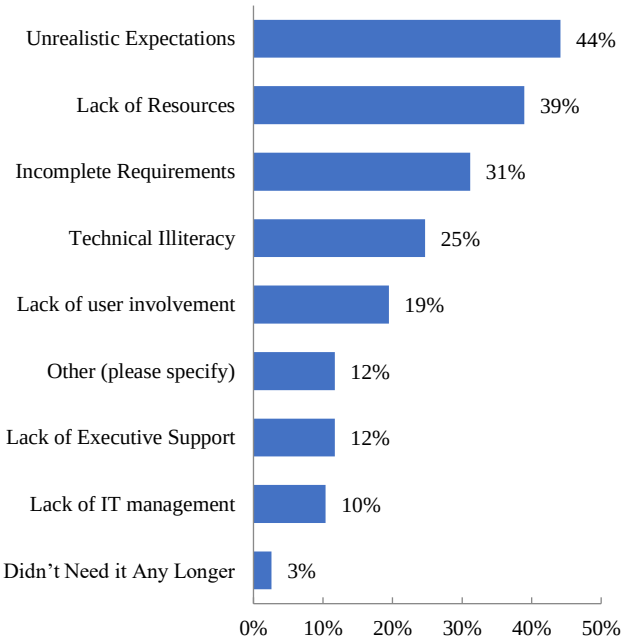

Figure 5: Challenges when working on projects

3.2 Skills Shortages

As depicted in Figure 6, the skills shortage identified by the respondents as being the major contributor were professionals leaving the industry (48%). A dysfunctional education system (45%) was considered to be the second highest contributor to the skills shortage, and 32% of the respondents identified emigration as being a reason to the skill shortage in South Africa.

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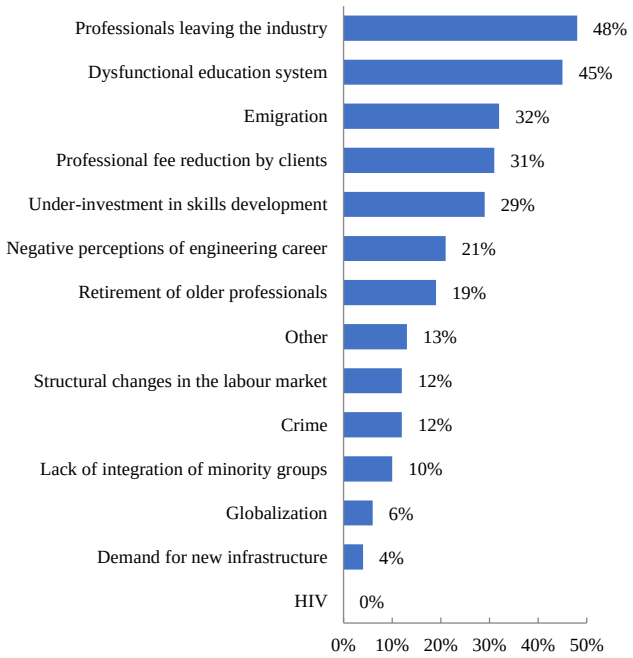

Figure 6: Factors that contribute to the shortage of skills in South Africa

The other factors that contributed to the skills shortage in South Africa is listed in table 1. Broad-Based Black Economic Empowerment (BBBEE) (7%) was one of the major factors that contributed to the skills shortage. BBBEE was launched in SA in 2003 and its mandate was to ensure that there was an increase in the number of Black people that own, manage, control and gain employment in South Africa's economy.

Table 1: Other Factors that contribute to the shortage of skills in South Africa

Other	**Percentage %**
Downturn in economy and the resulting lack of challenging work	1%
Poor utilization of key resources and momentum work	1%
No Mentorship	1%
Lack of infrastructure investment by Government	1%
BBBEE	7%
The skills are not valued by society	1%
Lack in training	1%
TOTAL	13%

Other factors included downturn in economy (1%), poor utilization of key resources (1%), no mentorship (1%), lack of infrastructure investment (1%), skills not valued (1%), and lack in training (1%) as illustrated in Table 1. The leading cause of brain drain in South Africa was Political instability (43%) as indicated in Figure 7. Economic under development (8%) is also a cause of political instability as highlighted by the respondents. The present government situation and the economic recession in South Africa have a huge impact on Engineering development and infrastructure requirements. With the Economic underdevelopment, declining Gross Domestic Product (GDP) growth, recessionary climate and junk status of the country, the

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lack of Engineering projects has a negative effect in uplifting an Engineer's career and their professional development.

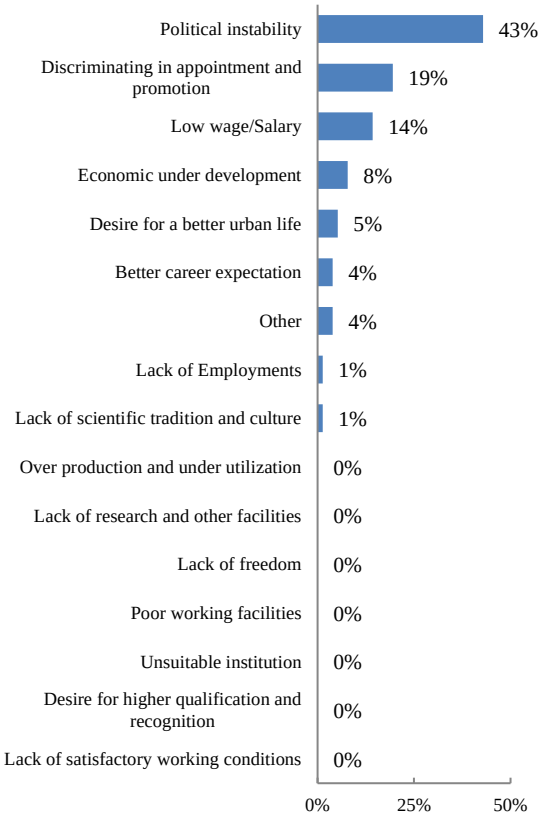

Figure7: Major cause of Brain Drain that makes a person want to leave a country

This next leading cause of the Brain Drain identified by respondents was the discrimination in appointment and promotion (19%). BBBEE regulations made it difficult for white Engineers to gain employment and therefore these professionals leave the country because of limited opportunities and no possibility for promotions. Engineers felt that they were underpaid (14%) and their salary was not according to their efficiencies, capabilities and skills, but purely on their qualifications. Other causes included corruption at government level and seeking a safer environment due to crime.

3.3 Project Success Factors

Respondents' preferred permanent employment compared to contract work because of job security and a fixed stable income. Other respondents preferred to work on contract because it allowed them to be flexible with time and some exposed to different types of projects. Many respondents stay at their current company because the company has been good to them, and they did not believe in jumping. Some respondents found it difficult in finding a job while others indicated that starting a new job would mean learning new policies of a new company.

A leader develops empowers others compared to a manager. Respondents indicated that leaders need excellent technical skills and a leader earns trust and respect. A leader pulls from the front and pushes from the back whilst walking alongside. Therefore, as illustrated in Figure 8, 95% of the respondents agreed that leadership courses should be offered at undergraduate level while 5% were not in favour of having leadership courses offered at undergraduate level.

In Engineering, a balance is required between experience and expertise. Experience is tacit while expertise is explicit. The foundation of engineering expertise is to understand the relevant codes of practice and guidelines. However, the nature of the engineering problem makes each project unique, resulting in the need to keep the knowledge acquired from experience, as the application of the acquired knowledge is project specific.

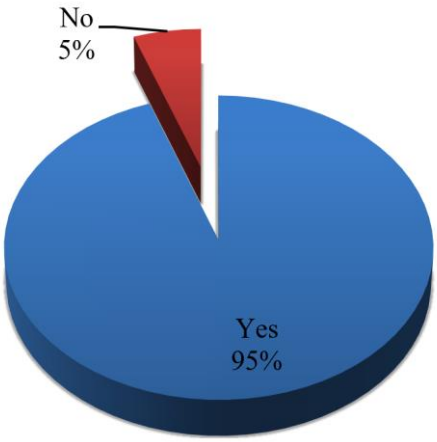

Figure 8: Leadership courses at Undergraduate level

As depicted in Figure 9, 75% of the respondents indicated that the most essential skill for an Engineer is technical knowledge and skills; followed by 73% of the respondents that rated standards of engineering practice to be an essential skill. The third most essential skill selected by 68% of the respondents was intellectual skills. 40% of the respondents indicated business practice was an essential skill and attribute while 31% rated attitudes to be of importance. International/national history and culture (4%) and proficiency in language (8%) are perceived to be the least essential skill and attributes of an engineer. Therefore, the three most essential skill and attribute of an Engineer, according to the respondents are:

- Technical knowledge and skills;
- Standards of engineering practice; and
- Intellectual skills.

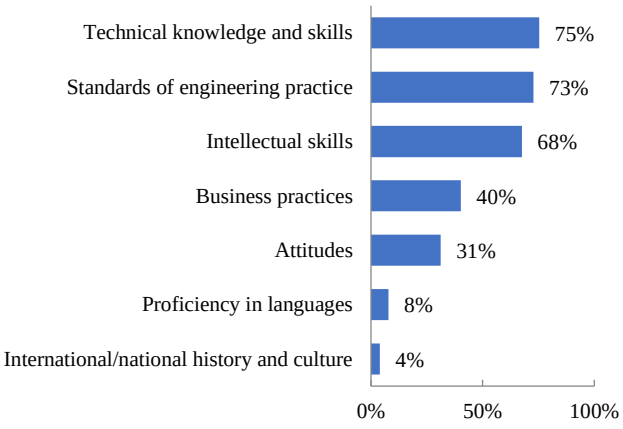

Figure 9: Skills and Attributes of an Engineer

As illustrated in Table 2, the 5 factors that influences a projects success are compliance with the planned budget, time frame and performance criteria (57%); competent project team members (53%); clearly defined goals and directions (49%); clearly defined roles and responsibilities (42%); and communication and consultation with stakeholders (32%). Sponsor's involvement within the project (6%), and top management support (9%) had the lowest influence on a projects success, since they received the least responses.

Some of the other factors, as illustrated on 2, that respondents felt had an impact on a projects success were adequate risk management (31%), client acceptance of the results (30%); synergy of the team (23%); ability to handle unexpected problems (23%); and adequate use of technical skills (22%).

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Table 2: Impact factors on a projects success

Factors	Responses
Compliance with the planned budget, time frame and performance criteria	57%
Competent project team members	53%
Clearly defined goals and directions	49%
Clearly defined roles and responsibilities	42%
Communication and consultation with stakeholders	32%
Adequate risk management	31%
Client acceptance of the results	30%
Ability to handle unexpected problems	23%
Synergy of the team	23%
Adequate use of technical skills	22%
Experience and expertise of the project manager	21%
Stakeholders satisfaction	18%
Accurate schedule and plan	18%
Adequate use of project management techniques	17%
Timely and comprehensive control	17%
Owner involvement within the project	16%
Provision of timely data to key players	12%
Top management support	9%
Sponsor involvement within the project	6%

3. Conclusion

Based on the findings of the survey, the lack of skills and brain drain were the two main reasons for the lack of resources in Engineering projects. The lack of skills is predominantly due to professional leaving the industry and in some instances leaving the country. Political instability leads to economic recession causing limited implementation of infrastructure requirements by Government. With the lack of implementing infrastructure, Engineering jobs are scarce and thereby resulting in lower salaries. Therefore, Engineers often take their skills abroad where there is a demand for the Engineering profession.

Suitable and correct resources are required for any project to succeed. Unrealistic deadlines and poor planning of resources puts additional pressure on resources, resulting in a failed task or project. A lack of skilled resources is also a challenge because the incorrectly skilled resource tasked on the project may not meet the deadline or the client's requirements. Another challenge with resourcing is shifting resources around, either to assist others or carry out damage control. In Engineering, a balance is required between experience and expertise. The environment of a project is always dynamic, so success factors might change over time.

To ensure the success of a project, compliance with the planned budget, time frame and performance criteria is required. A project is to have competent team members. The project goals and the team roles and responsibility are to the clearly defined.

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