Understanding construction projects schedule overruns in South Africa

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ABSTRACT

Construction schedule overruns are not uncommon on construction projects world over and the South African construction industry has not escaped the challenges of failing to deliver projects on time. In order to find mitigation measures of schedule overruns, the first step is to identify the causes of these overruns. Therefore, this paper assesses the causes of construction projects schedule overruns in the South African construction industry, a case of the Gauteng Province. The data used in this paper were derived from both primary and secondary sources. The secondary data was collected via a detailed review of related literature. The primary data was collected through a well-structured questionnaire which was distributed to construction professionals, who include: Architects, quantity surveyors, civil engineers, construction mangers and project managers. Out of the 200 questionnaires sent out, 146 were received back representing a 73% response rate. Data received from the questionnaires was analysed using descriptive statistics procedures. Findings from the study revealed that slowness in decision making process, reworks due to errors during construction, delay in approving major changes in the scope of work, delay in material delivery, shortage of skilled equipment operators, low productivity level of workers, delay in obtaining permits from municipalities and workers risky behaviour on sites were the major causes of construction projects schedule overruns in Gauteng, South Africa. The study contributes to the body of knowledge on the subject of the causes of construction project schedule overruns in Gauteng, South Africa.

INTRODUCTION

Construction schedule overruns are not uncommon on construction projects world over and the South African construction industry has not escaped the challenges of failing to deliver projects on time. Alkhathami (2004:14) defines schedule overruns as extra time required to finish a given construction project

beyond its original planned duration, whether compensated for or not. Mohamad (2010:1) says schedule overruns are an act or event that extends the time to complete or perform an act under the contract. Also, Assaf and Al-Hejji (2006:349), defined schedule overrun as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. However, despite the proven importance to deliver construction projects on time, it is not uncommon to see construction projects failing to achieve their objectives (Memon, Rahman and Azis, 2012). Hence this paper aims to identify the causes of construction projects schedule overruns.

CONSTRUCTION SCHEDULE OVERRUNS – CAUSES

Causes of schedule overruns are factors or events that occur before and during the construction process that will affect the time of completing a project. Ali, Smith, Pitt, and Choon (2012:2) states that there are four factors that causes schedule overruns and categorized them into the following categories: contractor- related factors, consultant-related factors, client-related factors and external factors. Motaleb and Kishk (2010:1154) five factors that can cause schedule overrun and these include change orders, slow decision making by clients, lack of capability of client representative, construction financial difficulties and late delivery of materials. Furthermore, Sambasivan and Soon (2007:524), describe the following as the main causes of construction project schedule overruns: contractor's improper planning, contractor's poor site management, inadequate contractor experience, client's finance and payments for completed work, problems with subcontractors, material shortages, labour supply, equipment availability and failure, lack of communication between parties, mistakes during the construction stage.

Hoverer; the current study adopted the categories studied by Theodore (2009:25-36) as they were more comprehensive categories of causes of construction projects schedule overruns.

Owner-related causes of construction project schedule overruns: The study by Wei (2010:35) shows that late revising and approving of design documents by the client is the major cause of schedule overrun associated with the client. However, Mohamad 's (2010:12) study illustrates that change in orders by owner during construction is a major cause of schedule overruns in project delivery time, which is also in agreement with the study by Motaleb and Kishk (2010:1153). In the work by Haseeb, Xinhai-Lu, Aneesa Bibi, Maloof-ud-Dyian, and Rabbani (2011:28) and Assaf and Al-Hejji (2006:352) delay in progress payments by owner was identified as the major cause of schedule overruns in project delivery associated with the client. This is also shown in the study by Sambasivan and Soon (2007:522). Further, Denini (2010:181) writes that the major causes of schedule overruns related to the owner are slowness in the decision-making process by the owner and delay in making progress payments to contractors. Furthermore, Ayudhya (2011:1032) found that the major owner-related causes of schedule overruns include: delay in progress payment by owner, adverse weather conditions, evaluation of completed works and insufficient

working drawing details. Ren, Atout and Jones (2008:754) show that unrealistic control duration, many provisional sums and prime cost, nomination of sub-contractors and suppliers and client's irregular payment to the main contractor are the major owner-related causes of schedule overruns. The study by Theodore (2009) identified nine causes of schedule overruns in this category and ranked them as follows: delay in progress payments, delay in furnishing and delivering the site, change of orders by owner during construction, late revising and approval of design documents, delay in approving shop drawing and sample materials, poor communication and coordination, slowness in decision-making process, conflicts between joint-ownership of the project and suspension of work by owner.

Contractor-related causes of schedule overruns: Theodore (2009) identified the contractor related causes of schedule overruns and ranked them as follows; difficulties in financing project, conflicts in sub-contractors schedule in execution of project, rework due to errors during construction, conflicts between contractor and other parties, poor communication and coordination, ineffective planning and scheduling of project, improper construction methods implement, delays in sub-contractors work, inadequate contractor's work, frequent change of sub-contractors, poor qualification of the contractor's technical staff and delays in site mobilization (Theodore, 2009). This was in agreement with the study by Assaf and Al-Hejji (2006:352). However in the study by Wei (2010:38), delays in sub-contractors works was ranked as the highest contractor related cause of schedule. Further, Denini (2010:181) revealed the following as the major contractor related causes of schedule overruns: financial difficulties faced by the contractor, poor project planning and scheduling, inadequate contractors' experience contractor-related, inaccurate cost estimation contractor-related and poor site management and supervision. The study by Motaleb and Kishk (2010:1152) shows that late delivery of materials is a major cause of contractor related schedule overruns. Furthermore, Wong and Vimonsatit (2012:3396) show that financial difficulties, low speed of decision, skills shortage, design errors made by designers, unforeseen ground conditions, poor organization of the contractor or consultant, difficulty of coordination between various parties, poor communication, shortage of labour and underestimation of time of completion are the most significant contractor related causes of schedule overruns. Ren, Atout and Jones (2008:755) revealed that non-preparing the method statements, financing project by the contractor, luck of organizational chart, poor communication externally and internally and mistakes during construction are the major contractor related causes of schedule overruns.

Consultant-related causes of schedule overruns: Theodore (2009) and Wei (2010:38) both identify and ranked delay in approving major changes in the scope of work by consultants as the major cause of consultant related schedule overruns. Further, the work of Le-Hoai, Lee and Lee (2008:370) showed that the major consultant related causes of schedule overruns include: poor project management assistance, inaccurate estimates, mistakes in design, poor contract management and slow inspection of completed works. Further, Wong and Vimonsatit (2012:3396) revealed that the major consultant related causes of schedule overruns include:

changes in specifications during construction, financial difficulties, skill shortage, shortage of labour, unrealistic deadlines for project completion, underestimation of complexity of projects, poor communication, materials shortage, underestimation of costs of projects and unforeseen ground conditions. In the study by Assaf and Al-Hejji (2006:352), delay in performing inspection and testing by the consultant was ranked as the highest cause of schedule overrun. However, Motaleb and Kishk (2010:1152) established that inadequate consultant experience was the major cause of schedule overruns associated with consultants. Ren, Atout and Jones (2008:754) revealed that the major consultant related causes of schedule overruns include: incomplete drawings, delay in approval of documents, incomplete contract documents, changes in drawings and specifications and duration of inspection procedure.

Material-related causes of schedule overruns: The study by Sambasivan and Soon (2007:522), identified quality of material and shortage in material to be the major causes of schedule overruns that are associated with materials. Wei (2010:42) shows that delay in material delivery and shortage of construction materials on the market are the two major causes of material related schedule overruns, this is also reflected in the work of Assaf and Al-Hejji (2006:352). Further, Alwi and Hampson (2003:4) revealed that the major material related causes of schedule overruns include: poor quality of materials, delay of material delivery to site, poor material handling on site, poorly scheduled delivery of material to site, inappropriate or misuse of material and poor storage of material. However, Theodore (2009) identified six material related causes of schedule overruns and ranked them as follows: shortage of construction materials in market, changes in material types during construction, delay in material delivery, damage of sorted material while they are needed urgently, delay in manufacturing special building materials and late procurement of materials.

Equipment-related causes of schedule overruns: Assaf and Al-Hejji (2006:352) identify equipment breakdowns and shortage of equipment as the major causes of equipment related schedule overruns. However, the study by Wei (2010: 46) identified lack of high-technology mechanical equipment and low productivity and efficiency of equipment as the top most causes of schedule overruns and they were both ranked first in the study. Low level of equipment-operators skill was also identified as a major cause of schedule overruns related to equipment.

Labour-related causes of schedule overruns: Assaf and Al-Hejji (2006:352) and Sambasivan and Soon (2007:522) reveal shortage of labour is the major cause of schedule overruns associated with labour force. Further, Theodore (2009) shows that: shortage of labour, work permits for international workers, low productivity level of workers and personal conflicts among workers. Wei (2010:44) identified low productivity level of workers as the second highest cause of schedule overruns on construction projects.

Causes of schedule overruns by external factors: Assaf and Al-Hejji (2006:352) and Sambasivan and Soon (2007:522) revealed that effects of subsurface and ground

conditions was the major external factor that cause schedule overruns on construction projects. Further, Le-Hoai, Lee and Lee (2008:370) found that the major causes of schedule overruns related to external factors include the following: unforeseen site conditions, price fluctuations, bad weather and obstacles from governments. Furthermore, Further, Alwi and Hampson (2003:4) showed that site condition, weather and damage by other participants are the major causes of schedule overruns caused by external factors. Furthermore, Theodore (2009) identified the following causes of schedule overruns cause by external factors: effects of subsurface and ground conditions, delay in obtaining permits from municipality, weather effect on construction activities, traffic control and restriction at job site, accident during construction, changes in government regulations and laws, delay in providing services from utilities, delay in performing final inspection and certification.

RESEARCH METHODOLOGY

The data used in this paper were derived from both primary and secondary sources. The primary data was obtained through the survey method, while the secondary data was derived from the review of literature and archival records. The primary data was obtained through the use of a structured questionnaire survey. This was distributed to a total of 200 construction professionals that included; Architects, quantity surveyors, civil engineers, construction mangers and project managers who are currently involved in construction works in Gauteng, South Africa. This yardstick was considered vital for the survey in order to have a true reflection of the causes construction project schedule overruns. All professionals in Gauteng province had an equal chance to be drawn and participate in the survey. Out of the 200 questionnaires sent out, 146 were received back representing a 73% response rate. This was considered adequate for the analysis based on the assertion by Moser and Kalton (1971) that the result of a survey could be considered as biased and of little value if the return rate was lower than 30–40%. The data presentation and analysis made use of frequency distributions and percentages of all the respondents.

Mean Item Score (MIS): A five point Likert scale was used to determine the causes of construction project cost overruns in Gauteng province with regards to the identified factors from the reviewed literature. The adopted scales was as follows:

1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

The five-point scale was transformed to mean item score (MIS) for each of the factors of causes of cost overruns as assessed by the respondents. The indices were then used to determine the rank of each item. The ranking made it possible to cross compare the relative importance of the items as perceived by the respondents.

This method was used to analyse the data collected from the questionnaires survey. The mean item score (MIS) was calculated for each item as follows;

$$MIS = \frac{1n1 + 2n2 + 3n3 + 4n4 + 5n5}{\sum N} \qquad \text{Equation 1.0}$$

Where;

n1 = Number of respondents for strongly disagree;
n2 = Number of respondents for disagree;
n3 = Number of respondents for neutral;
n4 = Number of respondents for agree;
n5 = Number of respondents for strongly agree;
N = Total number of respondents

After mathematical computations, the factors were then ranked in descending order of their mean item score (from the highest to the lowest).

FINDINGS AND DISCUSSION

Findings from the 146 usable questionnaires revealed that 59.6% of the respondents were male and 40.4% were female. Findings relating to the respondents' age group revealed that 29.5% of the respondents were in the age group of 20-25 years old, 26.7% of the respondents were in the age group 26-30 years old, 17.1% were in the age group 31-35 years old, 11.6% were in the age group 36-40 years old, 6.2% of the respondents were in the age group 41-45 years old, 4.1% were in the age group 46-50 years old, 3.4% of the respondents were above 50 years old and 1.4% of the respondents were between 51-55 years old. Further, results showed that 76.7% of the respondents were Black, 14.4% were White, 4.8% were either Indian or Asian and 4.1% of the respondents were Coloured. Findings relating to respondent's work professional qualification, results showed that 38.4% were quantity surveyors, 20.5% were civil engineers, 11% were project managers, 10.3% were construction managers, 8.9% were construction project managers, 5.5% were architects and 5.5% selected others, which included an artisan, a building inspector, electrical contractors, a safety consultant and a site agent.

Furthermore, results revealed that 56.8% of the respondents had experience that ranged from 1-5 years, 20.5% had experience in the range of 6-10 years, 11.6% had experience that ranged between 11-15 years, 6.2% had more than 20 years' experience and 4.8% had experience that ranged from 16-20 years in the construction industry. Further, 46.6% of the respondents had bachelor's degrees, 32.2% had diplomas, 12.3% of the respondents had masters degrees, 4.1% of the respondents had doctorate degrees and 4.8% of the respondents only had metric (grade 12) certificates. Furthermore, it was revealed that 35.6% of the respondents were employees of contractors, 34.9% of the respondents were employees of consultants and 20.5% were government employee, 8.2% were employed by clients and 0.7% of the respondents were self-employed.

Owner-related causes of construction projects schedule overruns: Based on the ranking (R) using the calculated standard deviation (SD) and mean scores ($\bar{x}$) for the listed causes of construction projects schedule overruns, the study revealed that slowness in decision making process (SD=0.802; $\bar{x}$=4.15; R=1), change in design by the owner during construction (SD=0.839; $\bar{x}$=4.15; R=1), poor project coordination (SD=0.892; $\bar{x}$=4.13; R=2), late revising and approving of design documents (SD=0.835; $\bar{x}$=4.08; R=3), poor communication by the client to the construction team (SD=0.924; $\bar{x}$=4.01; R=4), delay in progress payments (SD=0.997; $\bar{x}$=3.89; R=5), suspension of workers by owner (SD=1.105; $\bar{x}$=3.85; R=6), delay in handing over the site (SD=0.929; $\bar{x}$=3.80; R=7), delay in approving shop drawings (SD=0.854; $\bar{x}$=3.78; R=8) and delay in approving sample materials (SD=0.965; $\bar{x}$=3.74; R=9) were the causes of schedule overruns related to the owner. These results are in general agreement with the study of Denini (2010:28) who also identified slowness in the decision making process by the owner as the major cause of construction schedule overruns related to the owners. However, the results were not in agreement with the study of Wei (2010: 35) who showed that the major cause of construction projects schedule overruns related to the owner is late revising and approving of design documents by the client. However, they were not similar to the results in the study by Ayudhya (2011:1032) where delay in progress payment by the owner was identified as the major cause of schedule overruns related to the owner.

Table 1. Owner-related causes of construction projects schedule overruns

CAUSES OF SCHEDULE OVERRUNS	σX	$\bar{x}$	R
Slowness in decision making process	0.802	4.15	1
Change in design by the owner during construction	0.839	4.15	1
Poor project coordination	0.892	4.13	2
Late revising and approving of design documents	0.835	4.08	3
Poor communication by the client to the construction team	0.924	4.01	4
Delay in progress payments	0.997	3.89	5
Suspension of workers by owner	1.105	3.85	5
Delay in handing over the site	0.929	3.80	7
Delay in approving shop drawings	0.854	3.78	8
Delay in approving sample materials	0.965	3.74	9

σX = Standard deviation; $\bar{x}$ = Mean item score; R = Rank

Contractor-related causes of construction projects schedule overruns: The study further revealed that there are causes of schedule overruns that are contractor related. It was found that the major causes included: rework due to errors during construction (SD=0.771; $\bar{x}$=4.23; R=1), poor coordination (SD=0.769; $\bar{x}$=4.19; R=2), poor communication (SD=0.822; $\bar{x}$=4.18; R=3), ineffective planning and scheduling of project (SD=0.796; $\bar{x}$=4.14; R=4), difficulties in financing projects (SD=0.915; $\bar{x}$=3.99; R=5), contractors' experience (SD=1.034; $\bar{x}$=3.98; R=6), conflicts in sub-contractors schedule in execution of project (SD=0840; $\bar{x}$=3.94; R=7), conflicts between contractor and other parties (Construction team members) (SD=0.940;

$\bar{x}$=3.94; R=7), improper construction methods implementation (SD=0.886; $\bar{x}$=3.92; R=8) and delay in sub-contractor's work (SD=0.901; $\bar{x}$=3.92; R=8). These findings were not in agreement with the study by Wong and Vimonsatit (2012: 3396) where financial difficulties by the contractor was identified as the major cause of contractor related causes of schedule overruns. The results were also not in agreement with the study by Ren, Atout and Jones (2008: 755) where non-preparing of method statements was identified as the major cause of contractor related cause of schedule overruns.

Table 2. Contractor-related causes of construction projects schedule overruns

Causes of schedule overruns	σX	$\bar{x}$	R
Rework due to errors during construction	0.771	4.23	1
Poor coordination	0.769	4.19	2
Poor communication	0.822	4.18	3
Ineffective planning and scheduling of project	0.796	4.14	4
Difficulties in financing projects	0.915	3.99	5
Contractors' experience	1.034	3.98	6
Conflicts in sub-contractors schedule in execution of project	0.840	3.94	7
Conflicts between contractor and other parties (Construction team members)	0.940	3.94	7
Improper construction methods implementation	0.886	3.92	8
Delay in sub-contractor's work	0.901	3.92	8
Improper method statements	0.858	3.86	9
Frequent change of sub-contractors	0.960	3.78	10
Poor qualification of the contractor's technical staff	1.059	3.68	11
Delay in site mobilisation	0.985	3.60	12

σX = Standard deviation; $\bar{x}$ = Mean item score; R = Rank

Consultant-related causes of construction projects schedule overruns: Furthermore, the study revealed consultant related causes of schedule overruns. The causes were: delay in approving major changes in the scope of work (SD=0.905; $\bar{x}$=4.14; R=1), unclear and inadequate details in drawings (SD=0.840; $\bar{x}$=4.12; R=2), poor communication (SD=0.823; $\bar{x}$=4.10; R=3), poor coordination (SD=0.848; $\bar{x}$=4.06; R=4), delays in producing design documents (SD=0.881; $\bar{x}$=4.01; R=5), mistakes and inconsistences in design documents (SD=0.833; $\bar{x}$=4.00; R=6), inadequate experience of consultants (SD=0.937; $\bar{x}$=3.96; R=7), insufficient data collection and survey before design (SD=0.921; $\bar{x}$=3.92; R=8) and lack of advanced engineering design software (SD=1.008; $\bar{x}$=3.50; R=9). These findings were in agreement with the studies by Theodore (2009) and Wei (2010: 38) where delay in approving major changes in the scope of works by the consultants was ranked the number one cause of consultant related causes of construction projects schedule overruns. However, the results were not in agreement with the study by Le-Hoai et al. (2008: 370) where poor project management was identified as the major cause of contractor related schedule overruns.

Table 3. Consultant-related causes of construction projects schedule overruns

Causes of schedule overruns	σX	$\bar{x}$	R
Delay in approving major changes in the scope of work	0.905	4.14	1
Unclear and inadequate details in drawings	0.840	4.12	2
Poor communication	0.823	4.10	3
Poor coordination	0.848	4.06	4
Delays in producing design documents	0.881	4.01	5
Mistakes and inconsistences in design documents	0.833	4.00	6
Inadequate experience of consultants	0.937	3.96	7
Insufficient data collection and survey before design	0.921	3.92	8
Lack of advanced engineering design software	1.008	3.50	9

σX = Standard deviation; $\bar{x}$ = Mean item score; R = Rank

Material-related causes of construction projects schedule overruns: When the respondents were asked to rank the material related causes of construction projects schedule overruns in Gauteng, the following results were obtained: delay in material delivery (SD=0.847; $\bar{x}$=4.09; R=1), lateness in material ordering (SD=0.92; $\bar{x}$=4.01; R=2), damage of sorted material while needed urgently (SD=0.885; $\bar{x}$=3.97; R=3), changes in material types during construction (SD=0.964; $\bar{x}$=3.88; R=4), delivery of wrong material (SD=0.968; $\bar{x}$=3.88; R=4), ordering wrong material (SD=0.981; $\bar{x}$=3.87; R=5), inappropriate storage of material leading to damages (SD=0.928; $\bar{x}$=3.86; R=6), delivery of sub-standard material (SD=0.916, $\bar{x}$=3.81; R=7), fluctuation in material prices (SD=1.047; $\bar{x}$=3.65; R=8) and availability of specified construction materials on the market (SD= 1.101; $\bar{x}$=3.63; R=9) were the top ten material related causes of construction projects schedule overruns.

Table 4. Material-related causes of construction projects schedule overruns

Causes of schedule overruns	σX	$\bar{x}$	R
Delay in material delivery	0.847	4.09	1
Lateness in material ordering	0.920	4.01	2
Damage of sorted material while needed urgently	0.885	3.97	3
Changes in material types during construction	0.964	3.88	4
Delivery of wrong material	0.968	3.88	4
Ordering wrong material	0.981	3.87	5
Inappropriate storage of material leading to damages	0.928	3.86	6
Delivery of sub-standard material	0.916	3.81	7
Fluctuation in material prices	1.047	3.65	8
Availability of specified construction materials on the market	1.101	3.63	9
Availability of improved materials on the market	1.028	3.52	10

σX = Standard deviation; $\bar{x}$ = Mean item score; R = Rank

These findings were in agreement with the studies by Wei (2010: 42) and Assaf and Al-Hejji (2006:352) where delay in material delivery was identified as the major cause of material related schedule overruns. However, the findings were not similar to the study by Alwi and Hampson (2003: 4) where poor quality of material was identified as the major cause of material related overruns.

Equipment-related causes of construction projects schedule overruns: Based on the ranking (R) using the calculated standard deviation (SD) and mean scores ($\bar{x}$) for the listed equipment related causes of construction projects schedule overruns, it was observed that the causes include: shortage of skilled operators (SD=0.949; $\bar{x}$=3.88; R=1), shortage of equipment (SD=0.954; $\bar{x}$=3.88; R=1), equipment breakdowns (SD=0.966; $\bar{x}$=3.79; R=2), low productivity and efficiency of equipment (SD=0.963; $\bar{x}$=3.72; R=3), use of wrong equipment (SD=1.082; $\bar{x}$=3.61; R=4), use of absolute equipment (SD=0.970; $\bar{x}$=3.43; R=5) and lack of high-technology mechanical equipment (SD=1.071; $\bar{x}$=3.35; R=6). The findings were not in agreement with the study by Theodore (2009) and Assaf and Al-Hejji (2006: 352) where equipment breakdowns were identified as the major cause of equipment related causes of schedule overruns. Further, the results were not similar to the study by Wei (2010: 46) where lack of high-technology mechanical equipment was shown to be the major cause of equipment related causes of schedule overruns.

Table 5. Equipment-related causes of construction projects schedule overruns

Causes of schedule overruns	σX	$\bar{x}$	R
Shortage of skilled operators	0.949	3.88	1
Shortage of equipment	0.954	3.88	1
Equipment breakdowns	0.966	3.79	2
Low productivity and efficiency of equipment	0.963	3.72	3
Use of wrong equipment	1.082	3.61	4
Use of absolute equipment	0.970	3.43	5
Lack of high-technology mechanical equipment	1.071	3.35	6

σX = Standard deviation; $\bar{x}$ = Mean item score; R = Rank

Labour-related causes of construction projects schedule overruns: Further, the respondents were asked to rank the labour related causes of construction projects schedule overruns in Gauteng. The results obtained were as follows: low productivity level of workers (SD=0.822; $\bar{x}$=4.05; R=1), inexperience of workers (SD=0.832; $\bar{x}$=3.96; R=2), work attitude of workers (SD=0.892; $\bar{x}$=3.91; R=3), insecurity by not passing on related work experience (SD=0.835; $\bar{x}$=3.80; R=4), shortage of labour (SD=1.142; $\bar{x}$=3.73; R=5), conflicts among workers (SD=0.999; $\bar{x}$=3.62; R=6) and late approval or issuing of work permits for immigrant workers (SD=1.079; $\bar{x}$=3.40; R=7). The results were in agreement with the study by Wei (2010: 44) where low productivity levels of workers was identified as the major cause of labour related causes of schedule overruns. However, the results were not in agreement with the study by Sambasivan and Soon (2007: 522) where shortage of labour was identified

as the major cause of labour related causes of schedule overruns.

Table 6. Labour-related causes of construction projects schedule overruns

Causes of schedule overruns	σX	$\bar{x}$	R
Low productivity level of workers	0.822	4.05	1
Inexperience of workers	0.832	3.96	2
Work attitude of workers	0.892	3.91	3
Insecurity by not passing on related work experience	0.835	3.80	4
Shortage of labour	1.142	3.73	5
Conflicts among workers	0.999	3.62	6
Late approval or issuing of work permits for immigrant workers	1.079	3.40	7

σX = Standard deviation; $\bar{x}$ = Mean item score; R = Rank

Causes of construction projects schedule overruns by external factor: Furthermore, the respondents were asked to rank the causes of construction projects schedule overruns by external factors in Gauteng. The results obtained were as follows: delay in obtaining permits from municipality (SD=0.835; $\bar{x}$=3.98; R=1), weather effects on construction activities (SD=0.951; $\bar{x}$=3.77; R=2), delay in performing final inspection and certification (SD=0.992; $\bar{x}$=3.76; R=3), effects of subsurface and ground conditions (SD=0.883; $\bar{x}$=3.71; R=4), delay in providing services from utilities (SD=0.931; $\bar{x}$=3.62; R=5), natural disasters (SD=1.139; $\bar{x}$= 3.63; R=6), political interference (SD=1.071; $\bar{x}$=3.61; R=7), change in economic factors (SD=1.059; $\bar{x}$=3.60; R=8), change in government regulation and laws (SD=1.016; $\bar{x}$=3.51; R=9) and traffic control and restriction at sites (SD=1.019; $\bar{x}$3.42; R=10).

Table 7. Causes of construction projects schedule overruns by external factor

Causes of schedule overruns	σX	$\bar{x}$	R
Delay in obtaining permits from municipality	0.835	3.98	1
Weather effects on construction activities	0.951	3.77	2
Delay in performing final inspection and certification	0.992	3.76	3
Effects of subsurface and ground conditions	0.883	3.71	4
Delay in providing services from utilities	0.931	3.62	5
Natural disasters	1.139	3.63	6
Political interference	1.071	3.61	7
Change in economic factors	1.059	3.60	8
Change in government regulation and laws	1.016	3.51	9
Traffic control and restriction at sites	1.019	3.42	10

σX = Standard deviation; $\bar{x}$ = Mean item score; R = Rank

These findings were not in agreement with the study by Alwi and Hampson (2003:

4) where site conditions was identified as the major cause of external factors related causes of schedule overruns. Furthermore, the results were not similar to the results of the study by Wei (2010: 44) where effects of subsurface and ground conditions was identified as the major cause of external factors related causes of schedule overruns.

CONCLUSION AND RECOMMENDATION

Literature revealed that there are different causes of construction project schedule overruns and they include the following; causes that are client related, causes that are contractor related, causes that are consultant related, causes that are material related, causes that are equipment related, causes that are labour related and external factors related causes. Literature further showed the following as the causes in each of the above categories; delay in progress payments, difficulties in financing project by contractors, delay in approving major changes in the scope of work, shortage of construction materials in market, equipment breakdowns, shortage of labour and effects of subsurface and ground conditions as some of the causes of construction project schedule overruns.

From the survey results obtained from the respondents, slowness in decision making process, reworks due to errors during construction, delay in approving major changes in the scope of work, delay in material delivery, shortage of skilled equipment operators, low productivity level of workers, delay in obtaining permits from municipalities and workers risky behaviour on sites were the major causes of construction projects schedule overruns in Gauteng, South Africa. It is therefore recommended that all members of construction teams should be trained and educated on the factors that cause construction project schedule overruns in order to minimise these overruns. Furthermore, it is also recommended that frequent site co-ordination meetings should be held in order to flag possible schedule overruns.

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