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# Causes of delay in road construction projects in Malawi

M J Kamanga, W J v d M Steyn

A study was conducted to identify the causes of delay in completing road construction projects in Malawi. A literature review was done which yielded 72 typical causes of delay, and a questionnaire was sent to client, contractor and consultant representatives in Malawi. The results were analysed using the Relative Importance Index (RII) and Spearman's Rank Correlation Coefficients, which indicated that the top ten causes of delay in Malawi are: shortage of fuel, insufficient contractor cash-flow, shortage of foreign currency for importation of materials and equipment, slow payment procedures adopted by the client in making progress payments, insufficient equipment, delay in relocating utilities, shortage of construction materials, delay in paying compensation to land owners, shortage of technical personnel, and delay in site mobilisation. The causes of delay are significant and should be given attention by client organisations, consultants and contractors to enable the timely completion of projects in future. It should also be noted that most of the causes of delay are not unique to Malawi, and have been observed in other southern African countries such as South Africa, Botswana and Swaziland. Recommendations are made to prevent similar causes of delay in future.

## INTRODUCTION

Since the advent of multi-party democracy in Malawi in 1994, the construction industry has experienced a major growth in the number of participants, especially contractors. The construction industry in Malawi, as in most countries, has made a significant contribution to the growth of the economy through infrastructure development and job creation, apart from the multiplier effects on other sectors of the economy.

The contractors and consultants have varying experience, capabilities and management skills, all of which have a major impact on the completion times of construction projects. The growth in the number of these players in the industry has not seen a corresponding improvement in the timely delivery of projects, although with more contractors and consultants, there is increased competition among themselves and the clients have a greater variety of service providers from which to select. The construction industry in Malawi is now at a stage where most contractors, both emerging as well as long established, can hardly deliver their projects on schedule, not to mention failing to perform all together. This failure to deliver road projects on time annoys both clients and road users who expect to benefit from the completed roads. This state of affairs is undesirable to both the contractors and clients, as it is costly for both parties and has the potential to trigger disputes whose resolution is time-consuming and expensive.

Construction delays are often responsible for turning profitable projects into loss-making ventures (Sweis *et al* 2008). While delays are endemic in the construction industry, this need not be so. The consequences of these delays, which include cost overruns, loss of profits, increased overheads, stress, acrimony between parties, litigation and loss of opportunities because resources are tied up in delayed projects, warrant a study of this nature. The first step in correcting this anomaly is to identify the root causes of the delays so that corrective measures can be devised. Project managers will then be in a better position to monitor and control their plans. Projects that are on track give implementers satisfaction and stress-free hours of work, as they know that they are in control of their projects. All stakeholder (contractors, consultants, clients and others) should benefit from the findings of this study.

It appears that it has become the norm rather than the exception for road construction projects in Malawi to experience delay. Ellis and Thomas (2003) argue that a significant annoyance to the public is when important projects are not completed in a timely manner and when the actual construction work takes longer than necessary, thereby prolonging the inconvenience. Apart from inconveniencing road users, various studies (Al-Khalil & Al-Ghafly 1999; Ahmed *et al* 2002; Aibinu & Jagboro 2002; Assaf & Al-Hejji 2006) have shown that a delay usually leads to cost overruns and disputes, and negatively impacts the economic feasibility of such projects. Projects that are delayed are not just costly for the contractor and client,

MOSES KAMANGA obtained a Diploma in Civil Engineering in 1998 and a BSc in Civil Engineering in 2006, both from the University of Malawi, and an MSc in Project Management in 2013 from the University of Pretoria. He has considerable experience in construction management, contract management and project management. He has worked for construction companies as a site agent and contracts manager, for a consulting firm as a highway engineer and for the Government of Malawi as a project officer. Now he is a project manager at Mtalimanja Holdings Limited.

*Contact details:*
Graduate School of Technology Management
University of Pretoria
Lynnwood Road
Pretoria
South Africa
0002
PO Box 40326
Lilongwe 4
Malawi
T: +265 999 950 389
+265 888 895 996
E: mjkamanga@gmail.com

PROF WYNAND STEYN is a professional pavement engineer with a research interest in vehicle–pavement interaction, accelerated pavement testing and pavement materials and instrumentation. He obtained a PhD in Civil Engineering from the University of Pretoria in 2001. He spent 19 years working at the CSIR in various positions and is currently Associate Professor of civil engineering (focusing on road pavement-related subjects) at the University of Pretoria. His professional activities include academic and industry research in the areas of pavement engineering, vehicle–pavement interaction and pavement materials. He is the author and co-author of 13 journal papers, 13 book chapters and 59 conference papers.

*Contact details:*
Graduate School of Technology Management
University of Pretoria
Lynnwood Road
Pretoria
South Africa
0002
T: +27 12 420 2171
E: wynand.steyn@up.ac.za

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but also for other stakeholders. The cost of deprived benefits to the users, which by definition is higher than the cost of the project, is a major result of construction delays (Malotaux 2009).

The objectives of this paper are to document:

- The range of identified causes of delay in completing road construction projects in Malawi
- The most important causes of delay in road construction projects in Malawi
- Identified differences in perception of contractors, consultants and clients regarding causes of delay in delivering projects by the intended completion date.

This paper thus answers the following three questions:

- What are the general causes of delay in road construction projects in Malawi?
- What are the most important causes of delay in road construction projects in Malawi?
- What are the perceptions of contractors, consultants and clients regarding the causes of delay in delivering these projects by the intended completion date?

## THEORETICAL FRAMEWORK

Theories on the causes of delay in construction projects and methods used to develop the theories have been presented by various researchers (Mansfield *et al* 1994; Assaf & Al-Hejji 2006; Odeh & Battaineh 2002; Aibinu & Jagboro 2002; Tumi *et al* 2009). Most of these researchers based their research on reviews of publicly available literature. Others researchers (Mansfield *et al* 1994; Othman *et al* 2006; Aibinu & Jagboro 2002) based their theories on a combination of literature reviews (publicly available literature) and project files of completed projects or projects in progress to determine construction time performance. The third procedure (Al-Tabtabai 2002; Assaf & Al-Hejji 2006) was based on field visits to construction sites where discussions were held with some parties in the construction industry.

After the literature review and, in some cases discussions with parties on project sites, the identified causes of construction delay were tabled into a questionnaire which was completed by consultants, contractors and clients. Seventy-two causes of delay were identified, and they were divided into six categories related to consultants, clients, contractors, projects, resources and external causes. Analysis of the completed questionnaires indicated that the top three causes of delay are improper planning or lack of planning (Chan & Kumaraswamy 1997; Odeh & Battaineh 2002; Al-Tabtabai 2002; Tumi *et al* 2009; Mansfield *et al* 1994; Assaf & Al-Hejji 2006; Ogunlana *et al* 1996), variations (Chan & Kumaraswamy 1997; Mansfield *et al* 1994; Assaf & Al-Hejji 2006; Sullivan & Harris 1985; Ellis & Thomas 2003; Ahmed *et al* 2002) and changed site (ground) conditions (Chan & Kumaraswamy 1997; Acharya *et al* 2006; Mansfield *et al* 1994; Sullivan & Harris 1985; Ellis & Thomas 2003; Vidalis & Najafi 2002). The information obtained from these studies form an integral part of the questionnaire used for the present study.

The Relative Importance Index (RII) (Equation 1) is a favourite method for ranking causes of delay (Chan & Kumaraswamy 1997; Aibinu & Jagboro 2002; Odeh & Battaineh 2002; Al-Tabtabai 2002). It is used to rank the different causes of delays from the perspective of clients, consultants, contractors and other stakeholders.

$$RII = \sum_{i=1}^{5} WiXi \div \sum_{i=1}^{5} Xi \quad (1)$$

Where:

- $i$ = response category index for 1 (never), 2 (rare), 3 (occasional), 4 (frequent) and 5 (continual)
- $W$ = the weight assigned to the $i^{th}$ response = 0, 1, 2, 3, 4 and 5 respectively
- $Xi$ = frequency of the $i^{th}$ response given as a percentage of the total responses for each cause.

The indices for the causes are ranked for each group. The cause with the highest index is the most important, while that with smallest number is the least important. Spearman's rank correlation is a relationship measure among different parties or factors and the strength and direction of the relationship (Assaf & Al-Hejji 2006). This study uses Spearman's rank correlation to show the level of agreement between any two parties (Equation 2).

$$r_s = 1 - [6\sum d^2 \div (n^3 - n)] \quad (2)$$

Where:

- $r_s$ = Spearman's rank correlation coefficient
- $d$ = the difference in ranking between any two parties
- $n$ = the number of factors

The correlation coefficient varies between +1 and –1, where +1 implies a perfect positive relationship (agreement), while –1 results from a perfect negative relationship (disagreement). Sample estimates of correlation close to unity in magnitude imply good correlation, while values near zero indicate little or no correlation (Assaf & Al-Hejji 2006).

## RESEARCH METHODOLOGY

Self-administered surveys were used and questionnaires were delivered to participants by post, e-mail and in person. Participants filled in the questionnaires in their own time without any assistance from the researcher. This approach removes any undue pressure from the respondents and gives them the freedom to fill in the questionnaire as truthfully as possible, unlike one-on-one interviews, where interviewees may be influenced by the interviewer's attitude. The study started with a literature review, followed by identification of the survey participants. A questionnaire was developed for data collection, focused on the defined research questions. The study participants (population) comprised engineers working at the Malawi Roads Authority (client organisation), consultants (highway engineers and team leaders) who have been supervising road works and contractors (contracts managers, site agents and managing directors) who have been involved in the actual construction of roads.

The client for this study is the Malawi Roads Authority, which is headquartered in Lilongwe, Malawi's capital city. The Roads Authority is a natural choice as the client, considering that almost all road construction projects in Malawi are administered by them. They also have regional offices in the three regions of the country. Questionnaires were sent to senior managers/engineers at the headquarters as well as at regional offices.

Other questionnaires were sent to team leaders or highway engineers of consultants who have been involved in the design and supervision of contracts administered by the Roads Authority. The third set of questionnaires was sent to managing directors, contracts managers and site agents of contractors who have been involved in roads projects under the Roads Authority.

Of the 29 questionnaires distributed to the Roads Authority, 13 were returned (response rate of 44.8%). Since the Malawi construction industry is quite small, there are also a few consulting firms that are involved in the supervision of projects administered by the Roads Authority. Of the 27 questionnaires that were distributed to them, 12 were returned (44% response rate). For contractors, those with more than two years' experience working with the Roads Authority were randomly sampled since there are a large number of these stakeholders – 43 questionnaires were sent out and 20 were returned (response rate of 46.5%).

A combination of three methods was used to analyse the data:

- Relative Importance Index (RII)
- Spearman's rank correlation
- Probability values (p-values).

**Table 1** Study results

| Delay factors | Client | | Consultants | | Contractors | | All parties | |
|---|---|---|---|---|---|---|---|---|
| | RII | Rank | RII | Rank | RII | Rank | Average RII | Rank |
| Incomplete drawings/specifications | 0.615 | 26 | 0.568 | 43 | 0.461 | 53 | 0.548 | 43 |
| Design errors and omissions | 0.615 | 27 | 0.458 | 62 | 0.474 | 52 | 0.516 | 50 |
| Excessive extra works | 0.673 | 16 | 0.604 | 30 | 0.450 | 54 | 0.576 | 35 |
| Inadequate design team experience | 0.596 | 31 | 0.500 | 57 | 0.500 | 47 | 0.532 | 46 |
| Delays in producing design documents | 0.673 | 16 | 0.542 | 49 | 0.538 | 39 | 0.584 | 32 |
| Excessive variations in quantities | 0.654 | 20 | 0.625 | 27 | 0.500 | 47 | 0.593 | 30 |
| Rework due to wrong drawings | 0.346 | 65 | 0.417 | 66 | 0.250 | 71 | 0.338 | 69 |
| Insufficient data collection and survey before design | 0.538 | 42 | 0.604 | 30 | 0.550 | 33 | 0.564 | 40 |
| Slow response | 0.558 | 38 | 0.568 | 43 | 0.605 | 20 | 0.577 | 34 |
| Slow decision-making | 0.577 | 34 | 0.500 | 57 | 0.625 | 13 | 0.567 | 39 |
| Long period for approval of tests and inspections | 0.442 | 58 | 0.417 | 66 | 0.513 | 46 | 0.457 | 63 |
| Unfamiliarity with or lack of knowledge by the consultant's supervision staff regarding new construction methods, materials and techniques | 0.481 | 52 | 0.438 | 65 | 0.525 | 42 | 0.481 | 55 |
| Lack of application of construction management tools and techniques by consultant's project and site staff | 0.500 | 48 | 0.563 | 45 | 0.375 | 64 | 0.479 | 57 |
| Conflicts between drawings and specifications | 0.365 | 63 | 0.500 | 57 | 0.250 | 71 | 0.372 | 67 |
| Frequent design changes requested by client during construction | 0.417 | 61 | 0.455 | 64 | 0.450 | 54 | 0.441 | 66 |
| Inaccurate initial project scope estimate | 0.538 | 42 | 0.625 | 27 | 0.553 | 32 | 0.572 | 37 |
| Slow payment procedures adopted by client in making progress payments | 0.654 | 20 | 0.792 | 2 | 0.813 | 3 | 0.753 | 4 |
| Unrealistic time estimation | 0.596 | 31 | 0.667 | 22 | 0.638 | 10 | 0.634 | 19 |
| Executive bureaucracy at client's offices | 0.500 | 48 | 0.771 | 6 | 0.605 | 21 | 0.625 | 20 |
| Slow decision-making process by client's departments | 0.481 | 52 | 0.688 | 16 | 0.625 | 13 | 0.598 | 28 |
| Inefficient flow of information from client's departments | 0.423 | 60 | 0.583 | 38 | 0.525 | 42 | 0.510 | 52 |
| No or small time extensions associated with change orders initiated by client | 0.365 | 63 | 0.614 | 29 | 0.625 | 13 | 0.535 | 45 |
| Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors | 0.346 | 65 | 0.604 | 30 | 0.638 | 10 | 0.529 | 47 |
| Understaffed client's project and site personnel | 0.429 | 59 | 0.563 | 45 | 0.550 | 33 | 0.514 | 51 |
| Poor communication and coordination by client and other parties | 0.308 | 71 | 0.583 | 38 | 0.525 | 42 | 0.472 | 61 |
| Delays in work approval | 0.346 | 67 | 0.688 | 16 | 0.575 | 25 | 0.536 | 44 |
| Client-initiated variations | 0.481 | 52 | 0.591 | 37 | 0.487 | 50 | 0.520 | 49 |
| Insufficient contractor cash flow/difficulties in financing projects | 0.827 | 3 | 0.813 | 1 | 0.825 | 2 | 0.822 | 2 |
| Poor qualifications and inadequate experience of contractor's supervisors | 0.731 | 9 | 0.729 | 12 | 0.563 | 29 | 0.674 | 14 |
| Ineffective planning and scheduling of project | 0.731 | 9 | 0.750 | 7 | 0.563 | 29 | 0.681 | 12 |
| Equipment allocation problems | 0.654 | 20 | 0.708 | 14 | 0.600 | 22 | 0.654 | 16 |
| Materials management problems | 0.615 | 28 | 0.750 | 7 | 0.563 | 29 | 0.643 | 18 |
| Misinterpretation of drawings and specifications | 0.538 | 42 | 0.458 | 62 | 0.363 | 65 | 0.453 | 64 |
| Rework due to errors during construction | 0.558 | 38 | 0.521 | 54 | 0.350 | 66 | 0.476 | 60 |
| Poor communication and coordination with other parties | 0.500 | 48 | 0.521 | 54 | 0.434 | 42 | 0.485 | 54 |
| Poor contractor's site management and supervision | 0.615 | 28 | 0.688 | 16 | 0.538 | 39 | 0.614 | 23 |
| Delay in site mobilisation | 0.692 | 12 | 0.729 | 13 | 0.650 | 9 | 0.690 | 10 |
| Conflict between/with contractor and other parties (consultant and client) | 0.538 | 42 | 0.479 | 61 | 0.425 | 61 | 0.481 | 55 |
| Improper construction methods implemented by contractor | 0.538 | 42 | 0.500 | 57 | 0.400 | 62 | 0.479 | 57 |
| Late delivery of materials and equipment | 0.673 | 16 | 0.750 | 7 | 0.613 | 18 | 0.679 | 13 |

| Delay factors | Client | | Consultants | | Contractors | | All parties | |
|---|---|---|---|---|---|---|---|---|
| | RII | Rank | RII | Rank | RII | Rank | Average RII | Rank |
| Poor procurement programming of materials | 0.615 | 28 | 0.708 | 14 | 0.500 | 47 | 0.608 | 24 |
| Type of project bidding and award (lowest bidder) | 0.500 | 48 | 0.750 | 7 | 0.575 | 25 | 0.608 | 24 |
| Ineffective delay penalties | 0.404 | 62 | 0.542 | 49 | 0.434 | 59 | 0.460 | 62 |
| Inadequate definition of substantial completion | 0.327 | 69 | 0.354 | 69 | 0.342 | 67 | 0.341 | 68 |
| Legal disputes between/with various parties | 0.346 | 67 | 0.229 | 71 | 0.275 | 69 | 0.283 | 71 |
| Unrealistic project construction duration as specified in the contract | 0.558 | 38 | 0.563 | 45 | 0.600 | 22 | 0.574 | 36 |
| No financial incentives for contractors to finish ahead of schedule | 0.462 | 56 | 0.646 | 24 | 0.688 | 7 | 0.599 | 28 |
| No application of construction management procedures on the part of client contributes to late detection of construction problems | 0.462 | 56 | 0.523 | 53 | 0.447 | 56 | 0.477 | 59 |
| Unrealistic schedule programme submitted by contractor | 0.731 | 9 | 0.604 | 30 | 0.538 | 39 | 0.624 | 21 |
| Contractor's staff are not properly trained in professional construction management techniques | 0.692 | 12 | 0.646 | 24 | 0.625 | 13 | 0.654 | 16 |
| Poor judgement and inexperience in estimating procedures by contractor | 0.635 | 23 | 0.583 | 38 | 0.539 | 37 | 0.586 | 31 |
| Shortage of construction materials (bitumen, cement and steel) | 0.750 | 8 | 0.667 | 22 | 0.725 | 6 | 0.714 | 7 |
| Shortage of technical personnel | 0.813 | 5 | 0.688 | 16 | 0.613 | 18 | 0.705 | 9 |
| Insufficient equipment | 0.865 | 2 | 0.75 | 11 | 0.625 | 13 | 0.747 | 5 |
| Shortage of fuel | 0.904 | 1 | 0.792 | 2 | 0.863 | 1 | 0.853 | 1 |
| Shortage of labour | 0.481 | 52 | 0.417 | 66 | 0.438 | 57 | 0.445 | 65 |
| Price escalation | 0.577 | 34 | 0.646 | 24 | 0.763 | 5 | 0.662 | 15 |
| Low level of equipment operators' skills | 0.673 | 16 | 0.542 | 49 | 0.525 | | 0.580 | 33 |
| Low productivity and efficiency of equipment | 0.596 | 31 | 0.604 | 30 | 0.487 | 50 | 0.562 | 41 |
| Lack of high-technology mechanical equipment | 0.692 | 12 | 0.688 | 16 | 0.688 | 7 | 0.689 | 11 |
| Unqualified workforce | 0.635 | 23 | 0.542 | 49 | 0.539 | 37 | 0.572 | 37 |
| Low productivity of labour | 0.635 | 23 | 0.604 | 30 | 0.566 | 28 | 0.602 | 26 |
| Shortage of foreign currency (importation of materials and equipment) | 0.808 | 6 | 0.792 | 2 | 0.800 | 4 | 0.800 | 3 |
| Delays attributed to third-party testing of materials | 0.558 | 38 | 0.521 | 54 | 0.438 | 57 | 0.506 | 53 |
| Differing or unexpected geotechnical conditions during construction | 0.577 | 34 | 0.604 | 30 | 0.393 | 63 | 0.525 | 48 |
| Effect of rain on construction activities | 0.577 | 34 | 0.583 | 38 | 0.638 | 10 | 0.599 | 27 |
| Effect of hot weather on construction activities | 0.327 | 69 | 0.292 | 70 | 0.275 | 69 | 0.298 | 70 |
| Theft of contractor's resources | 0.692 | 12 | 0.583 | 38 | 0.575 | 25 | 0.617 | 22 |
| Vandalism of works (in progress or finished) | 0.538 | 42 | 0.563 | 45 | 0.550 | 33 | 0.550 | 42 |
| Delay in paying compensations (land-owners) | 0.827 | 3 | 0.688 | 16 | 0.600 | 22 | 0.705 | 8 |
| Delay in relocating utilities | 0.808 | 6 | 0.792 | 2 | 0.550 | 33 | 0.717 | 6 |
| Industrial action (strike/sit-in) | 0.250 | 72 | 0.229 | 71 | 0.288 | 68 | 0.256 | 72 |

The association between the ranking of parties is verified by a hypothesis testing at 95% significance (thus $\alpha = 5\%$) (Odeh & Battaineh 2002). The p-value is the probability of observing a sample value as extreme as, or more extreme than, the value actually observed, given that the null hypothesis is true. The p-value is then compared to the significance level ($\alpha$), and on this basis the null hypothesis is either rejected or not rejected. If the p-value is less than the significance level, the null hypothesis is rejected (p-value $< \alpha$, reject null). If the p-value is greater than or equal to the significance level, the null hypothesis is not rejected (p-value $\geq \alpha$, do not reject null) (Blumberg *et al* 2008).

## RESULTS

A complete set of the survey results is shown in Table 1. Analysing the data from the viewpoints of the three major stakeholder types, the following are observed:

### Clients' viewpoints

The top five causes of delay identified by clients are:

- Shortage of fuel (RII = 0.904)
- Insufficient equipment (RII = 0.865)
- Insufficient contractor cash-flow/difficulties in financing projects (RII = 0.827)
- Delays in paying compensation to land owners (RII = 0.827)
- Shortage of technical personnel (RII = 0.813).

**Table 2** Correlation test of all factors among respondents

| Group | Client & consultants | | Client & contractors | | Consultant & contractor | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P-value | Correlation coefficient | P-value | Correlation coefficient | P-value |
| All factors | 0.601 | 0.09 | 0.503 | 0.13 | 0.699 | 0.06 |

**Table 3** Top ten factors that cause delay

| Cause of delay | All parties | Group |
|---|---|---|
| | Average RII | |
| Shortage of fuel | 0.853 | Resource-related |
| Insufficient contractor cash-flow/difficulties in financing projects | 0.821 | Contractor-related |
| Shortage of foreign currency (importation of materials and equipment) | 0.800 | Resource-related |
| Slow payment procedures adopted by client in making progress payments | 0.753 | Client-related |
| Insufficient equipment | 0.747 | Resource-related |
| Delay in relocating utilities | 0.716 | Externally related |
| Shortage of construction materials (bitumen, cement and steel) | 0.714 | Resource-related |
| Delay in paying compensations (land owners) | 0.705 | Externally related |
| Shortage of technical personnel | 0.704 | Resource-related |
| Delay in site mobilisation | 0.690 | Contractor-related |

## Consultants' viewpoints

The top five causes of delay identified by consultants are:

- Insufficient contractor cash-flow/difficulties in financing projects (RII = 0.813)
- Slow payment procedures adopted by the client in making progress payments (RII = 0.792)
- Shortage of fuel (RII = 0.792)
- Shortage of foreign currency (importation of materials and equipment) (RII = 0.792)
- Delay in relocating utilities (RII = 0.792).

## Contractors' viewpoints

The top five causes of delay identified by the contractors are:

- Shortage of fuel (RII = 0.863)
- Insufficient contractor cash-flow/difficulties in financing projects (RII = 0.825)
- Slow payment procedures adopted by the client in making progress payments (RII = 0.813)
- Shortage of foreign currency (importation of materials and equipment) (RII = 0.800)
- Price escalation (RII = 0.763).

## Spearman's rank correlation coefficient

Table 2 shows the values of correlation coefficients among the parties and their corresponding p-values. These values show that there is a positive correlation between client and consultant, with a correlation of 0.601 and a corresponding p-value of 0.09 (greater than the level of significance, $\alpha = 0.05$), therefore there is no significant relationship between causes of delay ranked by client and consultants. Similarly, there is a positive correlation of 0.503 between client and contractors and a p-value of 0.13, an indication of insignificant relationships between causes of delay ranked by these two respondent groups. The correlation coefficient between consultants and contractors is also positive, but their corresponding p-value is greater than 0.05, denoting an insignificant relationship between causes of delay ranked by consultants and contractors.

Since all three p-values in Table 2 are greater than the significance level ($\alpha = 0.05$), the null hypothesis cannot be rejected.

## All respondents' viewpoints

The combined views of all three parties to the survey are shown in Table 3. They show that five out of ten causes of delay are linked to shortage of resources. These results also show that the causes of delay ranked by the consultants did not contribute to the top ten causes of delay.

Some of the results in Table 3 are very similar to those obtained by researchers in South Africa, Botswana and Swaziland. An exploratory study of problems facing small-scale contractors in the North West province of South Africa conducted by Thwala and Phaladi (2009) revealed that government was not paying on time. Lack of capital and difficulty in arranging guarantees, as well as lack of technical skills, were cited as other problems facing small-scale contractors. Four listed construction companies downed tools on 23 road contracts in the Free State because of non-payment of hundreds of millions of rand (Carte 2012).

A study of the current challenges and problems facing small and medium-sized contractors in Swaziland (Thwala & Mvubu 2008) also showed that slow payment and non-payment by government after a government project has been completed is common, leading to many construction firms suffering financial ruin and bankruptcy. Just like in Malawi, contractors in Swaziland also experience inadequacy in technical and managerial skills required for project implementation. Lack of resources also hampers effective delivery of large or complex projects in Swaziland.

Delays in payment for completed works has been cited as being among the top five key factors responsible for time delays of large construction projects in Botswana by Mathumo (2012). The other factors include poor project management skills, poor planning and lack of skilled subcontractors. Another study on delays in completion of building construction projects in the Botswana public sector by medium and large contractors reveals that poor management is the biggest cause of delays (Joseph 2004).

## CONCLUSIONS

This study was aimed at finding the causes of delay in road construction projects in Malawi. Seventy-two causes of delay were extracted from the literature on the subject. The seventy-two causes of delay were divided into six categories related to consultants, client, contractors, projects, resources and external. A questionnaire based on these causes of delay was sent to the client, consultant and contractor representatives. The collected data were analysed using the Relative Importance Index (RII) and Spearman's rank correlation coefficients. From this study a collective analysis of all three groups show that among the top ten causes of delay, five are related to resource shortages, two are contractor related, two are related to external factors, while one is client related. It was observed that there is no project-related or consultant-related delay factors among the top ten causes of delay, which are:

1. Shortage of fuel.
2. Insufficient contractor cash-flow/difficulties in financing projects.
3. Shortage of foreign currency for importation of materials and equipment.
4. Slow payment procedures adopted by the client in making progress payments.
5. Insufficient equipment.
6. Delay in relocating utilities.
7. Shortage of construction materials such as bitumen, cement and steel.

8. Delay in paying compensations to land owners.
9. Shortage of technical personnel.
10. Delay in site mobilisation.

## RECOMMENDATIONS

On the basis of these findings, the following recommendations are made (each bullet refers to one of the top ten causes of delay listed):

- Shortage of fuel hinges on the shortage of foreign currency used for the importation of fuel and other goods not available in the country. The country must increase its exports, and at the same time reduce its imports to enable its balance of trade to be in favour of exports.
- Insufficient contractor cash-flow/difficulties in financing projects develop either as a lack of liquidity on the part of the contractor and/or client delays in making progress payments. Assaf and Al-Hejji (2006) recommend that contractors should manage their financial resources and plan cash-flow by utilising progress payment. Contractors should ensure that the advance payment is used to finance project activities. The contractor can be paid on time if a clause is introduced in the contract whereby the client is required to pay the contractor the amount certified in an interim payment certificate within seven calendar days of the date of issue of the payment certificate, as is the case with the Joint Building Contracts Committee (JBCC) Series 2000 Principal Building Agreement. The client should not award a contract to the contractor when the client does not have adequate finances to execute the project. Mansfield *et al* (1994) recommend that clients should ensure that adequate funds are available before projects are started, so that contractors can be paid in accordance with the contract agreement. The FIDIC Multilateral Development Bank Harmonised Edition (2010) requires the employer to give the contractor evidence that it has access to or has the funds necessary to pay the contract price. Clause 2.4 reads in part "The Employer shall submit, before the Commencement Date and thereafter within 28 days after receiving any request from the contractor, reasonable evidence that financial arrangements have been made and are being maintained which will enable the Employer to pay the Contract Price punctually (as estimated at that time) in accordance with Clause 14 [Contract Price and Payment]. Before the Employer makes any material change to his financial arrangements, the Employer shall give notice to the Contractor with detailed particulars." Mansfield *et al* (1994) further recommend that comprehensive economic analysis and workable financial plans should be prepared before contracts are awarded.
- While it is common practice for contracts to include a performance guarantee clause, there should also be a payment guarantee clause so that if a duly issued payment certificate is not paid within the stipulated period, the contractor may demand his payment from the guarantor.
- In most contracts funded by development partners there is a currency split provision for paying the contractor in more than one currency. The contractor should, when tendering, assess his foreign currency requirement for importation of materials and equipment and factor it into the currency split. As for contracts funded by local resources, government must put in place policies that encourage export growth that will generate foreign currency for the country. The government should also create an economic climate that will see the country importing only those goods and services that are not locally available, thereby reducing the outflow of foreign currency.
- The inclusion of a clause in the contract, as is the case with the Joint Building Contracts Committee (JBCC) Series 2000 Principal Building Agreement (PBA) (2007), requiring that the employer (client) shall pay to the contractor the amount certified in an interim payment certificate within seven calendar days of the date of issue of the payment certificate, should considerably quicken payment procedures. Another clause should be introduced in the contract requiring the client to pay interest to the contractor for delaying his payment.
- Contractors should consider buying their own equipment from the proceeds of their contracts. There is an opportunity for investors to set up private plant and equipment hire organisations. Local investors can also invite international investors to invest in plant and equipment hire organisations, since there is a shortage of equipment in the country.
- Utility organisations should be involved at the planning stage so that there is coordination and cooperation in locating and relocating these services before construction works start. Goodrum *et al* (2009) recommend the establishment of utility corridors and systematic location of facilities. They further recommend avoiding the need to relocate many utility lines by collecting and mapping underground utility data that was primarily unknown, using subsurface utility engineering early in the design phase. Utility organisations should produce accurate and clear as-built drawings to provide utility location information.
- Concerted efforts should be directed towards research and development in the use of local materials. In order to encourage international contractors and investors to undertake greater foreign direct investment in such areas as materials development and production, it is necessary for the host government to relax 'interventionist monetary policies' and other strict economic measures (Mansfield *et al* 1994). This incentive will enable the local currency to find its true value in the free market, and thereby curtail excessive price fluctuations associated with imported construction materials, equipment and other plant items.
- At the planning stage, people whose properties would be affected by the construction works should be identified and compensations agreed with the property owners. After compensations have been agreed, they should be paid so that the affected people can relocate well in advance of the commencement of the construction works.
- All three parties (client, consultant and contractor), should put in place policies that will help them retain their valuable human resources, thereby reducing their high staff turnover. The parties should conduct continuous training programmes to improve the competency of personnel carrying out designs, supervision and construction at all levels, not just at the top, but all the way down to craftsmen and casual workers. There is an urgent need for offering training courses in scheduling, time and cost control, information systems, and management of human resources (Odeh & Battaineh 2002). Project personnel should also be trained in critical chain project scheduling.
- Most contracts stipulate the time frame within which a contractor should mobilise. The consequences of failing to mobilise must also be detailed, and include cancellation of contract.

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