

# Reducing Pathogens in Municipal Projects

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**Abstract:** This study was focused on exploring how to reduce pathogens to improve project delivery in a South African municipality. The primary motivation behind this study was the critical role of municipalities in ensuring effective and efficient service delivery. However, the implementation of such projects is often faced with obstacles, resulting in delays in their completion and higher costs than initially budgeted. The study was conducted based on a quantitative approach, using a survey questionnaire to collect primary data from a sample of 78 employees. The results of the study showed that several challenges result in delays in delivering infrastructure projects. These include supply chain and procurement challenges, lack of senior management support, lack of skills and competencies, changes in the scope of projects during implementation, delays in project approval, poor planning, and ineffective communication. Based on the study, it was recommended that municipalities enhance employees' skills to ensure that they have the necessary knowledge and skills to implement infrastructure projects effectively. In addition, the project design stage should be carried out thoroughly to ensure that each project has a clearly defined scope. Furthermore, it is critical for the municipality to improve project planning and communication. Effective planning of projects ensures that appropriate size, schedule, and critical paths are developed, ensuring the smooth running of the project.

**Keywords:** Construction, management, projects, pathogens.

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## 1. Introduction

This study was focused on reducing pathogens to improve project delivery in public projects. The primary motivation behind this study was to examine the critical role of municipalities in ensuring effective and efficient service delivery in South Africa. Coetzee and Kleynhans (2017) cited infrastructure as being the backbone that enables cities or municipal areas to stimulate social and economic growth. Municipalities are tasked with implementing service delivery projects to contribute to economic development and enhance the quality of residents life (Al-Amosh, 2021). However, the implementation of such projects is often faced with several obstacles, which result in delays in their completion and higher costs than initially budgeted (Mofleh, 2021). Project delays are a significant challenge that hinders the successful completion of municipal and other projects. Time, quality, and cost are considered to be vital factors for a project to be successful.

South Africa's lack of effective and adequate infrastructure is considered to be a constraint to economic and social development (Aiyetan and Das, 2021). The government recognised the link between infrastructure and economic growth and, therefore, has made concerted efforts to upgrade the existing and create the required, infrastructure (Coetzee and Kleynhans, 2017).

Despite making significant investments in infrastructure projects, South Africa has experienced slow delivery of such projects (Aiyetan and Das, 2021). Several projects have been confronted with challenges of delay and cost overruns. Although the infrastructure in South Africa is viewed as being of a better standard than that of other African countries, challenges of time, scope, and quality continue to be enormous, especially during project implementation. The primary reason for the failure of project delivery is poor project management, abysmal planning and design, inadequate stakeholder engagement and risk management, and poor project governance (Aiyetan and Das, 2021). This is not peculiar to South African construction. For example, it is common for clients to be accused of delaying payments and other needed approvals; contractors do not meet targets as planned; and consultants monitor the work poorly (Doloi et al., 2012).

Accordingly, several studies have been conducted to explore the causes and impacts of delays in the completion of projects (Assaf and Al-Hejji, 2006; Kumar, 2016; Pourrostam et al., 2012; Tafazzoli and Shrestha, 2017). The most common causes of delays are financial challenges, slow decision-making, poor planning, inflation, and governance issues. Hussain et al. (2017) cited unhappy clients, budget overruns, interruption of work, extension of time schedules, disputes, and termination of contracts as some of the common causes of project delays.

Poorly executed public projects cost governments vast sums of money in unexpected expenses and aggravate construction-related disruptions for businesses and users. According to Siemiatycki (2015), persistent project delays can affect the public's confidence in the government's ability to deliver essential infrastructure projects. The erosion of public trust, in turn, makes it challenging to build support for the next level of critical infrastructure investments. In this context, how to minimise delays by removing pathogens in public projects is considered in this paper.

## **2. Method**

### **2.1. Research Design**

A descriptive research design, as explained by Terre Blanche et al. (2007), was adopted for this study. Descriptive research was used because of the need to determine the pathogens that hinder effective project delivery in a municipality. Descriptive studies are conducted to identify and record features of phenomena, such as pathogens. The purpose of descriptive research is to enable the subject matter to be categorised (Fellows and Liu, 2008). According to Fellows and Liu (2008), 'the research can be undertaken as a survey (possibly of the population identified) or as a case study work'. The survey option was selected for the research reported in this paper to enable the researchers to identify and categorise pathogens in projects in a particular municipality in South Africa.

### **2.2. Sample**

The sample for this study was selected from 408 employees in Thembeisile Hani Local Municipality (THML) in South Africa. From this population, 78 employees were selected for participation in the survey. The sample was selected from all levels in the organisation's hierarchy, using stratified random sampling. According to Saunders et al. (2016), stratified random sampling is a probability sampling technique that involves dividing the population into homogenous sub-groups, known as strata, and then selecting elements from each stratum, using simple random sampling, to determine the sample size. The population was divided according to the different levels in the municipality's hierarchy into the following strata: general workers, supervisors, artisans, and management. A simple random sampling technique was used to select a sample for each group. The formula for sample size in relation to the response rate is explained by Fellows and Liu (2008).

### **2.3. Data Collection**

A self-administered survey questionnaire was used to collect primary data for this study. A self-administered questionnaire requires respondents to read and complete the questionnaire unaided by either the researcher or an external person. This form of questionnaire was chosen for this study because it enables the collection of data from a large sample of respondents at a low cost. The choice of a self-administered questionnaire was motivated also because it makes it possible to collect quantitative data that are easy to analyse with the aid of statistical packages to provide descriptive and inferential statistics.

The questionnaire was designed so that participants could identify with the language used and complete the questions in a maximum of 15 minutes. No personal information was requested. The questionnaire was semi-structured, with both open-ended and closed-ended questions. There were two sections in the questionnaire: demographic information was requested in Section A, and questions in Section B were related to the study's objectives. In Section B, a Likert Scale was used to measure responses, which required respondents to show the extent to which they agreed with given statements. A five-point Likert Scale was adopted, with each number indicating the following: 1 = strongly disagree; 2 = strongly agree; 3 = neutral; 4 = agree; and 5 = strongly agree.

The questionnaires were distributed by email. Respondents were given three weeks to complete and return the questionnaires. The respondents were sent reminders by email in order to obtain a high response rate of 70%. The rate achieved was 71.8%.

### **2.4. Data Analysis**

The Statistical Package for Social Science (SPSS) was used to analyse the data for this study. The programme produced descriptive statistics, which were then used to describe the data in the results section. Frequencies were used to describe the number of times a particular response, such as 'strongly agree', occurred among the responses for a particular statement, thus showing the extent to which respondents supported or rejected the statement. Another descriptive statistic used was the mean score (MS) to show the average number of responses supporting a particular statement. For the degree of concurrence relative to the 'strongly disagree' to 'strongly agree' scale, the following MS ranges and terms were used:

- Strongly disagree to disagree:  $\geq 1.00$  to  $\leq 1.80$ ;
- Strongly disagree to disagree/disagree:  $> 1.80$  to  $\leq 2.60$ ;
- Disagree to neutral / neutral:  $> 2.60$  to  $\leq 3.40$ ;
- Neutral to agree / agree:  $> 3.40$  to  $\leq 4.20$ , and
- Agree to strongly agree / strongly agree:  $> 4.20$  to  $\leq 5.00$ ;

### 3. Results

Demographic data were collected in Section A of the questionnaire to assess relationships between the research findings. The results are summarised in Table 1.

As shown in Table 1, the majority (66.1%) of the respondents were females compared with 33.9% male. The table also shows that most of the respondents were general workers (35.7%) compared with supervisors (16.1%), artisans (17.9%), technicians (16.1%), and managers (15.1%). One of the reasons for this result was that general workers were always available during the data collection period compared with other respondents. Regarding educational qualifications, most respondents had matric as their highest qualification. Other respondents had at least some forms of tertiary education as follows: diploma (32.1%), degree (16.1%), and master's degree (3.6%). The working experience results indicated that most respondents (39.3%) had work experience at THLM, ranging from 11 to 15 years. This denoted that most respondents had a fair understanding of the available legislation and policies that guide the delivery of services and which might be employed to reduce pathogens and improve project delivery in THLM.

**Table 1.** Demographic profile of respondents

Profile	Construct	Respondents
Gender	Male	19
	Female	37
Job title	General workers	20
	Supervisors	9
	Artisans	10
	Technicians	9
	Others	8
	Matric	27
Academic qualifications	Diploma	18
	Honors' Degree	9
	Masters' Degree	2
	PhD	0
Work experience	1 to 5 years	15
	6 to 10 years	19
	11 to 15 years	22
	16 years and above	0

### 3.2. Supply Chain Management

#### 3.2.1. Practices that delay project delivery

Table 2 indicates the extent to which the respondents agreed or disagreed with the notion that THLM deployed ways to implement the MFMA Act of 2003. It can be noted from Table 2 that the respondents confirmed that practices such as late payment of contractors and suppliers contributed to project delivery delays in THLM ( $MS > 3.40$  to  $\leq 4.20$ ). The respondents were either neutral or disagreed ( $MS 2.60$  to  $3.40$ ) that the practices of THML complied with the MFMA of 2003 in implementing projects. In addition, the respondents also disagreed ( $MS > 2.60$  to  $\leq 3.40$ ) that THML had effective supply-chain management practices and that payments to suppliers were made within 30 days.

In summary, 80% of the variables ranked 1 to 4 had an MS ranging from  $> 1.80$  to  $\leq 3.40$ , which indicated that the respondents strongly disagreed with the following: that THML complied with the MFMA of 2003 in implementing projects; THML has effective supply-chain management practices; payments to suppliers were made within 30 days; and employees had adequate supply-chain management skills and competences.

**Table 2.** Practices that delay project delivery

Contributor	MS	Rank
Late payments to contractors and suppliers	3.95	1
Compliance regulations in projects	3.38	2
Effective supply-chain management	2.98	3
Timely payments to suppliers	2.92	4
Appropriate skills and competences	2.28	5

#### 3.2.2. Impact of late payments on project delivery

Table 3 indicates the extent to which the respondents agreed or disagreed with the impact of late payments on project delivery in THLM. It is evident from Table 3 that the MSs for all the variables, i.e. 100%, are within the range ( $MS > 3.40$  to  $\leq 4.20$ ).

This denoted that all respondents agreed that late payment has the following impacts on project delivery: it provokes workers to go on strike (MS = 4.07) and prolongs the construction; program (MS = 4.01) results in skilled employees leaving the project (MS = 3.78); results in project cost and time overruns (MS = 3.82); and results in the contractor's running out of working capital (cash-flow problems) (MS = 3.68).

These factors seriously impact project delivery in the municipality. Furthermore, the respondents strongly disagreed (MS > 1.80 to ≤ 2.60) that employees had adequate supply-chain management skills and competencies in project delivery.

**Table 3.** Impact of late payment on project delivery

Outcome	MS	Rank
Workers strike on project site	4.07	1
The construction program is prolonged	4.01	2
Skilled employees leave the project	3.78	3
Projects experience cost and time overruns	3.82	4
Contractor runs out of working capital (cash-flow problems)	3.68	5

### 3.3. Management Duties and Responsibilities

#### 3.3.1. Management practices that delay project delivery

Table 4 indicates the extent to which the respondents agreed or disagreed on management practices that potentially delay project delivery in THLM. Table 4 shows that 40% of the variables (ranked 1 and 2) have an MS within > 3.40 to ≤ 4.20. This indicated that the respondents agreed that the following management practices delayed project delivery in THLM: late approvals contribute to project delays (MS = 3.94) and late payments made to contractors and suppliers (MS = 3.90). In addition, the respondents were either neutral or disagreed (MS = 2.71) that senior management was always available when required, which delayed project delivery in THLM. Furthermore, 40% of the variables (ranked 4 and 5) had MS values > 1.80 to ≤ 2.60. This implied that the respondents disagreed that senior management undertook the following practices to improve project delivery: changes in project scope are approved within a reasonable timeframe (MS = 2.39); and projects are approved within appropriate timeframes (MS = 2.08).

#### 3.3.2. Impact of project situation and changes on project delivery

Table 5 shows the responses regarding the impact of the project situation and changes on project delivery in THLM. It is noted in Table 5 that the MS values for all the variables, i.e. 100%, from rank 1 to 6, are within the range >3.40 to ≤ 4.20. This indicated that the respondents agreed that situations and changes in projects have the following implications which affect project delivery: changes deviate from the original project design (MS = 3.90); project costs increase (MS = 3.84); changes in scope during implementation contribute to project delays (MS = 3.81); these delays result in an unnecessary extension of project duration (3.78); the delays trigger variation orders (MS = 3.61); and poor definition of scope at design stage contributes to project delay (MS = 3.61).

**Table 4.** Management practices that delay project delivery

Contributor	MS	Rank
Late approvals contribute to project delays	3.94	1
Late payments to contractors and suppliers	3.90	2
Non-availability of senior management	2.71	3
Untimely approval of scope changes	2.39	4
Untimely approval of projects	2.08	5

**Table 5.** Impact of project situation and changes on project delivery

Contributor	MS	Rank
It changes the original design	3.90	1
It increases the project cost	3.84	2
It contributes to project delays	3.81	3
It delays the project duration	3.78	4
It triggers variation orders	3.61	5
Poor scoping contributes to project delay	3.61	6

### 3.4 Reducing pathogens to improve project delivery

### 3.4.1 Improving supply-chain management unit

Table 6 indicates the responses to measures suggested for improving the performance of the supply chain management unit to enhance project delivery in THLM. Table 6 shows that 75% of the variables, ranked 1 to 3 on measures for improving the performance of the supply chain management unit to enhance project delivery in THLM, had MS values in the range  $> 3.40 \leq 4.20$ . This implied that the majority of the respondents agreed that the following measures could enhance project delivery in THLM: proposed training of the existing staff members (MS = 3.88); increasing the staff members (MS = 3.77); and introducing the latest and most efficient supply-chain management procurement system (MS = 3.58). On the other hand, 25% of the variables (ranked 4) had an MS within the range of  $> 2.60$  to  $\leq 3.40$ . This denoted that the respondents were either neutral or disagreed with the variable that utilising the existing staff members by strengthening proper planning and communication could enhance project delivery in THLM.

**Table 6.** Improving the supply chain unit

Contributor	MS	Rank
Late approvals contribute to project delays	3.94	1
Late payments to contractors and suppliers	3.90	2
Availability of senior management	2.71	3
Timely approval of changes in scope	2.39	4
Timely approval of projects	2.08	5

### 3.4.2 Improving management practices

Table 7 shows the responses to management ways to reduce pathogens and improve project delivery in THLM. It is noted in Table 7 that the MS values for all the variables, i.e. 100%, from rank from 1 to 6, are within the range  $> 3.40$  to  $\leq 4.20$ .

**Table 7.** Ways to improve management practices

Solution	MS	Rank
Deploying proper interventions	4.14	1
Training and developing employees	4.12	2
Adapting to change	4.10	3
Establishing a feedback system	4.07	4
Proper planning of work activities	4.00	5
Investing in technology	3.97	6
Effective communication with staff	3.81	6
Recruiting qualified employees	3.75	8

This indicated that the respondents agreed that the following suggested approaches could reduce pathogens and improve project delivery in THLM: training and developing employees (MS = 4.12); establishing a feedback system (MS = 4.07); proper planning of work activities (MS = 3.97); deploying appropriate strategy (MS = 4.14); investing in technology (MS = 4.00); ensuring effective communication among staff members (MS = 3.81); recruiting qualified and experienced employees (MS = 3.75); and adapting to change (MS = 4.10).

## 4. Discussion

Based on the study, it was found that several practices by members of the organisation contributed to the delays in the delivery of infrastructure projects. Supply-chain management practices were found to have a significant impact on the ability of THML to complete tasks on time. The MFMA requires municipalities to develop and implement a supply-chain management policy that is fair, cost-effective, competitive, transparent, and equitable, and that complies with the prescribed regulatory framework in terms of tenders, quotations, auctions, and other types of competitive bidding. The aim of effective and efficient supply-chain management is to ensure that all project inputs are procured and received on time, thereby averting delays in project completion.

However, the results from the primary data indicated that the municipality did not have efficient supply-chain management practices. Problems, such as improper implementation of the MFMA, and lack of supply-chain management skills, knowledge, and competencies, were found to be some of the factors that resulted in delays in the delivery of projects by the municipality. Researchers who have sought to establish the causes of delays in project delivery have also highlighted these problems. In a study of local authorities in Kenya, Barsemoi et al. (2014) found that most employees did not possess adequate knowledge of procurement policies, procedures, or regulations. This resulted in poor implementation of such policies and procedures, leading to delays in delivering the local authority's projects. Regarding the lack of skills and competencies, Ambe and Badenhorst-Weiss (2011) noted that the South African public sector is faced with an ongoing shortage of skills problem. This has had a severely negative impact on the effective functioning of such organisations. According to Barsemoi et al. (2014), the poor performance of procurement departments in the public sector can largely be

attributed to incompetent staff. Several procurement functions are not staffed with employees who possess the skills and competencies that are critical for efficient management of procurement processes. This results in poor execution of supply-chain management activities, which hinders the effective delivery of infrastructure projects.

Furthermore, the effective functioning of the supply chain in the implementation of projects is affected negatively by delays in paying suppliers and contractors. Most respondents in this study indicated that the municipality did not pay its suppliers and contractors within the 30 days stipulated in the MFMA. Contractors and suppliers are usually paid well after the expiry of the 30 days, owing to limited budgets and the inefficiency of operations in most departments. According to Akinsiku and Ajayi (2016), delayed payments cause concern in most public sector organisations, including municipalities. Apolot et al. (2012) argued that late payments can slow down the progress on site and increase project costs. This means that the client might risk paying interest on late fees. Other problems that arise from late payments include contractors running out of working capital, the high turnover rate of skilled employees, and cost and time overruns. Akinsiku and Ajayi (2016) also cited disruption of work schedule, creation of cash flow problems for the contractor, an extension of time needed to complete the project, and cost overruns as some of the adverse effects of delays in paying contractors.

It was also found in this study that, when some management duties and responsibilities are not executed effectively, this leads to delays in the completion of projects, thus affecting service delivery in the municipality. One such issue is the availability of senior managers in the city. The study results related to the accessibility of senior managers in the city, indicated that some respondents felt that the senior managers were not always available when required. This would mean that documents, such as payment certificates, leave approvals, drawing of overtime, and variation orders were not approved on time, which necessitated project delays. Tafazzoli and Shrestha (2017) cited the lack of management support for projects as being one of the reasons for the failure of public-sector projects. Senior management plays a crucial role in the successful delivery of projects. Top leaders are responsible for setting the pace and ensuring that projects are on track. Siemiatycki (2015) noted the need to implement appropriate systems to facilitate project management processes to provide the timely delivery of projects. Furthermore, Pourrostan et al. (2011) highlighted the need for top management to communicate their support to the whole organisation through a clear and unambiguous declaration of intent.

In addition to the non-availability of management, late approval of documents by the client was also cited as one of the management problems that caused delays in project delivery in THML. Most respondents indicated that the late approval of documents by the client caused delays to a considerable extent. Several researchers support these findings. According to Elharare et al. (2016), the time taken to obtain new approval from the client or consultant can delay a construction project. Ke et al. (2013) posited that the primary source of delays in project delivery is obtaining approval from the supervision and administration department. Van Wee and Flyvbjerg (2010) argued that the delays in project approval are usually present in organisations where politicians are at the forefront at all levels and stages of the planning development, neglecting planners' findings and recommendations, to pursue their interests. Municipalities are well-known for experiencing political interference. This is a significant source of delays in project approval as the interests of the politicians are usually in conflict with the interests of municipal management. Projects cannot begin without being approved by the municipality. Since such approval usually takes a long time, the project timeframes set by planners are seriously affected.

Management ways to reduce pathogens and improve project delivery were also identified in this study. Effective project planning and communication were cited as being essential to ensure the effective and timely completion of public projects. If the organisation plans its projects carefully and effectively, it can address problems such as shortages of materials, changes in scope during implementation, and misunderstandings and conflicts that might arise between the client and contractor. According to Brown and Botha (2015), the aim of planning is to ensure that costs, resources, time, and scope are adequately addressed and to ensure the effective management of risk during project implementation. An effective feedback system should complement planning and communication to provide project information to all stakeholders. The views and perceptions of community members on the effectiveness and quality of project delivery can assist in identifying problems that must be addressed or strengths that must be enhanced (Assaf and Al-Hejji, 2006). Constant feedback from the contractor also assists in monitoring the progress of the project and identifying problems while they are still in their early stages.

In addition, staff training and effective human resource management can also enhance the delivery of projects. According to Banobi and Jung (2019), effective human resource management and development minimises project delivery delays. Chen et al. (2017) highlighted the need for skilled and experienced employees in all organisation departments, particularly those directly involved in the management and implementation of projects. Low levels of managerial and technical skills among the client and contractor's employees are problems that cause delays in project delivery. Therefore, both clients and contractors should organise training programmes for their personnel to update their knowledge and enhance their skills.

The respondents also cited investment in emerging technologies as a way to reduce pathogens and improve project delivery. Currently, there are new technologies that can make construction work more efficient. According to Aiyetan and Das (2021), developing advanced technology in the construction industry can minimise project delays and enhance project delivery. Using modern electronic technology to monitor and supervise labour activity can increase efficiency in project delivery. In addition, new technology can be adopted in all the organisational processes, such as supply-chain management and communication, to increase the efficiency of such operations.

## **5. Conclusion**

The focus of the study was on reducing pathogens to improve project delivery in public projects, based on a survey of a municipality. The study was motivated mainly by the crucial role of the successful delivery of infrastructure projects in

economic development in the country and the realisation that such successful delivery is essentially not being achieved. Therefore, several pathogens that delay the delivery of public projects were identified in the study. These include supply-chain and procurement management challenges, lack of senior management support, lack of skills and competencies, changes in the scope of projects during implementation, and delays in project approval. Ways to address the identified pathogens were recorded. These include proper planning and communication, an effective feedback system, practical training and human resource management, and adoption of emerging technologies.

The study makes a significant contribution to project management in public projects. The recommendations highlight some critical areas on which public-sector organisations should focus during the implementation of infrastructure projects to ensure the successful completion of such tasks. Paying attention to such vital areas will improve the delivery of public projects, thus enhancing the population's living standards. The study also contributes to the body of knowledge on improving success in project delivery. However, the study is limited because it was focused on only one municipality. This means that the results cannot be generalised to the entire management of public projects. Therefore, further research should be conducted on the same topic with a focus on several public-sector organisations to understand better public-sector project management and the overall challenges that affect project delivery.

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## Author Contributions

Venus Sibuyi contributed to conceptualisation, methodology, analysis, investigation, data collection, and draft preparation. Fidelis Emuze contributed to conceptualisation, methodology, analysis, investigation, data collection, manuscript editing, supervision, and project administration. Both authors have read and agreed with the manuscript before its submission and publication.

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