

# AVOIDING THE DEADLY LANDMINES: FACTORS TO CONSIDER WHEN EMBARKING ON RAILWAY CAPITAL PROJECTS

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“...Economic development is, in large measure, based on the existence of adequate infrastructure. Infrastructure opens the door to productivity, economic opportunity, and a higher standard of living. The lack of infrastructure contributes to uneven and inadequate economic growth, which, in turn contributes to political instability”. Dr Edward Deming

## 1 SUMMARY

Operational efficiency, safe railway operations and infrastructure investment projects are inseparably linked. Simply put, the three elements are intrinsically interwoven and failure to smoothly synchronise them may spell disaster for the organisation, government and the country at large. South Africa did not invest in its railway system for many years and the current generation has to address the imbalance. The great strides that have been current generation is an aphorism we must accept: each generation must pay for the sins of their fore bearers. The management philosophy of the then South African Transport Services (SATS) which was highly characterised by ‘blind’ subsidisation and cross subsidisation; is largely to blame for the poor state of our rolling stock and infrastructure on our railway network. SATS normatively incurred accumulated losses over many years. In assessing SATS’s financial viability, the De Villiers Commission had no option, but to recommend that: “Any further capital investment should be restricted to an absolute minimum” due to the unsatisfactory return on capital [6]. This paper focuses on the deadly ‘landmines’ that have to be avoided at all cost when embarking on railway capital projects. In addition, the authors provide success strategies that would counteract the pitfalls.

## 2 INTRODUCTION

The South African government has in the past few years committed a large amount of financial resources into infrastructure investment projects in order to revitalise the eroded railway system that is largely unreliable and grossly unsustainable. For many years in South Africa, there was little or no political will from politicians to support rail as a preferred mode of transport due to the capriciousness of politicians with regard to government priorities. This phenomenon is not only unique to South Africa; it is also found in other parts of the world such as the USA (California) and Australia where urban rail projects had been halted. The Australian Prime Minister, Tony Abbot’s mission is to unashamedly support road transport: “I want building the roads of the 21<sup>st</sup> Century to be a hallmark of my government”.

The South African railway industry is trying doubly hard to retrieve itself out of an abyss of hopelessness by investing billions of Rands into capital renewal programmes. Sadly, some of these investments are done on a hoof with the view to achieving efficiency without due consideration being given to the safety implications. It was Akira Matsuzaki of the East Japan Railway Workers’ Union (JREU) who sounded the following warning in good faith: “We must emphasise that efficiency without safety is not efficiency at all” [15]. More often than not, during the roll out of these investment programmes; mistakes of the past are being repeated similar to the ones made by non-progressive railways who placed more emphasis on utility rather than safety. Any investment in infrastructure and rolling stock will invariably result in manpower investment, which is called

variable capital. Labour without health and safety is palpable evidence that a human being is being compromised. Health and safety regardless of capital projects should be future proof.

These capital projects should not be rolled out at a whim. The following issues have to be taken into account: stakeholder management, personal safety issues, the smooth transition from the old system into the new system, systems engineering issues, reliability engineering, safety and efficiency as well as whole system design.

### **3 THE SOUTH AFRICA RAILWAY HISTORY**

The South African rail transport sector has experienced mixed fortunes from its introduction in 1860 hitherto, but the 1980s will go down in the annals of history as a traumatic period for the country. The 1980s were economically, politically and socially tumultuous for South Africa. The country was on the edge of the precipice thanks to the failure of the then government to find and maintain a dynamic equilibrium between these vital triangular forces. The country was entangled in a cob web and found it increasingly difficult to step back from the edge of the abyss. Simply put, things fell apart and the centre could no longer hold.

The National Executive Committee of the African National Congress (ANC) met in Zambia in 1985 and took a firm decision to make South Africa ungovernable. In addition, the ANC made a clarion call to the international community to impose comprehensive and mandatory sanctions against South Africa [36]. Economic sanctions led to serious capital shortages since a huge chunk of the fiscus was spent on military mobilisation. The cumulative effect of economic sanctions compelled the government to review capital spending programs of its state owned enterprises, including the South African Transport Service [5].

The South African Transport Services (SATS) were managed under the South African Transport Act No. 65 of 1981. The SATS Act was paved with good intentions and the primary goal of the act was to manage transport according to business principles, but this did not happen and all those intentions began to moulder. SATS comprised of the Railways, Road Transport, Harbours, Airways and Pipelines undertakings, was managed as a unit, and the principle of cross-subsidisation between the undertakings and within each undertaking was applied. The principle of cross subsidisation resulted in huge losses for the railway sector [6].

#### **3.1 The De Villiers Commission**

It is important to note that during the 1980s the South African Railways had reached the fourth stage of its life cycle where it yielded to competitive pressure when the transport sector was being locally and internationally deregulated. During 1983 – 1984 the South African Railways posted a loss of R 1 166, 5 million. De Villiers [6] warned that if the situation went unbridled "...the cash flow of approximately R4 766 million in 1990-91 and R9998 million in 1995-96 would have to be found outside these services unless the strategy is changed". SATS had been left with two choices: to either maintain the status quo and perish or paradigmatically shift from the traditional mode of thinking and to adopt a business acumen for survival. South Africa was not the only country to be blown by the wind of change in 1980s. For example, in 1980 the United States of America passed the Staggar Act, which was a milestone towards the deregulation of the railway industry.[2] De Villiers heralded railway reformation in South Africa. The leadership of SATS saw a portent of danger to the management philosophy.

In 1986 a commission of inquiry led by Dr W.J. De Villiers was appointed to look into SATS's Strategic Planning, Management Practices and Systems. The De Villiers Report [6] recommended amongst other, the

restriction of further capital investment in the railways by stating that: “ When an industry reaches stage four of the life cycle, representing a period of deregulation and transition, it is especially important to pay close attention to further capital investment in order not to create possible facilities which become redundant or alternatively may lead to the point where existing assets become under occupied before their economic life *expires* [emphasis mine]. This, together with the fact that major investments had been made in rail facilities over the past decade and from which an unsatisfactory return on capital has been obtained...This implies that further capital investment should be restricted to an absolute minimum”. As a result of the De Villiers Commission the Legal Succession to the South African Transport Services Act No.9 of 1989 replaced the SATS dispensation. De Villiers’ name will go down in the annals of history as the herald of railway reform in South Africa.

## 4 INFRASTRUCTURE INVESTMENT PROGRAMMES

Currently South Africa is striving to become a developmental state or an entrepreneurial state. The prerequisites for a developmental state are social cohesion as well as technical competence. In 2011 the National Planning Commission Diagnostic Report found that there was a lacuna in the country’s infrastructure development and advised that: “Successful countries generally invest at high rates and are continually modernising public infrastructure to suit their economic settlement and trade patterns. But South Africa has effectively missed a generation of infrastructure modernisation...” [1]

Developmental economies have often appeared to come to threshold of decision, of choice, of direction by growing their economies and South Africa could not muffle the chance of growing its economy by addressing the infrastructure backlog. This was enhanced by Malaysian Prime Minister Najib Razak said when pledging to invest US\$50bn in rail infrastructure by 2020: ‘once considered a dying industry, railroads have made a strong comeback, and are poised to become busier in the years ahead’[22].

In response to the National Planning Commission Diagnostic Report; President Jacob Zuma on the 9<sup>th</sup> of February 2012 pronounced during the State of the Nation address on the South Africa infrastructure plans. The President stated that the aim of rolling out these projects was to build social infrastructure and to create conditions for business to flourish. The plans are being coordinated by the Presidential Infrastructure Coordination Commission (PICC) [5]. The PICC ensures that the government gets value for the money invested in these projects as aptly put by Warren Buffet that “Price is what you pay. Value is what you get”. Billions of Rands have been invested into the railway sector with the view to “modernising the public infrastructure”. There is an African saying that goes: For any good side, there is always a bad side. Investment in capital projects brings about public optimism, but if enough caution is not exercised, these projects might result into chaos.

The fundamental principle of Economics states that societal means are always limited whilst the wants are limitless. It would be mistaken and short-sighted for anyone to assume that when the government commits billions of Rands into the infrastructure investment, organisations could spend the money at the whim and reverse this important economic principle. It is, therefore, important for organisations to know that we are not living in the era of abundance, but in the era of scarcity.

### 4.1 PITFALL 1: POOR STAKEHOLDER MANAGEMENT

One of the deadly landmines that should be avoided at all costs when embarking on infrastructure programmes; is paying lip service to *collaborative* governance. The relegation of key stakeholders to the background creates a huge social risk.

Up to relatively recently there has been a paradigm shift from *corporate governance* to *collaborative governance* and organisations that are entrusted with the rolling out of capital projects should collaboratively engage the stakeholders for the collective good of the project. According to the Public Participation Guidelines for Stakeholders in the Mining Industry [20] “Stakeholders are those individuals, groups, communities, organisations, associations or authorities whose interest may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences”.

It is also important to note that the social media has engendered a major shift from people as clients to people as citizens. Kapeng Makoko and Zolile Feketha quoted Tom Dewer of the University of Minnesota who drew a perfect line of separation between client hood and citizenship. “Clients are people who are dependant and controlled their leaders, helpers and *the state* [emphasis mine]. Citizens on the other hand are people who understand their own problems in their own terms. Good clients make good citizens. Good citizens make good communities” [3].

According to Accountability Stakeholder Engagement Manual [1] the effective and strategically aligned stakeholder engagement can

- Lead to more equitable and sustainable social development by giving those who have a right to be heard the opportunity to be considered in decision – making processes;
- Enable better management of risk and reputation;
- Allow for the pooling of resources (knowledge, people, money and technology) to solve problems and reach objectives that cannot be reached by single organisation;
- Enable understanding of the complex business environment, including market developments and identification of new strategic opportunities;
- Enable corporation to learn from stakeholder, resulting in product and process improvements;
- Inform, educate and influence stakeholders and the business environment to improve their decision-making and actions that impact on the company and on society; and
- Build trust between a company and its stakeholders.

### **Example a – Failure to identify key stakeholders**

Grimble and Wellard (1996) in Sopazi and Andrew [32] define stakeholder analysis “...as an approach for understanding a system by identifying the key actors in the system, and their respective interests in the system”. Ulrich [39] argues that the voices of ordinary people should be taken into account in any planning process.

Key stakeholders are the people who stand to be directly affected, influential people, spokespersons for the sector, people with authority to say “yes” or “No”, people whose local knowledge is important, people who may want to derail the process for personal gain and all those who think they are key stakeholders [9].

### **Success strategy**

Luyet, Schlaefler, Parlange and Butter [14] suggest the following criteria for evaluating stakeholders:

- Pay attention to those related to the process;
- Pay attention to those related to the outcomes;
- And include those linked to political, social, historical and environmental context.

The easiest way to identify key stakeholders initially is to ask other stakeholders. The mandate of key stakeholders to speak for their constituents can only be established as the process evolves, but their early involvement ensures that the views of all sectors are accommodated. Typically, the following special efforts would be made to ensure their contribution:

- Small-group briefing sessions at venues convenient to them;
- Checking their diaries before setting dates for major meetings; and
- At all times, sending them all documentation for comment, even proceedings of meetings they did not attend or discussion documents they did not request. This would ensure that such people cannot delay the process during the late stages by claiming that they have not been consulted. Electronic documents should be kept for these activities.

### **Example b – Failure to understand stakeholder diversity, power, urgency and legitimacy**

Stakeholders are heterogeneous in nature and not homogenous. Railway capital projects are technical in nature and there is a tendency to place more emphasis on “*Fiduciary stakeholders*” and “*Normatively legitimate stakeholders*” at the expense of other stakeholders. “*Fiduciary stakeholders*” refer to those persons who act on behalf of clients, representing them. They participate in the process of formulating and resolution of the problem, but they are not directly affected by the solution [32]. On the other hand, “*Normatively legitimate stakeholder*” is an actor with which the organisation has mutually beneficial, positively reciprocal relationship [21].

Sopazi and Andrew [32] enhance stakeholder diversity by defining “*Standard stakeholders*” and “*Silent stakeholders*”. “*Standard stakeholders*” refer to those persons who affect and are affected by the problem situation and who participate in its formulation and resolution. On the other hand there are “*Silent stakeholders*”. “*Silent stakeholders*” refer to those persons who neither participate in the process nor have control over resources or uncertainties that are relevant for the resolution of the problem, but are affected by the problem.

Organisations should understand stakeholder classes. Stakeholders classes are determined by three attributes namely *power*, *legitimacy* and *urgency* [17]. For example, where urgency and power characterise a stakeholder who lacks legitimacy, that stakeholder will be coercive and possibly violent making the stakeholder “dangerous”. On the other hand, a stakeholder who possess power, legitimacy and urgency will qualify for being a *salient stakeholder* or a *definitive stakeholder*.

According to Phillips [21] “*Derivatively legitimate stakeholders*”, do not have such mutually beneficial relationships with the organisation. Typical examples of “*derivatively legitimate stakeholders*” of “*derivatively legitimate stakeholders*” include the media and hostile activist/NGO groups among others. These stakeholders are in a position to mould negative public opinion against an organisation.

It should be understood that embarking on infrastructure projects is a titanic labour and mistakes are bound to happen due to the error of judgement. We are bound to make mistakes and we should learn from them since mistakes are part of the learning curve. On the other side of the coin, we should also understand the anger, hilarity and ridicule from the public when they have a feeling of being short-changed. For example, France and South Africa have learnt a bitter lesson of the media backlash when it was discovered that the newly acquired rolling stock appears to be incompatible with the existing infrastructure. The media has power, legitimacy and urgency to lead a moral crusade against the unnecessary cost to the taxpayers or fruitless expenditure.

The media as “*Derivatively legitimate Stakeholder*”, should be managed with enough caution because of its tendency to get information through emotional blackmail. Forward and Frazier [8] define Emotional Blackmail as a powerful form of manipulation in which people close to use threaten, either directly or indirectly to punish us if we don't do what they want. The media act as punishers – they let you know what they want and the consequences you will face if you don't give it to them. I think Benjamin Disraeli had the media in mind when he advised: “Don't complain and don't explain”.

The following are six deadly symptoms of emotional blackmailing used by journalists:

- a demand;
- resistance;
- pressure;
- threats;
- compliance; and

### **Success Strategy**

When you are faced with a journalist's pressure do not succumb to the following: apologise, “reason”, argue, cry, plead, change or cancel important plans or appointments, give in and eventually surrender.

Forward and Frazier [8] warn that if a black mailer is not well managed he or she goes a step further to infantilise you – reduce you to bad little children who need to learn a lesson. When faced with a blackmailer one has to be assertive. Smith [32] suggests among others, the following Bill of Assertive Rights:

- You have the right to offer no reasons or excuses for justifying your behaviour.
- You have the right to make mistakes and be responsible for them.
- You have the right to change your mind.
- You have the right to say “I don't understand”

When you are faced with the media; it is suggested to do the following:

- Stand up for yourself.
- Confront what's going on.
- Set limits or boundaries.
- Let the blackmailer know that their behaviour is unacceptable.
- Learn to be persistent and stick to the point (avoid a broken record approach) do not blow hot and cold.

Unfortunately sometimes, those in the middle of a crisis try to ride the storm, thinking their reputations are bulletproof. Others bury their heads in the sand, hoping the crisis will blow over. Organisations need to urgently carve out a crisis communication plan that will enable them to manage the media during the crisis instead of them being managed by the media. The reversal of roles between the media and the organisation only takes place in the absence of a watertight crisis communication plan.

According to Vick [37] the following are the golden rules of crisis communication:

1. Tell the truth and tell it quickly.
2. Be seen to be taking action – you need to show that you realise there is a crisis, and are in control of the situation. People will judge you on what you do, not just what you say.

3. Be genuine – show concern and commitment to finding out what caused the crisis, and in particular how you will avoid it happening again.
4. Develop a clear position statement, and distribute it as broadly as necessary. Keep on repeating the same message, as often as possible, so that it sinks in.
5. Make sure you communicate your position to your key stakeholders, in the right sequence. Draw up an 'influence map' that outlines who your most important stakeholders are (and that usually has clients and staff on the top of the list), and ensure they understand and embrace your position.
6. Ensure you use the right channels of communication to reach your intended audience. If you are trying to reach decision-makers, for example, do not talking to a useless tabloid.
7. Plan your actions in a way that contain the crisis rather than giving it momentum. That means trouble-shooting – even predicting – possible responses to your intervention, to ensure that one crisis does not create another.
8. Do not speculate or offer too much opinion – stick to the facts. Speculation could get you into trouble further down the line – for example, if there is some form of inquiry into the causes of the crisis.
9. Focus on the people affected by the crisis, and what they would want to know or need to know. Put yourself in their shoes, and communicate what they need and want to know.
10. Think ahead. Develop a plan for how you intend to turn your reputation around once the crisis is over.

It should be understood that there are few people in the media who understand the difference between special causes and common causes. Ronis [24] argues that by treating special causes with common cause solutions one creates a dysfunctional society.

#### **4.2 PITFALL 2: SELECTING A WRONG CONTRACTOR**

It is a truism that a decision made in haste is often regretted. The awarding of tenders out of expediency to none compliant contractors and not out of principles is a serious pitfall. Utility should not take priority over safety and the speed of execution should not be executed at the expense of safety. This was aptly captured by Christopher McDougall who observed that: "Every morning in Africa, a gazelle wakes up, it knows it must outrun the fastest lion or it will be killed. Every morning in Africa, a lion wakes up. It knows it must run faster than the slowest gazelle or it will starve. It doesn't matter whether you're the lion or a gazelle – when the sun comes up, you'd better be running". However, the reasons behind the need to be running differs. Briefly put, a gazelle is safety conscious whilst the lion is survival conscious.

Procurement systems are important as they affect contractual relationships, the development of mutual goals, the allocation of mutual goals, and the allocation of risk. These systems ultimately provide the framework within which capital projects are executed. The traditional procurement system which entails, inter alia, the evolution of a design by designers, the preparation of bills of quantities and related documentation by quantities and related documentation by quantity surveyors and the engagement of a contractor through competitive bidding, invariably on the basis of price, does not complement health and safety. This may be due to the separation of the design and construction processes, the incompleteness of design upon both preparation of documentation and the commencement of construction, and the engagement of contractors on the basis of price [28].

Various authors advocate pre-qualification of general contractors and subcontractors on health and safety by clients and general contractors and subcontractors on health and safety by clients and general contractors respectively. The purpose of pre-qualification in the health and safety sense is to provide a standardised method for the selection of contractors on the basis of demonstrated safe work records, health and safety commitment and knowledge, and the ability to work in a healthy and safe manner. This will ensure that only health and safety conscious contractors are selected [29].

#### **Example a – Awarding a tender without taking safety into account**

Some organisations award tenders to contractors without including safety as one of the functional areas.

## Success strategy

Hatami, Rahimi and Soleymani [10] suggest the following:

- **Tender evaluation**

No contract should be signed unless all the railway safety standards have been complied with.

- **Hold a meeting before signing a contract**

It is suggested that a meeting takes place with contractors to analyse their competencies as well as their commitments. In signing the contract, the contractors must guarantee to improve safety.

- **Safety inspection before signing a contract**

An organisation should inspect the installations and equipment of a contractor before signing the contract and this inspection should be done through checklist which will serve a safety road map.

- **Dangerous information cards**

All tenders for providing equipment must contain dangerous information card. These cards usually contain information about physical dangers, health risks, warning systems and machinery instructions.

The client also has responsibilities. The International Labour Office (ILO) [11] recommends that clients should:

- Inform all contractors of special risks to Health and Safety of which they are or should be aware.
- Require contractors submitting tenders to make provision for Health and Safety.
- Consider Health and Safety when estimating dates for stage and overall completion of the project.

The Business Roundtable in Smallwood [30] recommends that clients take the following actions: become committed to health and safety, support contractors' health and safety financially; include health and safety as a criteria for pre-qualification; schedule Health and Safety requirements prior to the bidding process; structure documentation to ensure equitable provision of health and safety by contractors; require a formal Health and Safety programme, the use of permit systems for potentially hazardous activities, the designation of a contractor health and safety coordinator, and reporting and investigating of accidents; conduct health and safety audits during construction, and adopt a partnership approach.

### 4.3 PITFALL 3: LACK OF HOLISTIC UNDERSTANDING OF SYSTEMS ENGINEERING ISSUES

If one is unable to see the connection between diverse things, it means that one is anything but holistic. According to Smuts [35], "Holism underlies the synthetic tendency in the universe, and is the principle which makes for the origin and progress of wholeness in the universe". Once one embraces General J.C Smuts' definition of holism, it will be simple for one to notice that ICT, infrastructure management, human resources, signalling upgrades, neurocytology, and even project management are part of a single discipline and ought not to be separated. Simply put, a system is an arrangement of certain components so interrelated as to form a whole. The system concept is diametrically opposed to a reductionist approach, which focuses on a particular system component or element in isolation [4].

#### Example a – Failure to synchronise systems engineering issues

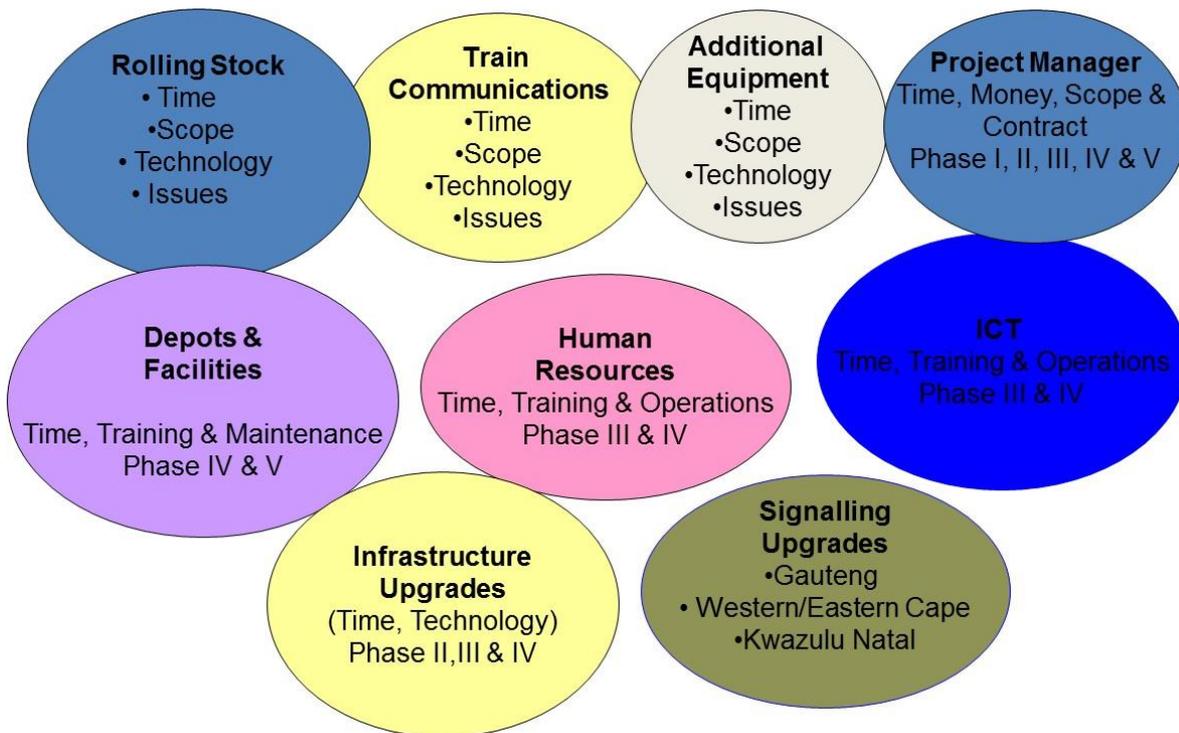
There is an apparent failure to synergise the railway system during the roll out of infrastructure and rolling stock programmes. The Association of General Contractors of America (AGC) [37] defines synergising as "The interaction of different entities so that the combined effect is greater than the sum of individual efforts".

According to Senge [26] there are two types of complexity, namely detail and dynamic. Detail complexity entails exposure to many variables, whereas dynamic complexity includes situations where cause and effect are subtle, and where the effects of interventions over time are not obvious. Smallwood [30] argues that the real leverage in most management situations lies in understanding dynamic complexity, not detail complexity.

Senge [26] argues that reality is made up of circles, but the people see straight lines. He further argues that language shapes perception, and that what we see, depends on what we are prepared to see. Furthermore, in order to see systems wide interrelationships, a language of interrelationships is required, a language of circles. The key to seeing reality is seeing circles of influence rather than straight lines. By tracing the flows of influence, the patterns that repeat themselves, either contributing to an improvement or deterioration, can be identified [30].

It should be understood that poor ergonomics contributes to hazards and risk, result in strain, which in turn results in both absenteeism and ill health. Hazards and risks contribute to the probability of exposure and accidents. Exposure can result in disease, and consequently ill health, and in turn absenteeism. Absenteeism can result in reduced productivity, rework, and falling behind schedule due to the absence of key crewmembers. Accidents, the outcome of which is largely fortuitous, can result in any, all, or a combination of the following: exposure; fatalities; injuries; reduced productivity as a result of work stoppages; rework as a result as a result of damage to completed work, or work in progress; falling behind schedule as a result of work stoppages, and damage to the environment [30].

**Figure 1: Relationship between railway systems**



**The following are the benefits of a systems approach:**

- Awareness and acknowledgement of the role and importance of client/Project Manager/designer to Health and Safety, is a pre-requisite for commitment and change. Such awareness and acknowledgement engenders and/ or reinforces government, client, Project Manager, designer and contractor commitment to Health and Safety.
- Consideration for Health and Safety increases the likelihood of the selection of an appropriate procurement system/conditions of contract, and appropriate design/details/specification/optimum constructability.
- Pre-qualification on Health and Safety and budgeting should engender the engagement of a Health and Safety conscious contractor.
- Health and Safety engenders all, any or a combination of the following: reduced strains /injuries/ disease; reduced fatalities; improved productivity; enhanced quality; enhanced schedule, and preserved environment, which ultimately result in enhanced overall performance and reduce cost.

### Example b – Paying little or no attention to whole systems design and the cost implications

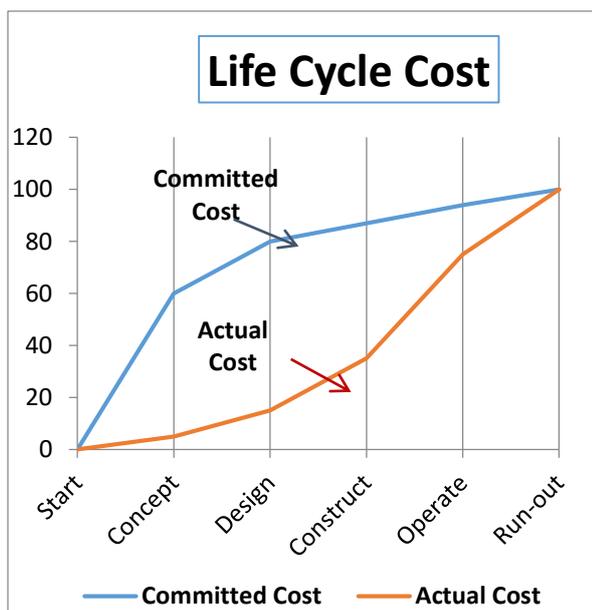
Any project has a beginning and an end; and every stage in the life cycle of a project costs money. A lack of understanding the cost implications throughout the life cycle of the project is a serious pitfall. Stasinopoulos et al [34] define the Whole System Design as a process through which the interconnections between sub-systems and systems are actively considered, and solutions are sought that addresses multiple problems via one and the same solution.

To understand the approach better, the history of the whole system design is worth a brief recapitulation. Before and during the industrial revolution engineers were generalists whose knowledge extended across all the fields of engineering. Designs were thus based on all the available engineering knowledge of the time. During the twentieth century the wind of change blew throughout the engineering world. It was no ordinary wind. It was a raging hurricane against which the old order could not stand. Through the influence of Frederick Taylor on specialisation; engineers had to specialise more and more due to the sheer volume of knowledge that became available.

The result was often sub-optimal designs because the designer was unaware of developments in all the related fields of engineering. During the second half of the twentieth century some designers started to develop the principles for the holistic or whole system design approach. This resulted in the formation of design teams consisting of engineers and others from a variety of backgrounds which brought back the ability of designers to consider all aspects that are affected. It brought “Victorian Engineering”<sup>(1)</sup> back to modern day designs.

Stasinopoulos et al [34] argue that up to 60% of the total life cycle cost of a project is committed during the pre-design conceptual stage with an additional 20% during the formal design stage. Figure 2 below illustrates the effect clearly. It is thus clear that mistakes in these early stages of the project are eventually the most costly as is well trenchantly expressed by Lovins et al [13] that “All the really important mistakes are made on the first day!” A considerable number of factors impact on the planning and design decisions that needs to act as a guide to the detail designs of the sub-systems.

**Figure 2: Life Cycle Costs**



### **Example c – designing stations without factoring in safety and security issues**

The designing of station with a ‘rear view mirror’ mindset without taking into account global security challenges as well as safety issues is a colossal mistake. The Founder and Chairman of Guardsmark, Ira Lipman said: “The world is not a safer place today than in the past, and the United States of America and its people and its people are at extreme risk” [28]. If one thought that the cold war was over, one should think again, the cold war been transform into global terrorism.

When the stations were build many years ago the risk of terrorism as well as the train platform interchange were not taken into account. According to the Railway Gazette International [22] stations have become targets of terrorist attacks around the world.

A useful framework for the planning of station security can be found in the United Kingdom, where counter-terrorism is categorised under four headings.

- Pursue** – to identify and stop terrorist activities;
- Prevent** – stopping people becoming terrorists;
- Protect** – to protect against terrorist attack;
- Prepare** – to mitigate the impact of a terrorist attach

According to Jeffrey and Douglas [12] it has been accepted that there is a causal link between design decisions and health and safety construction. This is based on research conducted by the European Foundation for the improvement of living and working conditions, which concluded that 35% of site fatalities were caused by falls that could have been reduced through design decisions. Schneider and Susi [26] say that constructing a new building is, by its very nature, a problem in ergonomics as construction involves work at floor and ceiling level requiring kneeling, bending, reaching out, twisting and the adopting of uncomfortable work posture. However, deliberation of the impact of design could result in the adoption of an alternative design thus mitigating, or even eliminating the ergonomics problems.

Constructability is a further design related issue. ‘Design for safe construction’ is one of 16 constructability design principles listed by Adam and Ferguson [16]. However, most of the other 15 principles are indirectly related to, and consequently influence health and safety. Method of fixing, size, mass and area of materials, position of components, inter alia, amplify the relevance of constructability to health and safety.

Designers also influence the pre-planning of health and safety. Pre-planning all the ingredients of and resources required for health and safety programme to be effective and efficient. However, the design of a project has a major influence on determining the method of construction and the requisite health and safety interventions. Consequently, designers need to make sufficient design related information available at pre-project stage to facilitate budgeting for adequate resources.

### **Success strategy**

- In medical science there is a saying that goes: ‘prevention is better than cure’. A preventative approach should also be adopted for the design of stations. Preventative measures need to be implemented within the layout of the station and are intended to serve a dual purpose: to enhance the

feeling of safety through a clear and legible design, and simultaneously to form the basis for the prevention of terrorist attack and/or other violent acts of criminals.

- Security measures should be incorporated into the design of the station in order for access control to be efficient.
- The design should also proactively cater for recovery measures after an attack. For example evacuation during an emergency.

Designers influence health and safety directly through design specific, supervisory and administrative interventions. Design specific interventions should include:

- Concept design
- General design;
- Selection of type of structural frame;
- Site location;
- Site coverage
- Details;
- Method of fixing, and
- Specification of material and mixing

#### **4.4 PITFALL 4: IGNORING PERSONAL SAFETY ISSUES**

Investing money into a capital programme does not mean that personal safety issues have to be relegated to the background. People make safety possible. The managers should be excellently equipped to energise their employees. Managers must be “high touch” with their employees during this “high tech” era. People do not perform well when they are not motivated. Managers must create a supportive and a safety work environment to foster desired behaviours and outcomes. Employees should be given the authority to make decisions. Employees should also be allowed to make mistakes because mistakes are part of the learning curve.

Pepsi CEO Wayne Calloway said that his company had celebrated occasions where people failed publicly. His argument was that he wanted them to take risks [7]. Rubinstein and Firstenberg [25] encourage people to learn from errors. “Experience” they write, “is not only to know what will work...but also to know what will not work. Railway safety has always been characterized by the box approach. Policies and procedures that fail to energize employees must be replaced with simple versions [19].

#### **Success strategy**

Safety should not be assumed, but it has to be demonstrated. The human factor strategy should be factored in for the collective good of a safety work place. The following human factor activities are suggested:

- Functional allocation; proper allocation of functions between human and machines;
- Task analysis;
- Job design;
- Interface design;
- Design support material, and
- Workplace design;

## **5 CONCLUSION**

The management of capital project is not a sprint, but a marathon. It is a complicated process that requires holistic thinking. The authors stepped out of their disciplines and adopted a transdisciplinary approach in order

to deal with the complexity of capital projects. The paper attempted to highlight the social risks that should be avoided at all cost in the rolling out of these projects. In addition, the possible pitfalls that have been discussed above should be taken into account when embarking on capital projects.

The success of the large scale and often viewed as herculean projects; currently underway in South Africa railways should be conducted systematically and holistically. It is also vital to ensure that in the rolling out of these capital projects, continuous improvement; what the Japanese call *Kaizen* should take place, to ensure that organisations do not fall into these possible identified pitfalls which could derail project that are paved with good intentions.

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