FORTIFYING MANAGEMENT CONTROL OF HEALTH, SAFETY AND PRODUCTIVITY LOSS IN SOUTH AFRICAN CONSTRUCTION

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This paper illustrates the paradox related to the tension between production and safety, which are competing elements. The study established the impact of unsafe health and safety practices on productivity in construction. A qualitative research approach was used to establish the relationship between health and safety practices and productivity loss. The 22 interviewees who answered both closed-ended and open-ended questions were active construction workers and professionals involved in projects at the time of data collection in South Africa. Based on the results of data analysis, a direct influence of health and safety on employees and their work practices was affirmed. For example, the results showed that poor health and safety practices at work lead to absenteeism resulting from illnesses and injuries. Poor health and safety practices, in turn, lead to a loss in productivity of the workforce. Cited instances show that work pressure leads to a lack of attention and concentration. Beyond compliance to legislation by the work crew, there is a case for reinforcing management controls on construction sites in the study area. Effective health and safety risk control and the steps of its deployment must be reinforced. Management controls would help contractors to remove the burden of hazard on a particular site by identifying what must be done and what gaps in the process are to be corrected. While the results from this study provide a reason to strengthen management control, the oversight should not be excessive to avoid unintended consequences.

Keywords: H&S; loss of productivity; management control; site work; South Africa

INTRODUCTION

Can contractors maintain high productivity and safety performance on a project simultaneously? This question has been a subject of scholarly work because of the belief that production pressure may cause adverse safety outcomes. Some scholars perceive that high levels of safety negatively impact productivity in construction, although direct influence between productivity and safety is difficult to observe (Smith, 2019). For example, when work pressure is on an upward trajectory, it is not common to see job hazard analysis (JHA) or safe operating procedure (SOP) change in tandem.

In contrast to the tension between productivity and safety view, Jia *et al. (*2017) provide an alternative perspective with two institutional logics (production and

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Emuze, F (2021) Fortifying Management Control of Health, Safety and Productivity Loss in South African Construction *In:* Scott, L and Neilson, C J (Eds) *Proceedings of the 37th Annual ARCOM Conference,* 6-7 September 2021, UK, Association of Researchers in Construction Management, 219-228

protection logic). Jia *et al. (*2017) suggest that construction workers will protect their interest by remaining safe as much as possible (protection logic). In contrast, their employers will show a positive disposition towards safety when workers are motivated and improve productivity (production logic). In analysing the two logics, Smith (2019) says that safety can boost high productivity, and production can motivate safer work.

The calls to emphasise the importance of safety, particularly when construction projects face production pressures (Zhang *et al.,* 2018), are premised on the realisation that managerial priorities override safety in time of work pressures (Han *et al.,* 2014). The literature shows that some contractors assume that it is impossible to meet H&S, quality, cost and time performance targets in a project simultaneously. In effect, there is a notion that a zero-sum relationship exists between the parameters as they influence each other. For example, an accelerated schedule could lead to increased cost and lower H&S status in a project (Forbes and Ahmed 2020).

Reason (2016) in "Managing the risks of organisational accidents" illustrated the tension between production and protection (H&S in this paper) to provide a means to comprehend the processes that lead to defensive failures and mishaps. He warned organisations against trading off protective gains against productive advantage. Doing so leads to the gradual decline of defences during times in which the absence of adverse events creates the view that the system is operating safely. The paradox theory explains the tension between production and safety. Smith and Lewis (2011: 382) say "contradictory yet interrelated elements simultaneously and persist over time" present a paradox. The authors stated that the interrelated elements seem logical when viewed separately but inconsistent when put side by side. However, choosing one before the other will not resolve the tension since they are inseparable (Johnson, 2014). For example, prioritising production at the expense of safety will inevitably result in an increased need for the other and intensify the tension. Therefore, organisations must strive for both elements (e.g. production and safety) at the same time (Johnson, 2014)

A descriptive study has been presented in this paper to respond to the question: How do unsafe H&S practices influence loss of productivity in construction? The purpose of the research was to establish the relationship between H&S practices and loss of productivity to propose appropriate interventions that will bridge the gap. Thus, the nature of loss of productivity has been examined. As a management function, how to control can limit the loss of productivity through effective removal or reduction of the burden of hazard.

RESEARCH METHOD

The interpretive view adopted for the study helped the researcher collect data related to the participants' lived experiences. Being a qualitative study of activity in a situation, the researcher was located on public construction projects (Denzin and Lincoln 2008). The primary source of data was face-to-face interviews conducted using a protocol of both closed-ended and open-ended questions. The data were obtained from people in the frontline of construction by visiting sites in two provinces (Mpumalanga and Limpopo) of South Africa.

Using the same instruments, data were collected from construction sites to make the convergence of observations possible to improve confidence in the results (Huberman and Miles 2002). A purposive sampling method was used to select project sites and

the participants. The criteria for selection were participation in physical work on-site and lived experience of H&S and productivity practices in construction. The fieldworker was a registered construction management student in 2018 who was familiar with the subject. Seminar-like training was provided to the field worker before data collection to ensure easy access and ethical conduct on sites. Statistical data gathered from the closed-ended questions were analysed descriptively. Based on open-ended questions, the interviews were audio-recorded and transcribed before the thematic analysis of the textual data. The required ethical considerations were observed, including informed consent, confidentiality, the anonymity of data and voluntary participation.

During the site visits, 25 people involved in construction work were approached. Only 22, whose demographic data are shown in Table 1, participated. Table 1 shows the positions of the respondents in the company. Most of the respondents who participated in the study were directors, followed by managers, senior managers, executive directors, and supervisors. All the participants had university qualifications, and most of them had been in the industry for more than five years.

Table 1: Background information of the respondents

Profile	Frequency	Percentage
Position in the company		
Supervisor	2	9.1
Manager	6	27.3
Senior Manager	3	13.6
Director	10	45.5
Executive Director	1	4.5
Total	22	100.0
Highest educational qualification		
National Diploma	6	27.2
University Degree	8	36.4
Postgraduate Degree	8	36.4
Total	22	100.0
Length of work experience in construction		
2-5 years	3	13.6
5-10 years	6	27.3
10-20 years	13	59.1
Total	22	100.0

RESULTS

Responses to Closed-Ended Questions (Quantitative Data)

Responses to the closed-ended questions asked in the interviews have been presented in this section. The interviewees expressed different views on H&S and loss of productivity on construction sites.

The 22 interviewees were requested to respond to the questions by rating their perceptions of the phenomenon according to a 4-point Likert Scale. The scale ranged from 1 (strongly disagree [SD]) to 4 (strongly agree [SA]). Given the qualitative nature of the study and the limited number of interviewees, the data were not suitable for rigorous statistical analysis, so they have been presented in Table 2 in an accessible, descriptive format. Table 2 shows that 12 of the interviewees concurred (agreed or strongly agreed) with the idea that H&S affects productivity on construction sites and is necessary for performance improvement. This observation implies that most of the interviewees agreed with the argument in the H&S management literature. However, although most (19) perceived that loss of

productivity is caused partially by poor H&S practices, only eight interviewees strongly agreed with the statement. The interviewees' perception indicates that H&S should be considered when the aim is to increase productivity in construction.

Despite the on-site experience of the interviewees, it is notable that 6 of them disagreed when asked whether H&S is a building block of productivity. The responses showed that more than 70% of the interviewees agreed with the statement. Therefore, it can be postulated that H&S has a significant impact on productivity on project sites. Most of the interviewees concurred that it is essential to use effective H&S methods that place the workers' interests first, on-site. The perceptions suggest that adequate H&S procedures (and practices) are not dispensable when contractors are keen to increase productivity but under safe working conditions. The perceptions also indicate that people in the frontline of construction determine production outcomes, and their H&S (including well-being) is central to project success.

Eight of the interviewees did not agree with the notion that limited resources and workforce categorisation could affect H&S. However, a sizeable number among them (19) was of the view that undefined roles influence H&S problems on site. This shows that job roles need to be defined to avoid H&S issues. Proper delineation of job roles helps to maintain productivity on site.

Table 2: Perceptions of interviewees on H&S and productivity

Aspect	SD...			....SA
	1	2	3	4
H&S on construction sites affect productivity	1	1	8	12
H&S is required for improved productivity	1	1	8	12
Productivity loss is partly caused by poor H&S	1	2	11	8
H&S is a building block of construction productivity	1	5	5	11
It is vital for project managers to use proper H&S methods.	0	1	3	18
Workers come first when H&S in construction sites is considered.	0	1	2	19
Limited resources and categorization of the workforce affect H&S.	3	5	4	10
Undefined roles influence H&S problems	0	3	6	13

Responses to Open-Ended Questions (Qualitative Data)

Responses to the opened-ended questions asked during the interviews have been presented in this section. The textual data contained views on H&S and loss of productivity on construction sites. The data have been presented under themes as follows.

Induction and training on construction sites

The interviewees emphasised the aspect of induction and training (I&T) of workers on sites to deal with H&S problems. Most of the respondents insisted that I&T helps in reducing the loss of productivity on construction sites. The interviewees outlined several reasons why the use of I&T as a way of dealing with H&S problems leads to an increase in productivity, including the reduction in mistakes and accidents is the vital aspect which is addressed by the use of I&T on construction sites; and I&T leads to a decrease of errors because the trained workforce can carry out the assigned tasks using the required knowledge and skills, with fewer mistakes. For instance, if people work without the necessary knowledge and skills, there will be a high likelihood of errors, leading to loss of productivity through accidents or incidents (near misses) that might result. Accidents and near-miss events often lead to delays in production and absenteeism of injured workers.

Therefore, the interviewees believed that I&T is a safeguard against the loss of productivity occasioned by H&S problems.

Furthermore, the interviewees pointed out the aspect of time-saving due to appropriate I&T. Time saving potentially reduces loss of productivity. The textual data showed that if the workforce is trained, there would be fewer production disruptions on site. Some of the interviewees insisted that trained workers have the knowledge to use machinery independently; hence, supervisors would not have to spend excessive time on close monitoring of their work. I&T also helps to minimise injuries on site. This is because trained workers should be able to operate plant and equipment safely. Injuries on the job lead to the loss of productivity, which is costly to the company. So, I&T is very important in ensuring good H&S practices on construction sites. The interviewees also observed that I&T motivates workers to work safely as it gives them a sense of belonging in the enterprise. Once inspired, the workers put in more effort to maximise productivity. If workers are inducted and trained, they are motivated to strive to work hard for the organisation's success.

Production investigations on construction sites

The focus of this theme was on the effect of production investigations on H&S and productivity on construction sites. The interviewees were asked to express their views on whether production investigations would reduce the loss of productivity. From the results, almost all of them agreed that production investigations could minimise loss of productivity since it would help forepersons or supervisors notice unsafe H&S practices immediately, which might negatively affect the completion of tasks. Such early warning signs would assist site management in finding the solutions that prevent loss of productivity. Inquiries through quality inspections (checks) or H&S audits can identify problems that result in the loss of productivity. The discovery of the issues can also promote early corrective actions. Similar to past studies, the interviewees confirmed that H&S audits save lives and time as the officials can identify hazards and risks before it is too late to address them. For example, an interviewee said inspectors could quickly identify non-compliance with H&S regulations or policy and correct it to prevent loss of productivity.

Loss of productivity on construction sites

The focus of this theme was on the effect of unsafe H&S practices on the loss of productivity on construction sites. Inappropriate H&S practices are regarded as dangerous on sites yet are done by workers whilst working. The interviewees were asked to give their views on how improper H&S practices lead to loss of productivity. They said inappropriate H&S practices lead to accidents, which reduce working time and productivity. Most interviewees indicated that inappropriate H&S practices reduce production rate and efficiency in construction because the workers would be at high risk of being injured, leading to extra costs to the company.

Moreover, some interviewees mentioned that inappropriate H&S practises cause workers not to work to capacity or wholeheartedly for fear of being injured. This leads to a loss of productivity because the workers will not produce the maximum production output, of which they are capable, because they will be afraid of being involved in accidents. Therefore, based on the study's findings, it was the view of the interviewees that inappropriate H&S practices reduce overall production on sites.

Some interviewees even mentioned that diseases caused by inappropriate H&S practices affect hygiene status on a site. They cited that the lack of necessary personal protective equipment (PPE) in the form of H&S clothing can lead to asthma, which might lead to absenteeism and low task performance. Both absenteeism and low task performance in combination reduce the productivity on construction sites. The

principal concern cited by the interviewees was that there would be injuries and illnesses if workers fail to use the appropriate safety clothing. By implication, they affirmed that inadequate or inappropriate safety clothing directly impacts the workforce's productivity on construction sites.

DISCUSSION

The results of this study underscore the role of functions of management work in the physical conversion processes on construction sites. The data also re-affirm the complicated relationship between production and protection (H&S) (Smith, 2019; Oswald *et al.,* 2019). Although researchers have advocated that the level of protection should always match the hazards of the production operations (Reason 2016), the reverse is the case in reality, especially in construction (Forbes and Ahmed 2020), where production pressures have been commonly accepted as a significant cause of accidents (Oswald *et al.,* 2019). The interviewees emphasised the need to implement I&T, production investigations (either through quality inspections or H&S audits) to address the loss of productivity by controlling the people and the process.

The interview data support the notion that productivity in construction negatively affect safety, though direct empirical influence is limited (Smith, 2019). Nevertheless, control is a critical management function because it drives the process forward. For example, a safety management system (SMS) consists of several controls which require construction managers (and other site management team members, such as supervisors) to lead the H&S effort as active members of the system. Inspections and housekeeping reviews, which remains a challenge in Southern Africa (Emuze *et al.,* 2016), are required to control the work environment. The same expectation applies to the role of committees where H&S work must be delegated, monitored and reported. The control function also extends to risk assessment, which involves identifying the likelihood of hazards becoming the source of accidents and preventing them. Essentially, identifying near-miss incidents and removing dangers and risks in the workplace falls under the H&S control function.

According to McKinnon (2014: 143), "Safety controlling is defined as the management function of identifying what must be done for safety, inspecting to verify completion of work, evaluating, and following up with safety action". The definition implies that controlling H&S goes hand-in-hand with production (Reason 2016). Oswald *et al. (*2019) unpacked and explored the link between production pressures and safety through a case construction project that shows the informal ways in which work pressure is managed. The case study found that an informal, covert and hazardous "piecework" process was used on the site in direct response to scheduling demands. In the study, construction workers were rewarded through extra income and rest breaks to complete tasks faster than expected pace in a clear prioritisation of production over safety. The safety controlling function in this case study thus requires interrogation.

A vital feature of the quality movement is that everyone in a firm shares the responsibility for quality. The same level of contributions is required for good H&S practice. Everyone on a site must share the responsibility for H&S, just as they would for quality and production. As shown in Fig 1, the Health and Safety Executive (HSE 2001) recognised that management control is essential for promoting good H&S practice. The HSE (2001) proposed three levels of management control, which are relevant to contractors in construction. Although all three levels in Fig 1 are vital to

prevent accidents, level 2 and 3 are close to what happens on a construction site.

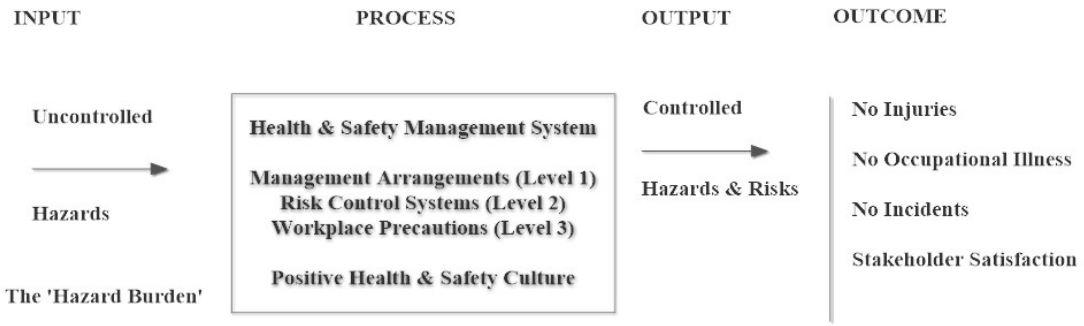

Fig 1: Effective H&S risk control (HSE 2001: 10)

The availability of adequate worksite precautions will prevent harm to people and damage to properties at the point of risk (2001). The idea is that if site management provides clear direction and take responsibility for the working environment, a collective effort to develop and maintain systems of risk control before the event - not on blaming individuals for failures afterwards - will evolve.

The outcome column in Fig 1 contains characteristics of an environment in which loss of productivity might not occur due to H&S lapses. However, having no injuries, occupational ill-health, incidents, and stakeholder concerns begins with converting uncontrolled hazards (inputs) into controlled dangers and risks (outputs) through SMSs, strategic directions by management (level 1), risk control systems (level 2) and worksite precautions (level 3) that inter-alia, produce a positive H&S culture. Notably, the range, nature, distribution and criticality of the burden of hazard will determine the risks to be controlled on a typical site. That is why the HSE (1997) proposed risk control systems (RCSs), which form the basis for ensuring that adequate worksite precautions are provided and maintained. Suppose the precautions are observed at the implementation stage of projects, risks associated with routine and non-routine operations, maintenance, plant and equipment, predictable emergencies, and related work can be contained. The containment of such threats leads to the outcomes in Fig 1, which are necessary to prevent loss of productivity because of incidents and accidents on construction sites. Risk control is required to promote both compliance- and behaviour-based safety. The primary approach in establishing workplace precautions includes identifying hazards that could cause harm (hazard identification), assessing the risk that might arise from identified hazards (risk assessment) and making decisions about suitable measures to control the risks (risk control) (HSE 1997).

The approach described above applies to the management control of work activities to eliminate and minimise risks within the construction process on-site. On a typical construction site, hazards are created where people interact with their task. The goal in such situations is to remove or minimise risks inside the construction site. For example, the risk control effort should cover the premises, plant and equipment, procedures and people. If the interviewees' comments in the previous section of the paper a considered, the emphasis of risk control efforts on their worksite should be on procedures and people. The effort should target the removal or minimisation of risks in job design and work procedures. Concerning people, the risk control effort should address the placement of workers (categorisation and role definitions in Table 1), their competence (knowledge and skills) for the specific task and other H&S requirements peculiar to the site. Therefore, when considering risk controls, management should

discuss the issues with their workers and focus on what is done on-site compared to legislation, regulations and industry standards (HSE 2013). The discussion should address risks that can be foreseen (predictable) through changes on a construction site and resource mobility (including people). In brief, mitigation of the loss of productivity by the outcomes in Fig 1 is possible when management techniques and practices are applied to H&S in the same way as production. The steps of management control applicable to H&S are summarised in Fig 2. Please see McKinnon (2014: 144-148) for elaboration.

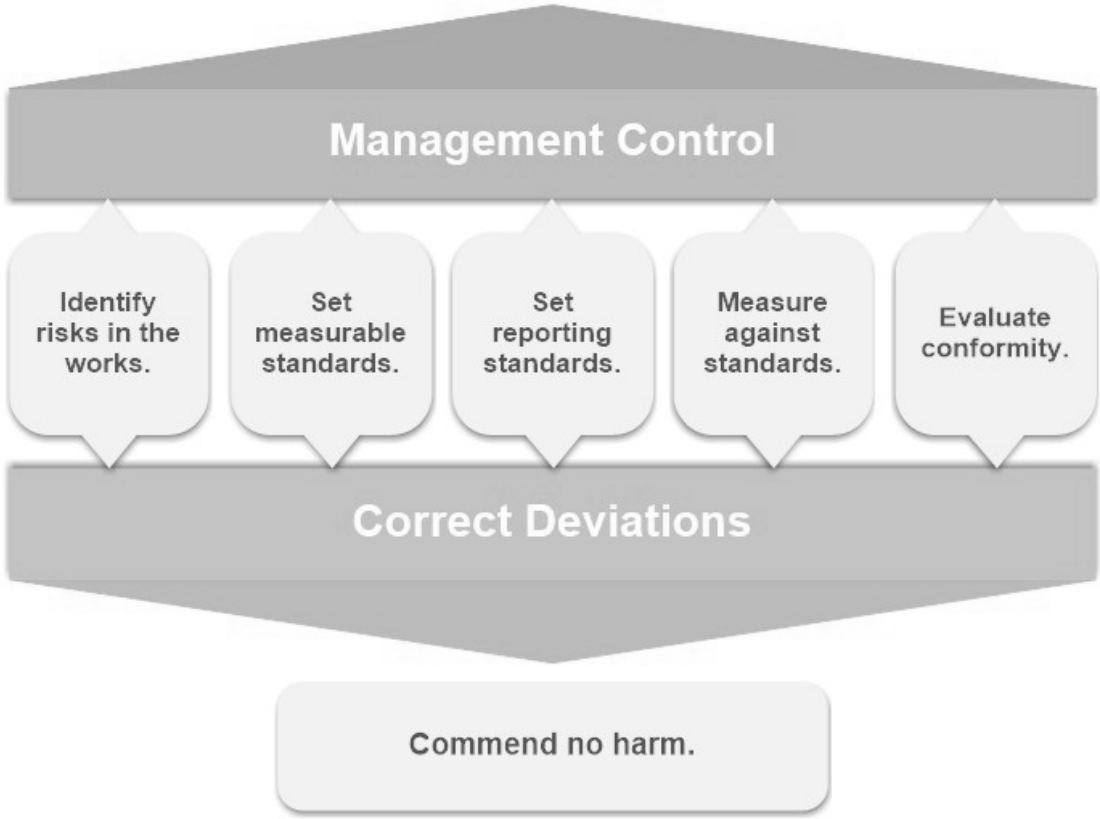

Fig 2: Management control steps for H&S (Modified from McKinnon 2014)

CONCLUSION

The impact of unsafe H&S practices on the loss of productivity has been established qualitatively in this paper. The 22 interviewees affirmed that H&S has a direct influence on work practices and productivity. They reinforced the notion that poor H&S practices lead to absenteeism due to illnesses and injuries, which, in turn, leads to loss of productivity. The themes that emerged from the textual data conveyed the links between induction and training, production investigations and loss of productivity in construction. The interview data suggested that it is necessary to fortify the management function that controls production (or productivity), quality, H&S and other project parameters. An attempt to reinforce management control should however not be excessive to prevent unintended consequences leading to project failure.

There is a case for strengthening management control on construction sites in the study area (Mpumalanga and Limpopo Provinces of South Africa), which the interviewees did not cite. Management control would help contractors to identify what must be done for H&S while inspecting and evaluating the works to verify

satisfactory completion before following up with required actions. The results from this study provide a reason for engaging contractors on how they should strengthen the three levels (see Fig 1) and seven steps (see Fig 2) of the management control function to limit the loss of productivity flowing from a heightened burden of hazard and uncontrolled risks on site. As cited by some interviewees, when adequate procedures and supervision are lacking or not used, loss of productivity is likely. It is for these reasons that management should devise and deploy a risk control system (RCS) through brainstorming sessions in which reflective questions such as the following are asked:

- Are roles and responsibilities well defined on this project site?
- Do all concerned parties understand the roles and responsibilities?
- Do responsible parties have the time and resources to discharge their tasks?
- Are people held accountable for discharging H&S responsibilities?

The answers to these questions should address the H&S competence, commitment and resource requirements of the construction project to enable the conversion of burdens of hazard into controlled risks that provide a worksite where harm and loss of productivity are mitigated through the outcomes shown in Fig 1 and steps in Fig 2.

The limitation of the interview results reported in this paper is typical of qualitative studies where analytic generalisation, advocated by Yin (2014), can be expedited. However, future rigorous research will examine how contractors expedite management control regarding hazards and risks in the study area. The prospective study should interrogate effective H&S risk control (Fig 1) on construction sites and the steps taken to ensure this is a continuous process (Fig 2).

ACKNOWLEDGEMENTS

In compiling this paper, the author has drawn on research work assigned to Alfred Rapitsi Rasebotsa in 2018. The author gratefully acknowledges his contribution. The help of the two anonymous reviewers of the abstract and paper are also appreciated.

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