

Role of human risk-taking behaviour and legislative standards on electrical incidents

South Africa has, due to its cultural, political and historical background, a far wider difference in individual risk perception, and as such, this would have a much greater impact on health and safety (H&S) management than other western countries. The purpose of the study is to determine what influence the individual's perception of risk has on H&S practices in the South African electrical industry.

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In most electrical engineering environments, individuals usually perform, to a certain extent, specialist tasks on their own. With this in mind it would be advantageous to understand how electrical workers' perception of risk allows him or her to perform certain job functions in a healthy and safe manner. The selection process of persons to perform certain tasks should incorporate both the specific aspects of the job and the characteristics of that individual that make them best suited to undertake such tasks.

Risk perception and the individual's attitudes towards H&S is related to a tendency of responding in a given situation in a particular way, and by not taking this into consideration the current approach of forcible compliance with standards, creates a tendency of resistance. According to Stranks [14] the attitudes of individuals towards H&S comprise of a cognitive component and an affective component. The cognitive component is concerned with thoughts and knowledge related to perceiving, remembering, judging, reasoning, and the analysis of a scenario. The affective component on the other hand, is concerned with emotions or feelings of attraction or revulsion. Both of these components play a critical role in an individual's risk behaviour profile.

Slovic [11] postulates that reaction to risk can be attributed to sensitivity to technical, social and psychological qualities of hazards that are not well modelled in technical risk assessments. The importance of social values in risk perception and risk acceptance has thus become apparent. According to Lussier [5], people are a manager's most valuable resource and as such need to be maintained, by understanding the potential an individual has to contribute to accidents; management will better care for this most valuable resource of an organisation.

Given that risk perception is argued to be quantifiable, an increasing number of studies have focused on cultural and national differences in risk perception. A few studies have focused on countries such as Japan and China, but developing countries on the whole have been ignored [16]. The need for research relative to this critical component of H&S management is indicative of the increase in serious accidents

in the electrical maintenance and construction industry of South Africa.

Review of the literature

H&S in the electrical maintenance industry

The South African electrical engineering and maintenance environment is faced with unique problems, which in totality reflect on the wider problems facing engineering in South Africa. Skill shortages due to a change in legislation and funding of apprentices, technicians and engineers and the ineffective implementation of training by selective Sector Educational and Training Authorities (SETAs) resulted in a shortage of trained engineering staff. Due to these factors and the ineffective management of applicable legislation and standards, the quality of services is deteriorating. A study conducted by Paivinen [8] to determine risk perceptions of electrical tradesmen, determined that electrocutions were not rated as a serious risk compared to that of working at heights. Paivinen [8] postulates that electrocution may be such a close work associated risk that its risk is underestimated in risk analysis by electricians.

Due to the physical environment of electrical maintenance work, the perception of danger is related to competence rather than the reliance on human sense.

In South Africa, electrical maintenance organisations and municipalities cannot expect to manage H&S in the same context as other developed countries due to the following internal factors. These are:

- A low skilled work force
- An expanding economy
- A unique cultural diversity
- A low level of investment in human capital
- A history of a large section of the population not exposed to technology
- A work force being exposed at a fast pace to complex technology

According to Hall et al [4], the profile of the engineering in South Africa has been enhanced and demand for related human capital and leadership talent has increased. The primary challenge lies in the development of basic skills, the procurement and development of strategic

and professional leadership and the protection of experience in South Africa.

The electrical maintenance industry is unique in the danger it poses to service providers as well as users, in that the perception of what is dangerous is not easily judged and the result of exposure can be more extreme than in other industries Trimpop & Zimlong, [17].

Cultural values and H&S

According to Lonner and Malpass (1994) as quoted by Smallwood [12] cultural values affect the view about risk. They cite Hofstede's conditions that the value of avoiding uncertainty has a direct effect on risk perception.

Weber et al [9] indicate that norms and values in a given culture influence the behaviour of members of that culture. In addition to this, events and circumstances over many generations contribute to the creation of those values as a cultural adaptation. Cultural norms can have a direct influence on the individual's perception of risk and to what extent risk will be taken.

Perez et al [9] believe that the study of culture could facilitate understanding as to when and why people behave in a safe manner at work. Cultural values thus affect the way in which people think and behave when faced with a safety-related issue. This aspect in terms of various culture interactions, in the South African workplace, is not acknowledged in H&S strategies.

Motivational behaviour

According to Stranks [14] human factors affecting H&S related behaviour are defined as a wide range of issues which include: the perceptual, physical and mental capabilities of individuals, the influence of equipment and system design on such person's performance, and the organisational characteristics that influence such individuals' behaviour.

To determine what motivates an individual to either intentionally or unintentionally behave in a certain risk taking manner there is a need to understand human motivational analysis. McClelland [6] indicates that human motivation has to do with the why of behaviour, as contrasted with the how or what of behaviour. The role of unintentional actions in incidents, or as Sigmund Freud names it unconscious intent

Measure	ICMEE	ECA	MUN	SAIEE	Mean
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Analysed (No.)	12	11	8	8	9,75
Sample stratum (No.)	145	450	30	64	689
Response rate (%)	8,3	2,4	2,4	13	10,7

Table 1: Response rates for the sample strata.

is a factor contributing to incidents not always taken into account.

According to McClelland [6] Freud's early work showed that peoples' motives for what they do in everyday life are often unconscious.

Ai Lin Teo et al [1] determined that positive reinforcements motivates workers to perform their jobs in a safe manner and is desirable above negative reinforcements in that although the same outcome may be achieved a negative climate would be created.

Regarding the issue of how to address the human (failure) element, a person intuitively looks toward inadequate, or lack of training and instruction. This aspect of appropriate training, education and instruction being a pre-requisite to achieving human H&S compliance appears frequently in the maintenance literature [3]. Human risk behaviour thus involves more than mere action or impulses.

Perception of risk

The individual's psychological make up affects their attitude towards H&S management in either acceptance or rejection of standards imposed on them. To understand why people accept certain risks and reject others there is a need to understand the psychological processes that lead to either rejection or acceptance [17].

Human behaviour and H&S relates to factors affecting psychology, sociology, and the anthropology of humans. Individual human factors that affect decision making in taking or rejecting risks relates to both the external socio environment as well as the individual's beliefs.

Trimpop and Zimlong [17] quote Slovic et al, who conclude from factor-analytical studies

and interviews that risk is assessed differently by the dimensions of controllability, voluntarism, dreadfulness, and whether the type of risks are known.

Mitchell [7] indicates that although physical harm can be measured by experts using specific measurement tools. Psychosocial risk is less easily calculated. Although psychometric scales, in some cases, could be devised to measure such phenomena, the risk is so complex and potentially changeable, that it is difficult to measure accurately. An objective measure of risk is therefore difficult to obtain, but that is not to say that it does not exist. All that can be easily measured is the subjective or perceived risk.

According to Wilde as quoted by Trimpop and Zimlong [17] people adjust their risk taking behaviour towards their target level of perceived risk. This means that people will behave more cautiously and accept fewer risks when they feel threatened and conversely, they will behave more daringly and accept higher levels of risk when they feel safe and secure. Stallen and Vlek [13] indicate that the subjective perception of risk is the basis for risk acceptance regardless of the objective or quantified nature. Dey [2] found that the probability and severity of each risk factor are determined through active involvement of the experienced persons from the field in an interactive environment. The experience of risk therefore is not only an experience of the physical properties of the situation, but also a process of learning and understanding the potential of specific aspects of the risk environment.

Risk can be related to the probability of an incident occurring. According to Ridley and Channing [18] risk reflects both the likelihood

that harm will occur and its severity, and hence these factors should be taken into account when undertaking either qualitative or quantitative risk assessment.

Risk is a complex concept. It is the natural consequence of uncertainty and is part of human activity. It means different things to different people, and is intimately linked to personal or collective psychology although analysts give it the trappings of objectivity [15]. Risk in totality to an organisation is the threat of loss to any of its assets. In terms of its most important asset, human resources, the threat of loss of individual employees injuring themselves or others is a serious risk that needs management intervention.

Research

Sample stratum and response rate

The sample stratum consisted of members of the Western Cape branch of the Institute of Certificated Mechanical and Electrical Engineers of South Africa (ICMEE), the South African Electrical Contractors Association (ECA), various employees of municipalities (MUN) electrical departments in the Southern Cape and the South African Institute of Electrical Engineers (SAIEE), Southern Cape branch only.

Table 1 presents the size of the sample strata, the number of completed questionnaires included in the analysis of the data, and the net response rates relative to each of the sample strata, including a mean.

Table 2 indicates the importance of five parameters in terms of a mean score ranging between 1,00 and 5,00, based upon percentage

Parameter	ICMEE		ECA		MUN		SAIEE		Mean	
	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank
Cultural impact	4,22	1	4,13	1	2,50	5	3,00	4	3,46	1
Perception of hazards	3,39	2	3,50	2	3,30	2	3,25	1	3,39	2
Motivational incentives	2,83	3	3,19	3	2,83	4	3,00	4	2,96	3
Management Influence	2,61	4	2,25	5	2,93	3	3,13	2	2,73	4
Role of H&S legislation	2,44	5	2,58	4	3,70	1	2,00	5	2,68	5

Table 2: Degree of importance of various parameters to respondents' organizations.

Aspect	ICMEE		ECA		MUN		SAIEE		Mean	
	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank
Training can alter risk taking behaviour of electrical maintenance workers	4,44	1	4,25	1	3,50	2	5,00	1	4,30	1
Electrical workers will perceive hazards differently	3,78	3	4,00	3	3,00	3=	4,00	3	3,70	2
Existence of different cultures perception of risk	4,22	2	4,3	2	2,50	4=	3,00	5=	3,46	3
The influence of safety standards on risk perception	3,00	6	3,00	6=	4,50	1	3,00	5=	3,38	4
Electrical accidents are related to management incompetence	3,11	5	2,25	10=	2,25	5=	3,50	4	2,78	5
Management competency is related to risk taking behaviour	3,56	4	3,00	6=	3,00	3=	1,50	12=	2,77	6
The framework of legislation, prevents risk taking behaviour	2,67	8=	2,75	8=	2,50	4=	2,50	9	2,61	7
Safe work procedures differ among electrical maintenance workers	3,00	6	3,50	4	2,25	5=	1,50	12=	2,56	8
Financial gain or other advances results in unsafe behaviour	2,67	8=	3,38	5	1,00	9	3,00	5=	2,51	9
Management training not the solution to risk taking behaviour	2,00	12=	1,75	14	1,50	7=	4,50	2	2,44	10
Better government policing will prevent risk taking behaviour	2,67	8=	2,75	8=	2,25	5=	1,00	14	2,17	11
Health and safety legislation can alter risk perception of unsafe acts	2,00	12=	2,25	10=	1,75	6	2,50	9	2,13	12
Unsafe behaviour is the norm for general electrical workers	2,33	11	2,25	10=	1,25	8	2,50	9	2,08	13
Management practises do not promote safe behaviour	1,78	14	2,00	13	1,50	7=	3,00	5=	2,07	14

Table 3: The impact of risk perception in the electrical maintenance industry.

responses to a scale of 1 (not important) to 5 (very important).

It is notable that the mean scores are all above the midpoint score of 3,00, which indicates that in general the respondents can be deemed to perceive the parameters as prevalent. The mean score for the impact of culture and perception of hazards is $> 3,40 \leq 4,20$, the respondents can be deemed to perceive them to be between important to more than important/more than important. Given that the mean scores for motivational incentives and the influence of management are $> 2,60 \leq 3,40$, the respondents can be deemed to perceive them to be between less than important to important. It is significant that risk perception and the impact of culture are ranked first and second. Furthermore, it is notable that the role of H&S legislation in altering risk taking behaviour is ranked last with a mean score of 2,68, which means that the current legislative approach is not seen as a motivation for better H&S management.

Table 3 indicates the impact of risk perception in the electrical maintenance industry in terms of a mean score ranging between 0,00 and 5,00 based upon percentage responses to a scale of 1 (minor) to 5 (major). Given that effectively a six-point scale ("no impact" linked to a five-

point) was used, and that the difference between 0,00 and 5,00 is five, ranges with an extent of 0,83 (5/6) are used to discuss the degree of central tendency.

Firstly, it is notable that the mean scores for 12 of the 14 manifestations are above the midpoint score of 2,50, which indicates that in general the related manifestations can be deemed to be prevalent.

The manifestations falling within the upper range of mean scores $> 4,17 \leq 5,00$ – between a near impact to impact/impact, are discussed first. The importance attributed to training in altering risk taking behaviour of electrical maintenance workers is a significant indication of the need for knowledgeable workers.

The manifestations falling within the second range of mean scores $> 3,33 \leq 4,17$ – between an impact to near major impact/ near major impact: The manifestation, electrical workers will perceive hazards differently than in other industries, is significant in terms of the view of the electrical engineering environment in acknowledging their unique work environment.

The existence of different cultures' perception of risk is indicative of the importance that cultural

influences can have on risk perception. The high ranking at level three, of the influence that H&S standards have on risk perception, reiterates the importance of knowledge in altering risk taking behaviour and the influence in individuals risk perception.

The third range of manifestations, those with mean scores $> 2,50 \leq 3,33$ – between a near minor impact to impact/impact, are discussed below. Management competency is related to risk taking behaviour, is significant as the importance and relation between management competencies is rank highly in the relation between management and accidents and indicative of the need to not only address workers but also management competency. The framework of legislation, which prevents risk taking behaviour, is ranked seventh. It is notably lower that the manifestation of the influence of safety standard with a mean score of 2,61, which is 12,83% lower.

The ranking of safe work procedures differs among electrical maintenance workers is notable, in comparison to the manifestation, ranked fourth, of the influence of safety standards where the latter is guidance to uniformity in work procedures.

Financially gain or other advances results in unsafe behaviour is ranked lower at position nine which indicates than manifestations such as training and cultural influences, ranked first and third, have a greater impact on risk perception. Although ranked tenth, the indication that management training will not be the solution to risk taking behaviour, is ranked below management competency is related to risk taking behaviour, ranked six, effectively 5,5% lower than the latter, it is nevertheless a manifestation, for the need for competent management that includes both experience and relevant knowledge.

The last range of manifestations, those with mean scores $> 1,67 \leq 2,50$ – between a minor impact to near minor impact / near minor impact, are discussed below. The mean score and eleventh ranking of review that better government policing will prevent risk taking behaviour is notable as this low ranking provides the view of the current perception on the effectiveness of government inspectorates.

The mean score of the twelfth ranked manifestation, namely that H&S legislation can alter risk perception of unsafe acts, is notable in that legislation is not viewed as the strongest drivers in altering risk perception. The view of the thirteenth manifestation that unsafe behaviour is the norm for general electrical workers, at a mean score of 2,33 can be described as the tendency and belief of the industry not to accept unsafe behaviour.

The last ranking of review that management practises do not promote H&S behaviour, are significant as the implication are that management do promote healthy and safe behaviour, but as per the manifestation ranked six that this does not imply that management has the relevant competency.

Conclusions and recommendations

The approach to H&S in South Africa should be expanded to take into account human behaviour factors related to the individual's psychological behaviour in relation to the capacity for analysing risk factors in a work environment. Further, should such psychological traits take into account South Africa's unique environment of different cultures and the effect change in economic expansions and technologies have on people. Weber and Hsee [18] found consistent and reliable cross-cultural differences in risk perception and indicated that the effects of different cultural backgrounds of workers on H&S management are not always incorporated into H&S management.

Edwards et al [3] postulate that non-compliance with H&S rules includes worker apathy and ignorance (which in turn can result from inadequate or absence of training and instruction); pressure to get the job done as quickly as possible; and lack of supervision. This aspect of human acts or omissions and their relationship to H&S failings generally in maintenance, is well documented.

The use of standards alone is no guarantee that an organisation's H&S management system will reduce incidents of loss. Standards used in South Africa in relation to H&S are usually developed or obtained from other sources such as the International Labour Organisation (ILO). The ILO has, as one of its key functions, the creation of international standards on labour and social matters where such standards are contained in conventions and recommendations.

Regarding the issue of how to address the human (failure) element, one intuitively looks toward inadequate, or lack of training and instruction. This aspect of appropriate training, education and instruction being a pre-requisite to achieving human H&S compliance appears frequently in maintenance literature (Edwards et al [3]). Developing workers' competency by increasing their knowledge through training and by identifying individuals with low risk taking behaviour for high risk tasks should form part of the H&S system processes.

The future management of H&S must include the development of that section or part of this field that will concentrate on the component that interact on the process that influence human behaviour in evaluating specific job task where this component can have significant influence on human risk behaviour.

Consequently, it can be concluded that the impact of human risk perception in the electrical service and maintenance industry is significant and forms part of that section in H&S management not always addressed.

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