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THEME: SUSTAINABLE INNOVATIONS FOR ENHANCING INDUSTRIAL GROWTH

SUB THEME: INDUSTRIAL SAFETY

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SUSTAINABLE INNOVATIONS FOR ENHANCING INDUSTRIAL GROWTH

Sustainable development is certainly a key issue in both developed and developing countries. Finding the balance between the consumer's demand and the carrying capacity of Earth's natural resources with regards to economic growth is crucial and the key element of sustainable development. This report explores various aspects of the green growth concept, which builds on a number of existing sustainable development initiatives. The overall objective is to integrate the key aspects of economic performance, such as poverty reduction, job creation, social responsibility, and improving environmental performance, through mitigation of climate change and biodiversity loss and security of access to clean water and energy.

Our current socio-economic progress and the overall growth paradigm need to be rethought and restructured as the current focus on quantitative growth has shown to have had detrimental effects on our environment and the preservation of various natural resources for our future generations. Instead, our growth concept should evolve around a more sustainable and qualitative growth, which invests in and embraces new ideas and innovations. This paper explores various aspects which builds on a number of existing sustainable development initiatives and the role Innovation System Frameworks play in helping countries achieve environmentally sustainable development.

Sustainable development is certainly a key issue in both developed and developing countries. It stands for meeting the needs of present generations without jeopardizing the ability of future generations to meet their own needs and their quality of life. Finding the balance between the consumer's demand and the carrying capacity of Earth's natural resources with regards to economic growth is crucial and a key element of sustainable development. It will be a vital step in addressing the multiple and interrelated global crises, which are impacting on the international community. Innovation tends to spring from the creative generation and application of knowledge, and the application of a wider range of methodologies to guide and foster creativity. It is a driving force for sustainable industrial development, poverty reduction, and of economic growth and competitiveness.

The significance of innovation for sustainable industrial development cannot be over-stated; even the poorest countries cannot afford to neglect innovation. It offers new ways of adding value, as the innovation process itself is a series of methodologies that reduces the uncertainty of the outcome of change processes; in effect, it is a risk management tool improving the chances to deal successfully with change, be it local or global, incurred by social, economic or sustainability pressures. It has also been defined to be vital for the survival of thriving economies, as it equips them with a certain level of independency and the ability to match challenges to human, financial and institutional resources and the knowledge infrastructures required to solve them. Previous conceptions of innovation have changed from a linear model of innovation to a more integrated, dynamic, and holistic framework that is composed of a set of interconnected institutions, agents, organizations and the linkages between them that contribute to the development and diffusion of knowledge, which are in the form of processes or products. Economic growth and resource efficiency are two sides of the same coin. They are both prerequisites
for the sustainable growth of our modern societies and are essential to face the current environmental,

social and economic challenges. Sustainable growth is embedded in the concept of sustainable development, which evolved from environmental concerns, and is based around development that"meetstheneedsofthepresentwithoutcompromisingtheabilityoffuturegenerationstomeettheirondustrial terms this means growing industry while keeping the environmental, and also the social and economic, impacts at a sustainable level. Resource efficiency is less well defined. Resources in this context include all material resources, living and non-living, so in addition to materials this also includes land, soil, air, water, biodiversity and ecosystems. Resources efficiency involves improving the efficiency and effectiveness of how we use these resources, i.e. using less to do more, and causing less impact from those resources we do use. The first goal of measurement is to understand where we are and where we have come from. In this way, progress, and its speed and direction, can be understood.

INDUSTRIAL SAFETY

In India the construction industry is the second largest employer next to agriculture whereas it is next to the road accidents in our country. The annual turnover of the construction industry in India is about 4000 Billion Rupees, which is more than 6% of the National GDP employing a large work force. The construction works in NPCIL, are enormous. The number of fatalities occurring from construction work in the industry is quite disturbing and fall of person from height and through openings are the major causes for serious accidents. . With strong planning, effective implementation and continual training with focused safety management a good safety record could be achieved comparable to we need to focus on the following aspects, Innovation in the training methodologies to achieve higher effectiveness of training among the contractor employees. Developing and implementing Behaviour Based Safety Program to improve orientation of work force towards safety in work. Implementation of innovative engineering measures to strengthen the safety requirements at design stages to achieve safe working environment during construction.

A well designed safety organization for contractors, sub-contractors and interface with department is are very essential. Implementation of Safety is a line management function; therefore its ownership lies with them. These line managers are to be backed up by competent persons in Industrial safety that provide expertise and supervision of work environment and equipment such as lifting tool, tackles, scaffolding, ladders etc used in construction.

Some of these systems to identify areas of improvement and achieve enhanced industrial safety status are enumerated below:

1 1) Safety surveillance and Safety Related Deficiency Management system.

2 2) Area-wise Task Force for enforcing safety at construction Projects.

3) Contractors Safety surveillance and correction programme.

4) Entry passes to the work site only after Induction Safety training etc.

5) Periodical Safety Audits

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The dynamicity, complexity and parallel activities in construction are unavoidable at times. These activities, though planned, are carried out by the work force which is skilled in the execution of work but lack of awareness of safety requirements overconfidence, complacency, at times, leads to breach in safety requirements. Hence, a regular monitoring and surveillance program along with coaching & mentoring of employees during execution becomes necessary to correct the aberrations in safety implementation.

SHIPPING INDUSTRY

"Shipping is perhaps the most international of all the world's great industries and one of the most dangerous."
(International Maritime Organization [IMO], 2002).

The shipping industry is expanding exponentially: 80 million Americans per year use U.S. flagged vessels, 90% of the U.S. population is served by domestic shipping, 97% of the UK's trade by weight arrives or leaves by sea. The United States maritime administration states that "ship- ping is vital to the nation's security, economy, and transportation" .The 2004 operating budget for the United States Coast Guard was 330 million dollars. Globally, statistics reflect the same fiscal importance of this industry, for instance there are around 50,000 merchant ships trading internationally, transporting a range of cargos.

INJURIES AND ACCIDENTS

Merchant shipping is known to be an occupation with an annual high rate of fatal injuries caused by organizational accidents and maritime disasters. The United States Coast Guard (USCG, 2004) reports their 5-year average of 673 passenger and maritime worker injuries and fatalities. Common incidents such as collisions, allusions, and groundings specifically have decreased in this period; this is attributed to enhanced technology in aids to navigation. The USCG operating expenses for safety in the fiscal year 2004 were 330.4 million dollars, illustrating that there are both fiscal and humanistic drivers to improve safety performance in shipping.

METHOD

Several electronic databases (e.g., PsychARTICLES, PsychINFO, ScienceDirect, and Web of Science) were used to identify research articles on human factors in shipping by using the following search terms: maritime, shipping, stress, fatigue, situation awareness, decision making, communication, teamwork, safety, and shipping/ maritime accidents. Additionally, institutions that had conducted work in these areas (including government bodies) were sourced through search engines (e.g., Google) and authors were contacted directly with requests for relevant literature.

AUTOMATION

Due to reduced manning levels in the maritime industry there is now an emphasis on automation. There has been a cultural shift in the maritime industry toward increased levels of automation in tasks, particularly with regard to navigation systems. This increase in automation and decrease in manning levels has changed the role of the seafarer purport that automation can create new attentional demands. The operator has to permanently keep track of the numerous systems, what they are doing and what they will do next, which mode they are operating in and so on, this is termed "mode awareness".

PERSONAL ISSUES

This first section deals with human performance factors or behaviors that may contribute to maritime incidents and presents research that has evaluated the contribution of these factors in accident causation.

FATIGUE

Fatigue is not a new issue in the maritime domain. However, the conditions in which seafarers work are becoming increasing demanding. There are shorter sea passages, higher levels of traffic, reduced manning, and rapid turnaround. Extended hours on duty and hours worked in the last three days are associated with marine accidents that could be attributable to fatigue . In their research, investigating officers were presented with 98 ship casualty reports and identified in 23% of cases that fatigue was a major contributory cause.

STRESS

Stress has been identified as a contributory factor to the productivity and health costs of an organization as well as to personnel health and welfare. Most seafarers reported occasional to frequent stress at sea (80%). There were departmental differences in stress levels, over 65% of engineers, 60% of crew, and over 60% of masters report moderate to high stress levels. Frequency and levels of reported stress tended to be lower in the crew than all other groups. Exposure to elevated stress levels for an extended period of time leads to negative mental and physical health outcomes.

HEALTH

Research from other domains such as the offshore oil industry indicates a positive relationship between health management and safety performance .In the AMSA seafaring sample around a third of seafarers (32%) exceeded the National Heart Foundation (NHF–Australia)guidelines for safe limits of alcohol consumption .Furthermore, 28% of individuals smoked as compared with 24% of the Australian male population. Of the seafaring sample, 81% failed to reach minimum exercise levels required for good health (as recommended by the NHF–Australia), however, reports noted a wide variety in quality of exercise facilities made available to personnel.

PERSONAL ISSUES

Non-technical skills

Non-technical skills are an additional set of competencies that are used integrally with technical shipping skills, such as
those to manoeuvre the vessel, or set down the anchor. They encompass both interpersonal and cognitive skills such as situation awareness, communication, team working, and leadership.

Situation awareness (SA)

Situation Awareness is the ability of an individual to possess a mental model of what is going on at any one time and also to make projections as to how the situation will develop.

Communication

One of the core skills central to effective and safe production and performance in all high-risk industries is communication, this also influences team SA as well as team working and effective decision-making.

Safety training

As the previous section of the review has demonstrated, there are many non-technical skills in shipping, which have been established through research as being integral to best practice. In his book Normal Accidents, notes that it is not unusual for a deck officer to remain aghast and silent while his captain grounds the ship or collides with another (p 178), it appears that deficiencies in non-technical skills, in the previous example communication, sometimes result in the occurrence of incidents.
There are currently initiatives in place in the maritime industry that aim to address deficiencies in performance of non-technical skills. Crew resource management (CRM) is a training initiative based on the core non-technical skills integral to best practice, developed in the light of many well publicized aviation incidents, resulting in the loss of many lives. CRM refers to a set of defined cognitive and social skills: communication, teamwork, situation awareness, leadership, assertiveness, decision making, and workload management, which contribute to enhanced ability to work in teams and also enhanced safety performance.

Engine Room Resource Management (ERM)

Engine Room Resource Management, the version of CRM for ships engine room personnel, was introduced in the 1980's and has been used to train teams in skills of systems resource and crisis management .There is little work evaluating the impact of these courses.
The majority of the limited work conducted in this area has focused on human factors and interventions at the individual level: situation awareness, decision-making, fatigue, automation, communication health and stress, and teamwork.

Bridge resource management/Bridge team management (BRM/BTM)

The maritime equivalent of CRM is termed Bridge Resource Management (BRM), or bridge team management (BTM), and has been used in the maritime industry for the last decade. However, a review of the literature reveals that there appears to be no empirical foundation for this type of course beyond research that was originally conducted in the formation of aviation CRM courses.

CONCLUSION

There are many demanding aspects of seafaring such as the inability of employees to leave the worksite, extreme weather conditions, long periods away from home, and motion of the workplace. Some of these are unchangeable and are a reflection of the nature of the domain. However, it is possible to modify, supplement, and introduce new strategies or interventions to potentially reduce the impact these factors have on the health and welfare of the individual seafarer.

There are many human factors influencing safety in this domain as have been presented in this review: fatigue, automation, situation awareness, communication, decision making, team work, and health and stress. These issues were reviewed within a framework that proposed that these individual factors can be contributory causes in accident causation, however the safety climate on ship will also influence whether or not an individual engages in safe behaviors or not. The review also considered the current status of attempts to address these human factors issues prevalent in the maritime industry, looking at CRM, BRM, and ERM. The review demonstrated that there are many gaps in the maritime literature, and a number of methodological problems with the studies undertaken to date. The current economic development paradigm has steadily contributed to the deterioration of the environment, including air, water and soil quality. This calls for a focal shift from short-term economic growth to the achievement of long-term sustainable development. This will require a multifaceted paradigm shift, ranging from the introduction and implementation of national policies right down to the individual consumer's behavior. Furthermore, countries need to be independently competitive and have a knowledge-based innovative economy. This can be achieved through the introduction of an Innovation System Framework, which states that a country's innovation performance depends on many actors, their individual capacity to support aspects of innovation and the linkages connecting them into productive networks, as well as the various framework conditions.