

“Environmental management practices for sustainable development: agenda for harmonization”

AUTHORS

Gibson Nyirenda
Collins C. Ngwakwe  <http://orcid.org/0000-0002-6954-8897>

ARTICLE INFO

Gibson Nyirenda and Collins C. Ngwakwe (2014). Environmental management practices for sustainable development: agenda for harmonization. *Environmental Economics*, 5(1)

RELEASED ON

Thursday, 27 March 2014

JOURNAL

"Environmental Economics"

FOUNDER

LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

0



NUMBER OF FIGURES

0



NUMBER OF TABLES

0

© The author(s) 2021. This publication is an open access article.

Gibson Nyirenda (South Africa), Collins C. Ngwakwe (South Africa)

Environmental management practices for sustainable development: agenda for harmonization

Abstract

This paper explores the role of environmental management practices on sustainable development. To promote corporate environmental management practices and green economic development, governments enact legislation aimed at curtailing damage to the environment; in addition to government regulation, some firms apply voluntary self-regulatory measures to limit their impact on local environments. This paper will critically review literature on current environmental management practices and their role on sustainable development. Based on the literature review of different sections of society, preliminary findings suggest that current environmental management practices have dissimilar effects on sustainable development. These practices in the fields of health and law are more indicative of policy based practices, while those in engineering and industry are more hands on. This paper concludes by recommending that these environmental management practices be harmonized across the different sectors of society which will result in improved sustainable development and promote green economic development.

Keywords: environment, environmental management practices, green economic development, sustainable development.

JEL Classification: M11, M41.

Introduction

Sustainable development is a key area championed by the United Nations (UN) as a key part of the Millennium Development Goals (MDGs). These MDGs place an onus on all UN member countries to drive towards meeting these goals and hence act to promote overall sustainable development.

This paper thus explores the role of environmental management practices for sustainable development based on four fields of society: engineering, health, industry and law. Environmental management practices for sustainable development are examined based on each field and the results indicate a lack of harmonization of these practices. Using a review of extant literature, a framework is proposed that can enhance harmonization of these environmental management practices. This paper concludes by recommending that enhancing education on environmental management practices is necessary for global sustainable development to be achieved.

The structure of this paper is as follows; the next section briefly outlines some important concepts and frameworks critical to this study, followed by a review of literature, then the current framework, discussion and proposed framework based on this review. A section with the recommendations follows and lastly, the conclusion to this study completes this paper.

1. The concept of environmental management practices

The concept of environmental management practices has remained on the agenda of the corporate world since a series of significant events in the sus-

tainability arena; the Brundtland Report (1987), the Earth summit in Rio de Janeiro, Brazil in 1992, the World summit on Sustainable Development in Johannesburg in 2002 and the recent Earth summit 2012 in Rio de Janeiro, Brazil. In various literature, environmental management practices has been interchangeably used with corporate environmental responsibility (CER), corporate environmental management (CEM), corporate environmental engagement (CEE) and corporate social responsibility (CSR). Montabon, Sroufe & Narasimhan (2007) defined environmental management practices in their paper as the techniques, guidelines and ways a firm uses that are targeted at monitoring and controlling the effect of its actions on the natural environment. Whilst there may be many aspects of environmental management practices as can be noted from the literature (Evangelinos & Oku, 2006; Montabon et al., 2007; Liu, Liu, Shishime, Yu, Bi & Fujitsuka, 2010); in this paper, environmental management practices refers to the action taken by organizations and firms to remedy environmental pollution vis-a-vis waste management, carbon emission reduction, efficient energy use and efficient water usage.

1.1. Global reporting initiative (GRI) guidelines and framework. Founded in 1997, the non-profit Global Reporting Initiative (GRI) was established to help foster sustainable development and transparency in all aspects of economic, social and environmental development. The G3.1 guidelines are the most recent guidelines published by the Global Reporting Initiative (GRI). These sustainability reporting guidelines are the bedrock of the GRI's reporting framework (GRI, 2012). Organizations are expected to voluntarily use these performance indicators to measure their individual sustainability reporting areas of economic, social and environmental disclosures. These indicators are an important resource

that can be used to achieve sustainable development. The key indicators with regards to environmental management are EN22, EN23, EN24 and EN25 (GRI, 2012). EN22 requires organizations to disclose their waste type and methods of disposal; EN23 calls for organizations to report their complete number and volume of any significant waste spills; EN24 encourages organizations to describe the weight of conveyed, exported, imported or treated waste that is considered hazardous and the percentage of such waste transferred internationally; EN25 calls for organizations to disclose the identity, scope, protected status and ecological worth of water bodies and related environments considerably affected by an organization's expulsions of water and runoff (GRI, 2012).

1.2. ISO 14001:2004. This standard, prepared by a specialized technical committee within the ISO aims to standardize environmental management systems worldwide (ISO, 2004). Within the standard, there is a call for organizations to adopt an integrated environmental management system that allows organizations to meet increasingly stiff legislation while also meeting their economic and environmental objectives (ISO, 2004). This standard on environmental management systems is critical to ensuring that environmental management systems are uniform worldwide and at least aim to enforce environmental policies and regulations. Implementation of this environmental management system enables sustainable use of resources, minimizing ecological degradation and promoting sustainable development.

1.3. Millennium development goals. As a means to further understand the basis of this study, it was necessary to conceptualize sustainable development in the context of the MDGs. According to the UN (2013), the September 2000 millennium summit resulted in the adoption of the United Nations Millennium Declaration, which placed a commitment on leaders of UN member states to engage in a global partnership whose major aim was to reduce extreme global poverty by half. This was to be done through a standardized time-frame with a deadline set for 2015. As the years went by, more objectives were added hence this evolved into what is now termed as the Millennium Development Goals (MDGs).

In 2002 the UN Millennium Campaign was launched and this supported and inspired people from UN member states to throw their weight and act towards achieving these MDGs. In the same year, the UN Millennium project was launched by the UN Secretary-General. This project set out to establish a sound action plan for the world to achieve the MDGs. New commitments towards achieving these MDGs were announced in 2008 and in 2010, the global MDG conference ended with the

approval of a global plan of action and new initiatives towards meeting the MDGs.

The Current Millennium Development goals are:

- ◆ Eradicate extreme poverty and hunger.
- ◆ Achieve universal primary education.
- ◆ Promote gender equality and empower women.
- ◆ Reduce child mortality.
- ◆ Improve maternal health.
- ◆ Combat HIV/AIDS, malaria and other diseases.
- ◆ Ensure environmental sustainability.
- ◆ Global partnership for development (UN, 2013).

With this brief background, it can be seen that sustainable development is key and is addressed in this paper by the goal of ensuring environmental sustainability.

1.4. Sustainable development. Sustainable development has been defined according to the Brundtland report as "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*

- ◆ *the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- ◆ *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs"*(WCED, 1987).

Sustainable development is also seen to embrace the triple bottom line that is economic, environmental and social development (Manoliadis, 2008). Sustainable development has gone through a transformation since coming to the fore in the WCED (1987). In the earth summit (Rio de Janeiro, 1992), the Rio declaration was made and it stated among others that to achieve sustainable development, environmental protection had to be at the heart of the development cycle and not independent of it (UN, 1992). The World Summit on Sustainable Development reaffirmed global commitment towards achieving sustainable development (WSSD, 2002). A call was made to ensure that protection of bio-diversity, access to clean water and sanitation is improved. The Rio+20 summit was held 20 years to the date of the first earth summit in 1992. The resolutions included a renewed commitment towards achieving sustainable development. This was to be through examining current progress, closing the remaining gaps existing in the implementation of this development and addressing emerging challenges (UN, 2012).

2. Review of literature

2.1. Engineering, environmental management practices and sustainable development. The engineering field is a critical sector to any meaningful

development. Over and above the innovations that are cardinal to development, engineering has taken on a new lease of life as a result of the quest towards sustainable development. According to Perdan, Azapagic & Clift (2000), engineering should be taught to include environmental and social concerns. Perdan et al. (2000) state that incorporating sustainable development in teaching reinforces engineering students with sound awareness of environmental issues and promotes innovative ideas that contribute to green engineering solutions. Perdan & Azapagic (2003) argue that engineers continue to provide and develop technologies that have a meaningful impact on the livelihood of communities. At the same time, the engineering field also faces major challenges in their concerted efforts to augment economic and social development and preserve the environment through sustainable development.

Abdul-Wahab, Abdulraheem & Hutchinson (2003) recognize the need to educate an expanding global population on the need for sustainable development. They further argue the need for embedding environmental education into the curricula of engineering studies so that this crucial part of education is adopted at an early level amongst learners. It is argued that at some stage in their career, engineers do come into direct or indirect conflict with the environment and hence there is need for this environmental education to be taught as part of the curricula. Engineering students well grounded in environmental awareness will be able to design innovate engineering solutions that the expanding global population demands, while at the same time take environmental management and protection into account (Abdul-Wahab et al., 2003). Fokkema, Jansen & Mulder (2005) discussed the need for sustainability in order for societies to prosper. They showed that technology was cardinal to sustainable development, though innovations were alone insufficient. They concluded that engineers had to address a three challenges: initiate original ingenious methods on the one hand, and initiating and implementing research and development programs that yield outcomes, on the other; working hand in hand with other fields and untrained stakeholders, on the one hand, and safeguarding disciplinary excellence, on the other; linking moralism and calculated realism (Fokkema et al., 2005).

Fenner, Ainger, Cruickshank & Guthrie (2005) examined the level at which concepts in sustainable development were introduced into the Department of Engineering at Cambridge University. They were able to draw lessons from managing the change process in the huge department and concluded that theories of sustainable development could be fused into the curriculum of engineering studies. This

would result in engineers with grounded knowledge in sustainable development concepts which would be beneficial across the engineering field. A conceptual basis for embedding sustainable development knowledge in engineering students was developed based on a Spanish technical university (Pérez-Foguet, Oliete-Josa & Saz-Carranza, 2006). Pérez-Foguet et al. (2006) argued that using technology as driving force, engineers could contribute immensely to sustainable development. Whilst exploring what role environmental engineering education had on sustainable development in Iran, Alavi Moghaddam, Taher-shamsi & Maknoun (2007) discovered that studying the strategies and undertakings of a university in developing countries could avail important information to other universities that could then be used to enhance the push towards sustainable development goals. They also found that comprehensive education of engineering students and facilitators had an important role in shaping their attitudes and awareness towards the environment, which in turn could benefit societies as these groups would translate this knowledge into practical sustainable development. This was more prevalent in developed countries (Alavi Moghaddam et al., 2007).

2.2. Health, environmental management practices and sustainable development. As included in the MDGs, healthcare is an integral part towards achieving sustainable development. Preceding the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002, health ministers and representatives from the Southern African Development Community (SADC) and other World Health Organization (WHO) member countries met to discuss and plan an agenda for the WSSD 2002 (WHO, 2002). They resolved to table among others, poverty, disease problems and sustainable development; environment and health consequences of urbanization with singular focus to Johannesburg and solidifying the role of health in sustainable development. All this was included to show the importance of health towards the environment and sustainable development (WHO, 2002). Jameton, McGuire & The working groups of the green health center and exploring bio-technics upstream projects (2002) examined the principles, obstacles and processes towards achieving sustainable healthcare in an academic medical center setting. Minimizing environmental impacts was one of the fundamental factors needed to achieve sustainable health care. They concluded that to ultimately sustain environmentally friendly ecosystems, energy consumption and health care material usage had to be limited. Academic medical centers had to utilize their advantageous position to instil into students environmental ideals, promote innovative biomedical research and encourage inclusion of environmental education

into health studies (Jameton et al., 2002). In the United Arab Emirates (UAE), there is a concerted effort to spearhead affordable, sustainable and world-class health-care (Bowman, Matzopolous & Lerer, 2008). Bowman et al. (2008) show that to achieve a sustainable health care system, investment in healthcare infrastructure, personnel, technology and governance is essential and this contributes towards sustainable development.

Using a total quality management (TQM) based model, Wreder, Gustavsson & Klefsjö (2007) studied management for sustainable health in Sweden. They found that management and employee commitment was crucial to achieving sustainable health, encouraging a healthy working environment. This contributes towards sustainable development. Ramirez, West & Costell [s.a] studied the concept of sustainability in healthcare organizations with a focus on management strategies and competencies required to implement the culture of sustainability in this field. They discovered that managers in healthcare field could implement broad strategies that would encourage sustainable practices. This would be achieved with the implementation of a comprehensive framework on sustainability.

2.3. Industry, environmental management practices and sustainable development. Industry plays a major role in the development of nations and has had a profound effect on improving the quality of human life Gutberlet (2000). Gutberlet (2000) argued that industry was co-responsible for the current global environmental crisis through industrial production and consumption. They concluded that to achieve sustainability, industry required a paradigm shift with industry adopting an internal sustainability concept focussed on eco-efficiency and minimal use of energy and material per output unit. Fortuński (2007) examined the link between the environmental management standard ISO 14001 and sustainable development. They argued that the standard had an influence on sustainable development and environmental quality in the energy sector. Fortuński (2007) concluded that ISO 14001 may boost sustainable development in particular where applicable legislation was weak. Pitt, Tucker, Riley & Longden (2009) examined the factors that promote or prevent sustainable construction practices. Through a literature review, they investigated the effect of industry on sustainability and highlighted existing initiatives and actions. Pitt et al. (2009) found that financial incentives and penalties help drive firms towards sustainability, and this had a broader impact on global sustainable development.

In their study, Nunez & Bennett (2010) examined green activities initiatives in the motorised industry as shown in the sustainable reports of designated

firms. A review of literature and an analysis of secondary data were used. Nunez & Bennett (2010) found that the firms were pursuing multiple environmental initiatives, all contributing towards sustainability. Pubule, Blumberga, Romagnoli & Rochas (2012) analyzed the environmental impact assessment of power energy projects in Latvia. They argued that industrial activity and processes had an impact on the environment to some degree. Pubule et al. (2012) concluded that improving the quality and efficiency environmental impact assessments goes a long way in preventing environmental problems leading to sound environmental management. Dos Santos, Svensson & Padin (2013) investigated how a South African chain store evaluated and managed its sustainable trade practices through examining its environmental, economic and social indicators. Through a content analysis of the company's sustainability and annual reports, they showed that the three sustainable indicators played a major role in assessing and implementing the company's sustainable business practices and the company's sound governance system ensured that these practices were achieved.

2.4. Law, environmental management practices and sustainable development. Law plays an important role in sustainable development. For instance in South Africa, legislation is in place that ensures the protection of the environment and encourages sustainable use of resources. Legislation includes:

- ◆ The Hazardous Substances Act (Act 5 of 1973).
- ◆ The Occupational Health and Safety Act (Act 85 of 1993).
- ◆ The South African Constitution (Act 108 of 1996).
- ◆ The Municipal Structures Act (Act 117 of 1998).
- ◆ The National Environmental Management Act (Act 107 of 1998).
- ◆ The National Water Act (Act 36 of 1998).
- ◆ The National Environmental Management Act (Act 107 of 1998).
- ◆ The Municipal Systems Act (Act 32 of 2000).
- ◆ The Mineral and Petroleum Resources Development Act (Act 28 of 2002).
- ◆ The Health Act (Act 63 of 2003).
- ◆ The Air Quality Act (Act 39 of 2004).
- ◆ The National Environmental Management: Waste Act, 2008 (Act 59 of 2008).

2.4.1. The National Environmental Management Act (Act 107 of 1998). Under this Act, the national environmental management principles stipulate in Sec 2 sub-section (2) that environmental management must put people and their needs at the heart of its concerns and further calls for all measures of development to be undertaken in a sustainable, economical and envi-

ronmental manner (Sec. 2 ss [3]). Crucially in Section 4 (ss 1, 2, 3 and 4), the Act stipulates that pollution and degradation of the environment, disturbance of heritage sites and landscapes and waste are avoided or minimized and remedied if possible.

According to Kumssa & Mbeche (2004), institutions play a pivotal role in the development process of African countries. It is argued that these institutions functioning in an organized manner can help reduce poverty and promote growth in African countries by enabling a decent environment that can allow for the enactment of sustainable development programs (Kumssa & Mbeche, 2004). This can be when the rule of law is strong and there is minimal political impediment. In the United Kingdom, Watson & Emery (2003) studied the developing United Kingdom law on the environment and the responses of environmental auditing. They showed that even though laws existed that protected the environment from pollution, no environmental code was present. This left companies with an option of environmental audits, though these proved costly for the firms. Watson & Emery (2003) concluded that unless robust laws were put in place, environmental audits would not yield the desired results and hence companies could not contribute to sustainable development from an environmental standpoint. Oladapo & Olotuah (2007) studied the relevant real estate regulations and guidelines for sustainable development in Nigeria. Using a legislative and literature review, they highlighted the relevance of these laws and policies on sustainable development and concluded that the real estate laws and policies in Nigeria were insufficient to meet the aims of sustainable development (Oladapo & Olotuah, 2007).

Sobol (2008) examined governance barriers to sustainable development in Poland. An analysis and review of complex multidimensional aspects of local sustainable development policy were carried out. Using empirical research, Sobol (2008) concluded that an absence of comprehension of the significance of sustainable development was identified at local policy making level. The link between local government policy makers and communities could improve or hinder sustainable development ideas at local level. Mohammad (2011) studied the concept of environment and sustainable development in international and domestic laws. Using theoretical sources and empirical data, Mohammad (2011) finds that environmental law arose out of necessity to defend the environment from degradation and that human development is linked to the concept of environment and sustainable development. They conclude by arguing the need for an environmental court and laws at local level to enhance environmental protection and promote sus-

tainable development. David, Abreu & Pinheiro (2013) examined social obligations, accountability, and law linked to local action groups to attain local economic and sustainable development. Through a review of literature, David et al. (2013) showed that by promoting local economies, communities were kept in rural areas and applying public and private investments enabled these communities maximise their potential and was critical in the course of sustainable development.

3. Methodology

This paper adopts a conceptual review approach. A critique of the current literature that supports the different environmental management practices and their effect on sustainable development is carried out and these are presented in Table 1 below. Consequently previous literature provided the qualitative data used in this paper.

Literature reviews have been used in previous studies such as Cheung & Hew (2009), Nunez & Bennett (2010) and Smith & Pitt (2011). In their study, Cheung & Hew (2009) reviewed research methods used to evaluate the effects of mobile handheld devices on teaching and learning in institutions of higher learning. Nunez & Bennett (2010) studied the green operating initiatives of car manufacturers. They carried out a comprehensive review of existing literature regarding this topic. This led the researchers to identify the existing gap in knowledge and was able to benchmark the green operating initiatives in the automobile industry. Also Smith & Pitt (2011) used a literature review to examine the role of sustainable buildings in providing a healthy working environment for employees. Thus in this paper, the review of literature is followed by authors' suggested framework for harmonizing environmental management practices.

Accordingly this paper used the conceptual review method to show how different professions' environmental management approach contributes toward sustainable development. A review of the literature was carried out across four different fields namely engineering, health, industry and law. Current environmental management practices and their effect on sustainable development are presented in Table 1 below. This then lead the authors into developing the suggested framework for harmonizing the approaches.

Table 1. How environmental management practices contribute to sustainable development

Environmental management practices	Effect on sustainable development
<i>Engineering:</i>	
Environmental education (Perdan, Azapagic & Clift, 2000)	Engineering education reinforces students with sound principles on

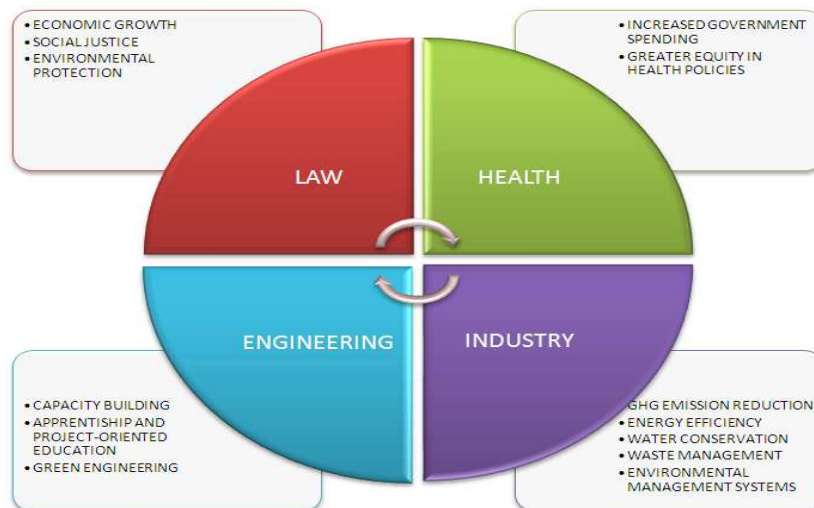
	sustainable development
--	-------------------------

Table 1 (cont.). How environmental management practices contribute to sustainable development

Environmental management practices	Effect on sustainable development
Green technologies (Perdan & Azapagic, 2003)	New innovative technologies could enhance sustainable development through minimal resource use and eco-friendly materials
Sustainable construction methods (Pitt, Tucker, Riley & Longden, 2009)	Sustainable use of materials during construction leads to cost savings and less environmental footprints
<i>Environmental management:</i>	
Waste recycling (Kang & Schoenung, 2005)	Environmental cleanliness and new jobs
Water conservation (Mitchell, 2004)	Prevents loss of soil water and erosion
Carbon emissions reduction (Brown & Corbera, 2003; Omer, 2008)	Buying carbon credits thus contributing towards economic growth
Energy efficiency (Omer, 2008)	Reduction in energy usage resulting in reduction in carbon footprint
Land management (Enemark, Wallace & Rajabifard, 2010)	Astute land policies resulting in sustainable land use
<i>Health:</i>	
Jameton, McGuire & The working groups of the green health centre and exploring bio-technics up-stream projects (2002)	Sustainable health care through the efficient use of health care materials and efficient energy utilization
Bowman, Matzopoulos & Lerer (2008)	Substantial investment into health facilities and technologies resulting in sustainable provision of world class health care
Smith & Pitt (2011)	Sustainable buildings enhance healthy working environments
<i>Industry:</i>	
Cleaner production (Maxwell & Van der Vorst, 2003)	Cleaner production through developing sustainable products and services
Energy efficiency (Rosen, 2003)	Sustainable use of energy resulting in cost savings and reduced emis-

	sions
Green technology (Gutberlet, 2000)	New eco-efficient technologies enhancing production and reducing ecological damage
Industrial waste management (Côté & Cohen-Rosenthal, 1998)	Promoting sustainable waste management through the establishment of industrial eco-parks.
Water efficiency (Rosegrant, Cai & Cline, 2002)	Enhancing food security and access to safe drinking water
<i>Law:</i>	
Fortuński (2007)	International standards adopted by firms contribute towards sustainable development by providing benchmarks for environmental management
Halbert & Ergburth (1999)	Promotes adherence to strict environmental laws, thus promoting greater ecological protection
Marzukhi, Omar & Leh (2012)	Promotes proper land use
Watson & Emery (2003)	Developing environmental policies to enhance environmental compliance
Yakob, Yusof & Hamdan (2012)	Introducing penalties or fines forcing firms to comply with environmental legislation

3.1. Framework of current environmental management practices in the fields of engineering, health, industry and law. After scrutiny of the literature, it can be seen that the four areas examined have different approaches towards environment management practices. As shown in Figure 1, engineering focuses more on apprenticeship and project-oriented education, capacity building, and green engineering while health is more oriented towards increased public and private spending and greater equity in health policies. Industry focuses on energy efficiency, green house gas emissions, environmental management systems, waste management and water efficiency.



Source: Authors.

Fig. 1. Framework showing current environmental management practices across engineering, health, industry and law

4. Discussion

As seen from the above diagram, environmental man-

agement practices across the four areas under study are

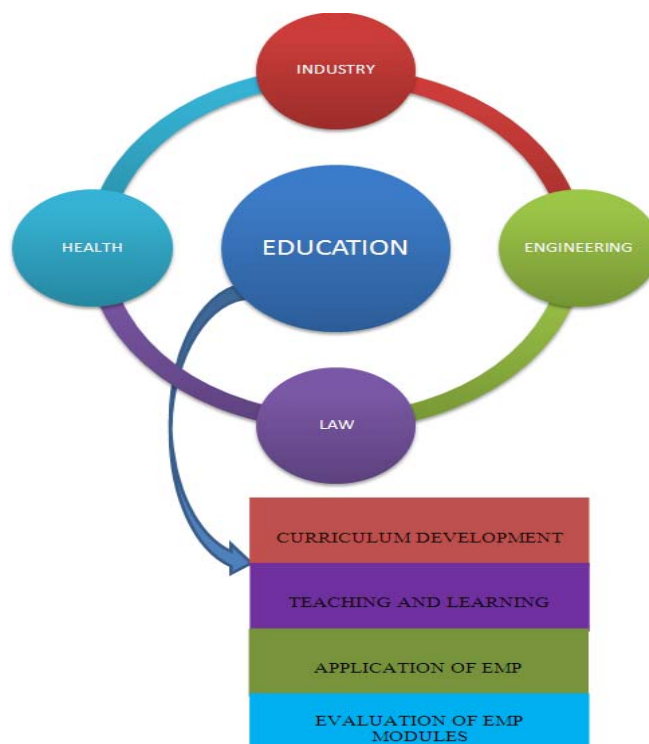
based on different spheres. This creates a problem with regards to sustainable development. For instance increasing public and private spending on health diverts finances from developing innovative engineering solutions that can contribute towards sustainable development. Like wise, economic growth in developing countries often comes through increased industrial activities such as mining, which result in increases in GHG emissions, energy usage, waste and water usage.

Education of environmental management practices and sustainable development is the key that will help harmonize the practices in these fields. Education and sustainable development have been scrutinized by authors such as Hopkins (1998), Bonnett (1999), Rasool (1999), Jickling (2000), Foster (2001), Gough (2002) Dale & Newman (2005). Introducing education on environmental management practices and sustainable development in institutions of higher learning can lead to a better understanding of environmental and sustainability matters. In Russia, Verbistkaya, Nosova & Rodina (2002) examined the attempts at introducing sustainable development education in one of Russia's biggest universities. They stated that new standards for environmental and ecological courses and land management were adopted. The standards in question required the presence of environmental courses across several disciplines. They concluded that a new model be adopted within the Russian higher education system that will enable the effective and efficient delivery of sustainable development and environmental education going into the future.

Segovia & Galang (2002) studied the role of sustainable development in higher education in the

Philippines. They argued that for sustainable development to occur it had to be entrenched in the minds and cultures of communities, through using education as the enabling tool. In order to fully grasp the concept of sustainable development, one has to look at it holistically and from a wider view. Through self-investigation of their own teaching and learning methods, institutions of higher learning can integrate sustainable development modules that will embed knowledge into students. These students can then get involved in the pursuit of sustainable development in whatever field they specialize in (Segovia & Galang, 2002). Dale & Newman (2005) studied sustainable development, education and literacy. Through a critique of published literature, they argued that academics developing and delivering sustainable development related modules should integrate an interdisciplinary approach and let issue based practical learning to happen.

As seen from the above previous works, it can be argued that in order to harmonize environmental management practices for sustainable development across the engineering, health, industry and law fields, education will be a key component. Institutions of higher learning should target to develop modules or a curriculum that incorporates elements of environmental management and sustainable development. Figure 2 below shows the where education fits and the proposed agenda is shown as well.



Source: Authors.

Fig. 2. Proposed agenda for incorporating EMP education into the various sectors

Once sustainable and environmental management education principles are introduced, it will become much easier for graduates to promote sustainability regardless of their future professions. Other relevant stakeholders that can help contribute to the development of environmental management practices for education will include the Department of Higher Education, the Higher Education South Africa (HESA), and the South African Qualifications Authority (SAQA). Their oversight mandates can enable them to actively contribute to the development of the necessary curricula that will enable provision of the said education.

Contribution to knowledge

This paper has added a new insight to the body of knowledge on environmental management practices for sustainable development. No previous study has looked into the distorted nature of environmental management practices for sustainable development,

thus this paper fills this gap and offers an agenda for further research on how to pull different and diverse professional initiative towards a common goal of sustainable economic development.

Conclusion

An all-inclusive approach is needed to implement elements of environmental management practices and sustainable development into the educational curriculum of our institutions of higher learning. It requires concerted efforts from governments, academics and other supporting stakeholders. Harmonizing environmental management practices for sustainable development through the use of education will enable upcoming graduates understand and contribute towards sustainable development. Further studies are needed to examine the effectiveness of introducing these concepts to learners at undergraduate level and how these graduates carry this acquired knowledge through to their professions.

References

1. Abdul-Wahab, S.A., Abdulraheem, M.Y. & Hutchinson, M. (2003). The need for inclusion of environmental education in undergraduate engineering curricula, *International Journal of Sustainability in Higher Education*, 4 (2), pp. 126-137.
2. Alavi Moghaddam, M.R., Taher-shamsi, A. & Maknoun, R. (2007). The role of environmental engineering education in sustainable development in Iran: AUT experience, *International Journal of Sustainability in Higher Education*, 8 (2), pp. 123-130.
3. Bonnett, M. (1999). Education for sustainable development: a coherent philosophy for environmental education, *Cambridge Journal of Education*, 29 (3), pp. 313-324.
4. Bowman, B., Matzopolous, R. & Lerer, L. (2008). Spearheading human and economic development in the Arab world through evidence-based and world-class healthcare, Education, *Business and Society: Contemporary Middle Eastern Issues*, 1(1), pp. 12-15.
5. Brown, K. & Corbera, E. (2003). Exploring equity and sustainable development in the new carbon economy, *Climate Policy*, 3, pp. S41-S56.
6. Cheung, W.S. & Hew, K.F. (2009). A review of research methodologies used in studies on mobile handheld devices in K-12 and higher education settings, *Australasian Journal of Education Technology*, 25 (2), pp. 153-183.
7. Côté, R.P. & Cohen-Rosenthal, E. (1998). Designing eco-industrial parks: a synthesis of some experiences, *Journal of Cleaner Production*, 6 (3), pp. 181-188.
8. Dale, A. & Newman, L. (2005). Sustainable development, education and literacy, *International Journal of Sustainability in Higher Education*, 6 (4), pp. 351-362.
9. David, F., Abreu, R. & Pinheiro, O. (2013). Local action groups: accountability, social responsibility and law, *International Journal of Law and Management*, 55 (1), pp. 5-27.
10. Dos Santos, M.A.O., Svensson, G. & Padin, C. (2013). Indicators of sustainable business practices: Woolworths in South Africa, *Supply Chain Management: An International Journal*, 18 (1), pp. 104-108.
11. Enemark, S., Wallace, J. & Rajabifard, A. (2010). *Land administration for sustainable development*, Redlands, California: ESRI Press Academic.
12. Evangelinos, K.I. & Oku, M. (2006). Corporate environmental management and regulation of mining operations in the Cyclades, Greece, *Journal of Cleaner Production*, 14 (2006), pp. 262-270.
13. Fenner, R.A., Ainger, C.M., Cruickshank, H.J. & Guthrie, P.M. (2005). Embedding sustainable development at Cambridge University Engineering Department, *International Journal of Sustainability in Higher Education*, 6(3), pp. 229-241.
14. Fokkema, J., Jansen, L. & Mulder, K. (2005). Sustainability: necessity for a prosperous society, *International Journal of Sustainability in Higher Education*, 6 (3), pp. 219-228.
15. Fortuński, B. (2007). Does the environmental management standard ISO 14001 stimulate sustainable development? An example from the energy sector in Poland, *Management of Environmental Quality: An International Journal*, 19 (2), pp. 204-212.

16. Foster, J. (2001). Education as sustainability, *Environmental Education Resources*, 7 (2), pp. 153-165.
17. Global Reporting Initiative (2012). RG sustainability reporting guidelines 3.1. Pdf. Available at: <https://www.globalreporting.org/resourcelibrary/G3.1-Guidelines-Incl-Technical-Protocol.pdf> (Date obtained: 05th November, 2012).
18. Gough, S. (2002). Right answers or wrong problems? Towards a theory of change for environmental learning, *The Trumpeter*, 18 (1), pp. 1-15.
19. Gutberlet, J. (2000). Sustainability: a new paradigm for industrial production, *International Journal of Sustainability in Higher Education*, 1 (3), pp. 225-236.
20. Halbert, C.L & Erbguth, E. (1999). The challenge of environmental law as a tool for balancing environmental and economic interests, in the search for sustainable development. *LIMNOLOGICA*, 29, pp. 362-365.
21. Hopkins, C. (1998). The content of education for sustainable development in Scoullos, M.J. (ed.). *Environment and Society: Education and Public Awareness for Sustainability*, University of Athens, Athens.
22. International Organisation for Standardisation (2004). ISO 14001:2004. Available at: <http://www.iso.org/obp/ui/#iso:std:iso:14001:ed-2:v1:en>. (Date accessed: 05th November, 2012.)
23. Jameton, A., Mcguire, C. & The working groups of the green health centre and exploring bio-technics upstream projects (2002). Towards sustainable health-care services: principles, challenges and a process, *International Journal of Sustainability in Higher Education*, 3 (2), pp. 113-127.
24. Jickling, B. (1994). Studying sustainable development: problems and possibilities, *Canadian Journal of Education*, 19 (3), pp. 231-240.
25. Kang, H.Y. & Schoenung, J.M. (2005). Electronic waste recycling: A review of US infrastructure and technology options. *Resources, Conservation and Recycling*, 45 (4), pp. 368-400.
26. Kumssa, A. & Mbeche, I.M. (2004). The role of institutions in the development process of African countries, *International Journal of Social Economics*, 31 (9), pp. 840-854.
27. Liu, X., Liu, B., Shishime, T., Yu, Q., Bi, J. & Fujitsuka, T. (2010). An empirical study on the driving mechanism of proactive corporate environmental management in China, *Journal of Environmental Management*, 91, pp. 1707-1717.
28. Manoliadis, O.G. (2008). The Role of Adaptive Environmental Management in Sustainable Development Case Study Assessing the Economical Benefits of Sustainable Construction in Greece. E. Burcu Ozkaraova Gungor (ed.). Available from: http://www.intechopen.com/books/environmental_technologies/the_role_of_adaptive_environmental_management_in_sustainable_development_case_study_assessing_the_ec.
29. Marzukhi, M.A., Omar, D. & Leh, O.L.H. (2012). Re-appraising the framework of planning and land law as an instrument for sustainable land development in Malaysia, *Procedia-Social and Behavioural Sciences*, 68, pp. 767-774.
30. Maxwell, D. & Van der Vorst, R. (2003). Developing sustainable products and services, *Journal of Cleaner Production*, 11(8), pp. 883-895.
31. Mitchell, V.G. (2004). *Integrated urban water management: a review of current Australian practice*, Melbourne: CSIRO.
32. Mohammad, N. (2011). Environment and sustainable development in Bangladesh: A legal study in the context of international trends, *International Journal of Law and Management*, 53 (2), pp. 89-107.
33. Montabon, F., Sroufe, R. & Narasimhan, R. (2007). An examination of corporate reporting, environmental management practices and firm performance, *Journal of Operations Management*, 25, pp. 998-1014.
34. Nunez, B. & Bennett, D. (2010). Green operations initiatives in the automotive industry: An environmental reports analysis and benchmarking study, *Benchmarking: An International Journal*, 17 (3), pp. 396-420.
35. Oladapo, R.A. & Olotuah, A.O. (2007). Appropriate real estate laws and policies for sustainable development in Nigeria, *Structural Survey*, 25 (3/4), pp. 330-338.
36. Omer, A.M. (2008). Energy, environment and sustainable development, *Renewable and Sustainable Energy Reviews*, 12 (9), pp. 2265-2300.
37. Perdan, S., Azapagic, A. & Clift, R. (2000). Teaching Sustainable Development to engineering students, *International Journal of Sustainability in Higher Education*, 3, pp. 267-279.
38. Perdan, S. & Azapagic, A. (2003). Sustainable engineering design: an interactive multimedia case study, *International Journal of Sustainability in Higher Education*, 1, pp. 33-43.
39. Pérez-Foguet, A., Oliete-Josa, S. & Saz-Carranza, A. (2006). Development education and engineering: A framework for incorporating reality of developing countries into engineering studies, *International Journal of Sustainability in Higher Education*, 6 (3), pp. 278-303.
40. Pitt, M., Tucker, M., Riley, M. & Longden, J. (2009). Towards sustainable construction: promotion and best practices, *Construction Innovation*, 9 (2), pp. 201-224.
41. Pubule, J., Blumberga, D., Romagnoli, F. & Rochas, M. (2012). Analysis of the environmental impact assessment of power energy projects in Latvia, *Management of Environmental Quality: An International Journal*, 23 (2), pp. 190-203.
42. Ramirez, B., West, D.J. & Costell, M.M. (s.a). *Development a Culture of Sustainability in Health Care Organizations*.
43. Rassool, N. (1999). *Literacy for Sustainable Development in the Age of Information*, Multilingual Matters Ltd, University of Reading, Reading, MA.
44. Rosegrant, M.W., Cai, X. & Cline, S.A. (2002). *World water and food to 2025: dealing with scarcity*, International Food Policy Research Institute.

45. Rosen, M.A. (2002). Energy efficiency and sustainable development, *International Journal of Global Energy Issues*, 17 (1), pp. 23-34.
46. Segovia, V.M. & Galang, A.P. (2002). Sustainable development in higher education in the Philippines: The case of Miriam College, *International Journal of Sustainability in Higher Education*, 3 (3), pp. 288-296.
47. Smith, A. & Pitt, M. (2011). Sustainable workplaces and building user comfort and user satisfaction, *Journal of CORPORATE REAL ESTATE*, 1393, pp. 144-156.
48. Sobol, A. (2008). Governance barriers to local sustainable development in Poland, *Management of Environmental Quality: An International Journal*, 19 (2), pp. 194-203.
49. South Africa (1998). National Environmental Management Act, No. 107. Government Gazette No:19519. Pretoria. Available at: <http://www.info.gov.za/view/DownloadFileAction?id=70641>. (Date accessed: 12th September, 2013).
50. United Nations (1992). The Rio Declaration, United Nations Conference on Environment and Development (UNCED), Rio de Janeiro.
51. United Nations (2013). United Nations Millennium Development Goals (MDGs). Available at: <http://www.un.org/millenniumgoals/> (date accessed: 12th September, 2013).
52. United Nations conference on Sustainable Development (Rio+20) (2012). Report of the United Nations Conference on Sustainable Development "The future we want". Available at: <http://www.uncsd2012.org/content/documents/814UNCSD%20REPORT%20final%20revs.pdf> (date accessed: 12th September, 2013).
53. Verbistkaya, L.A., Nosova, N.B. & Rodina, L.L. (2002). Sustainable development in higher education in Russia: The case of St. Petersburg State University, *International Journal of Sustainability in Higher Education*, 3 (3), pp. 279-287.
54. Watson, M. & Emery, A.R.T. (2003). The emerging UK law on the environment and the environmental auditing response, *Managerial Auditing Journal*, 18 (8), pp. 666-672.
55. WCED (1987). Our Common Future [Brundtland Report]. World Commission on Environment and Development, Oxford University Press, Oxford.
56. World Health Organisation (2002). Health and Sustainable Development Meeting of Senior Officials and Ministers of Health: Summary Report, Johannesburg, South Africa, January 19-22, 2002.
57. World Summit on Sustainable Development (2002). The Johannesburg Declaration on Sustainable Development: From our Origins to the Future. Available at: http://www.un.org/jsummit/html/documents/summit_docs/1009wssd_pol_declaration.doc (date accessed: 12th September, 2013).
58. Wreder, A., Gustavsson, M. & Klefsjö, B. (2007). Management for sustainable health: A TQM-inspired model based on experiences taken from successful Swedish organizations, *International Journal of Quality & Reliability Management*, 25 (6), pp. 561-584.
59. Yakob, H., Yusof, F. & Hamdan, H. (2012). Land use regulations towards a sustainable urban housing: Klang Valley conurbation, *Procedia-Social and Behavioural Sciences*, 68, pp. 576-589.