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CONFERENCE 2019

ABSTRACTS



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ABSTRACTS

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THE FIFTH INTERNATIONAL SEEDS CONFERENCE 2019

Growing Sustainability - Natural Capital and Society in the Built Environment

University Campus, University of Suffolk, Ipswich, UK – 11th and 12th September 2019

The built environment has a greater impact on natural resources and produces more waste than any other industry. That in mind, beyond the green rhetoric research is being applied on the ground to address the balance between the built and natural environment. The International SEEDS Conference aims to bring together experts from around the world focusing on the changes that are taking place and the benefits or consequences that are being predicted and measured regarding the built environment's impacts. As well as addressing technical issues, measuring energy efficiency and modelling energy performance, emphasis is placed on the health and well-being of the users of spaces occupied and enclosed. Understanding how buildings and spaces are designed and nurtured to obtain the optimal outcome is the focus of discussion and debate. This holistic approach draws together the research themes of energy, building performance and physics while placing health, well-being and ecology at the heart of the conference.

Sustainable building practices are rooted in the need for reliable information on the long-term performance and more specifically, the expected service-life of building materials, components and assemblies. This need is ever more evident given the anticipated effects of climate change on the built environment and the many governmental initiatives world-wide focused on ensuring that structures are not only resilient but also can maintain their resilience over the long-term.

Through research and proven practice, the aim of the SEEDS conference is to foster ideas on how to reduce negative impacts on the environment while providing for the health and well-being of society. The professions and fields of research required to ensure buildings meet user demands and provide healthy enclosures are many and diverse. The SEEDS conference addresses the interdependence of people, the built and natural environments, and recognises the interdisciplinary and international themes necessary to assemble the knowledge required for positive change.

4 main conference themes:

- 1 **Sustainable Place Making** (Social dimensions and natural capital considerations)
- 2 **Sustainable Behaviours** (Human and machine - smart buildings, smart cities)
- 3 **Sustainability Education**
- 4 **Sustainable Production** (Factories of the Future - building design for industry/business/agriculture)

Through research and proven practice, the aim of the SEEDS conference is to foster ideas on how to reduce negative impacts on the environment while providing for the health and wellbeing of the society. The professions and fields of research required to ensure buildings meet user demands and provide healthy enclosures are many and diverse. The SEEDS conference addresses the interdependence of people, the built and natural environments, and

recognises the interdisciplinary and international themes required to assemble the knowledge required for positive and much needed change.

Conference Sub Themes

- Protecting nature and the natural environment
- Building and environment design
- Energy efficient modelling, simulation and BIM
- Integrating urban and natural environment
- Building performance, analysis and evaluation
- Thermal comfort, air quality and overheating
- Green spaces, enclosures and buildings
- Green technologies and IT
- Renewable energy
- Energy flexible buildings
- Energy behaviour and lifestyle
- Dampness, water damage and flooding
- Building surveys, thermography, building pathology
- Water and air quality
- Education & training
- Planning and sculpturing positive change
- Reducing consumption and waste
- Sustainability, ethics and responsibility
- Occupant behavioural change
- Community building and master planning
- Health benefits of alternative and natural materials
- Urban heat island and mitigation
- Building resilience
- Sustainable cities
- Zero energy and energy plus buildings
- Local producers and urban environments, edible
- Trees and green city landscape
- Edible urban landscape
- Biomimicry and biophilic design

Conference Chairs

Professor Lloyd Scott
Professor Chris Gorse

Preface

Sustainability and the associated issues are expected to be considered at a very integrative and holistic way in addressing the three key pillars of sustainable development, namely the environment, technology and the associated economics, while taking into consideration the macro and micro contexts. The tenets of sustainability science are widely being incorporated as a tool for attaining sustainable development by nations and are becoming the core philosophy of national and multinational developmental agendas, especially since the inception of the UN-SDGs, for nations to integrate developmental policies with environmental, economic and social ethos. This event provides a platform to discuss the recognized and important problems affecting sustainable built environment. Specialized practitioners and researchers have the opportunity to share their research and views in a range of topic related to Sustainability, Engineering, Ecology and Design for Society. Interested policy makers, researchers, practitioners and educators whose interest lies in the subjects of sustainability, design, engineering, energy and education will be more effective if they integrate their efforts in order to share and influence governments, the greater society at large and academic institutions in these topical areas. This conference provides the opportunity for researchers and practitioners to share emerging research, best practice, develop and promote a network of experts who are passionate about a sustainable future.

SEEDS 2019

Greetings and a special welcome to Suffolk! It has been our honour to chair this 5th Sustainable, Ecological, Engineering, Design for Society (SEEDS) Conference. It is my pleasure to welcome you to the wonderful city of Ipswich; a vibrant city with an unbroken history of community as a town since early Anglo-Saxon times.

It is a special pleasure to welcome you to the SEEDS conference at the fast-developing campus here at Suffolk University. This is the fifth SEEDS conference but the first to take place outside of the UK and so I would particularly like to extend a warm welcome to Dublin. The conference has grown over the last five years and as well as being associated with it I have been privileged to take on the role of conference chair for the past two years. While on a day-to-day basis we tend to focus on our own distinct areas of research, an occasion like SEEDS provides the opportunity to reflect on where our work fits in to the complex environment in which we exist.

Climate change, resource efficiency, greater demands on social care, urbanisation and immigration, an ageing infrastructure, the need to stimulate economic growth, as well as constrained budgets: these are challenges faced by society as a whole. An innovative and growing built environment is a crucial component for tackling these issues that confront us. There are increasing global concerns related to climate change and sustainability in the built environment. Buildings contribute some of the largest environmental impacts. For instance, in many developed countries nearly half of total carbon dioxide emissions come from energy use in buildings, more than half of all public water supply in the developed world is for household use, building construction and demolition waste still accounts for 32% of all waste, with 13% of products delivered to construction sites being sent directly to landfill without being utilised. The emergence from the current economic recession, have challenged the industry to explore effective ways of achieving sustainability. There is both a need and an opportunity for research in the disciplines relating to sustainability in the built environment. Research that can lead to, for instance, a better understanding of the concept of sustainability and the measurement and management of sustainable construction etc.

The contributions to the four themed areas of Sustainable Place Making, Sustainable Behaviours, Sustainability Education, and Sustainable Production have been impressively positive. We have been particularly driven to create a unique programme that truly represents the SEEDS mission: to collaborate and to share! To collaborate as academic peers, and to collaborate with our industry partners.

It is with great excitement then that we will see some 65 conference attendees from more than 30 different countries come and exchange ideas, research and practices both formally in the parallel sessions, and informally over coffee, lunch, dinner, or drinks. Just like the city itself, this conference series is diverse and exciting, and promises the opportunity to expand professional networks and research partnerships; engage in new, and consolidate old, friendships; and to be challenged and inspired.

The past few months have been a busy but an exciting time for the organising committee, as we have collaborated on a number of stimulating interdisciplinary projects and initiatives. What is more, we have recently launched Twitter (SEEDS2019) and Instagram (Seeds2019) accounts for you to share your experiences – please join in and get involved.

I would like to thank the members of the SEEDS Scientific Review Group, the conference Organising Committee members, our keynote and featured speakers, but most notably the University of Suffolk, Technological University Dublin, and Leeds Sustainability Institute, Leeds Beckett University. Last, but not least, I would like to thank the delegates from around the world, who make this conference possible, and this organisation come alive.

This SEEDS conference is focused on sustainability in the built environment with the purpose of helping researchers to develop the area and highlight some of the research approaches being taken. The themed emphasis includes the five papers being presented (and another two that were submitted but could not be delivered at the workshop for a variety of reasons). All of these papers, together, present a useful insight into the current research in addressing sustainable, ecological, engineering design for the society in which we live. It is interesting to see the diversity of research covered in this two-day gathering. Possibly, such diversity is a reflection of the wide-ranging attempts to define sustainability and measure sustainable development. However, the themes of **Sustainability Education**, **Sustainable Place Making** (Social dimensions and natural capital considerations), **Sustainable Behaviours** (Human and machine - smart buildings, smart cities) and **Sustainable Production** (Factories of the Future - building design for industry/business/agriculture) that are embedded in the papers of these proceedings will certainly be relevant to future debate in the wider community. We are particularly pleased to have such a great response in the themed area of Sustainability Education.

We look forward to two eventful days where discourse, sharing and building up new relationships in charting a ‘sustainable’ future is the imperative! We have so much to learn from each other and I am confident that you will come away from the conference inspired!

Have a wonderful time in Ipswich, enjoy the conference, and enjoy the discourse and camaraderie among the fellow SEEDS community.

Professor Lloyd Scott
Professor Chris Gorse

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THE SIGNIFICANCE OF SOCIAL SUSTAINABILITY

Prof. J.L. Sturges

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Keywords: Social sustainability, energy, population, development.

Abstract

Various societies that have achieved a sustainable mode of living are examined in the light of the global history of human development, which is reviewed first. These are societies that never made the transition from agriculture to mercantile capitalism, and one group that never adopted agriculture at all.

The objective of the paper is to identify how social sustainability played a part in these achievements. Some of the factors that drove the development of non-sustainability are also identified. The impact of western ideas and civilization on these societies is also identified and discussed. Societies that achieved social sustainability also achieved stable populations.

Introduction.

Sustainability first emerged as a matter of concern at least five centuries ago when people expressed concern about the impact of mankind's consumption of natural materials and its impact on the environment. These concerns centred on timber, a very visible resource. Some of the earliest literature on silviculture was produced in Germany 500 years ago (Caradona, 2014). In England, the Woodlands Act was passed by parliament in the reign of Henry VIII, as there was widespread concern about the depletion of forests. Timber was being cut for building, for ship-building, for fuel and for charcoal-burning for iron production. In Japan Tokugawa Ieyasu founded the last Shogunate in 1603, and an early measure instituted was one to protect Japan's forests which were rapidly becoming depleted at that time. These concerns show us that sustainability first had an environmental and resource-depletion element, and this is still the case today.

We have come to realise that there are two other, equally important dimensions to sustainability, namely the economic and social ones. Elkington (1997) for example, refers to the "triple bottom line", where economic prosperity, environmental quality and social justice are the three elements. The need for social sustainability is logical, as it is people and their economic activities that impact the world's environment. Elkington points out that conventional economics places no monetary value on natural materials and resources such as air and water, which are assumed to be free and freely available. He makes the point that sustainability cannot be achieved unless social sustainability is also achieved. In describing

social sustainability, he quotes from Gladwin (1996), who calls for a paradigm shift in our current attitudes. This will involve a transformation of human values, its political values, and normal behaviour to:

"economic efficiency towards social equity, from individual rights to collective obligations, from selfishness to community, from quantity to quality, from separation to interdependence, from exclusion to equality of opportunity, from men to women, from luxury to necessity, from repression to freedom, from today to tomorrow, and from growth that benefits a few to genuine human development that benefits us all."

These words set out a vision of society moving in the opposite direction from the one we live in at present. We can compare them with the findings from the case studies.

After sharing the Earth with other, earlier hominins, *Homo sapiens* became the dominant species around 30 to 40 thousand years ago. Emerging from Africa, *Homo sapiens* spread to Europe, Asia and America by 15,000 BC, eventually even colonising small islands in the Pacific Ocean. Human societies are complex adaptive systems, and form in response to the local conditions where they take root. The earliest societies evolved sustainable lifestyles, generally in harmony with their local conditions. If so, these societies must have achieved Social Sustainability, in a way that has been lost, or at least no longer exists. Today, in 2019, the fact that we no longer live sustainably is a matter of great concern, and the question arises; do we have any evidence of societies that lived sustainably among all the diverse societies in the world? How do these societies relate to the present global situation and what can we learn from them?

Writers on sustainability have recognized the three elements of environment, economy and society, and represented a sustainable situation in the form of a Venn diagram with three overlapping circles as shown in figure 1 below. Our present world is on a non-sustainable trajectory, and this could similarly be represented by a second Venn diagram where the circles do not overlap, as depicted in figure 2 below.

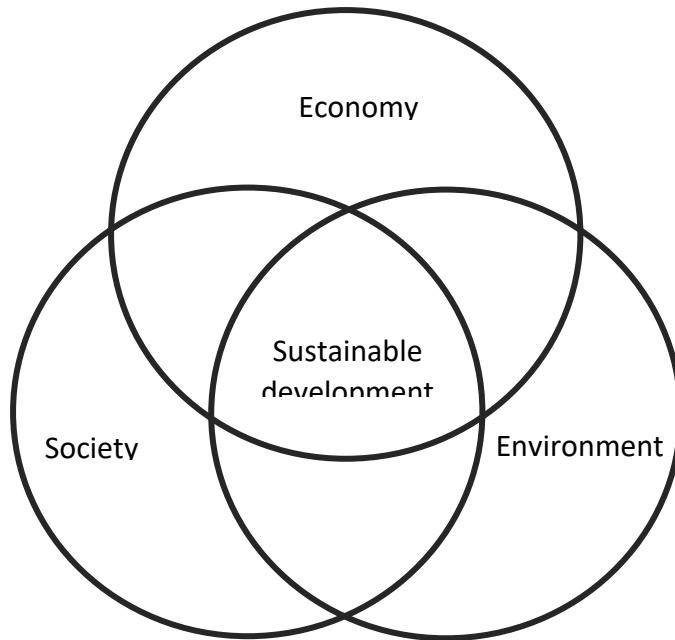


Fig. 1. Idealised picture of sustainability, with the environment, the economy and society being in harmonious relationship.

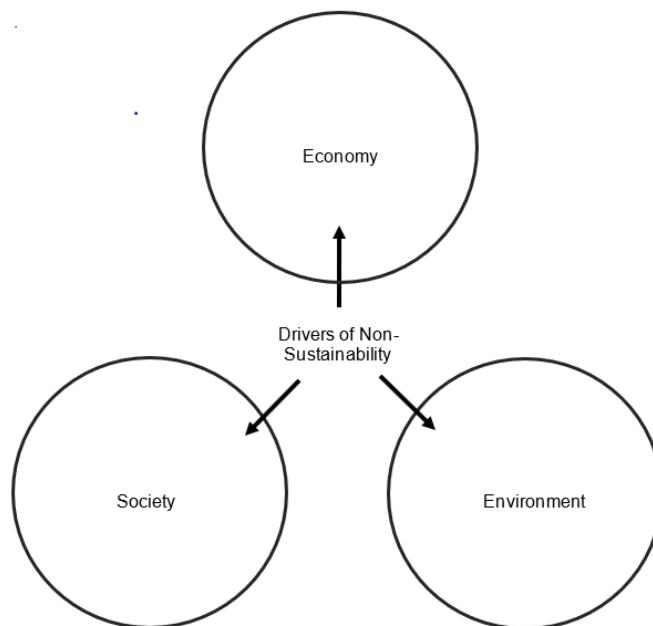


Fig. 2. Picture of our current non-sustainable situation where the environment, the economy and society are seriously out of harmony.

Development of Human Society.

The evolution of human society has been punctuated by a series of events that have changed its course. When *Homo sapiens* emerged as potentially the dominant life form on Earth around 200,000 years ago, he adopted the role of hunter-gatherer to survive. Then around 10,500 years ago, he began to adopt Agriculture. Just over 500 years ago, Spain and Portugal carved out empires for themselves in central and South America and in Asia, and adopted the role of mercantile capitalists. Three hundred years later came the Industrial Revolution when industrial capitalism became the human role. Finally, following World War II came the evolution of consumer capitalism. Throughout history, man has always sought to maximise his access to energy, in whatever form. Table 1 below summarises the stages in human development, giving approximate dates, population sizes and *per capita* energy consumption. This table summarises the situation for most, but not all of the human population of our world. When much of the world had reached the industrial and consumer stage, there were still a few remote societies living in the agricultural and hunter-gatherer modes.

Each transition from one mode of living to the next is brought about by an increase in the amount of available energy, an increase in information available and an increase in the scope for human action. Although dates are quoted in Table 1, these transitions were not overnight changes, but took some time to become established. In addition, not all peoples and societies made all the transitions, this was determined by their remoteness or proximity to the great centres of population. However, at each stage, the adoption of the next stage gave rise to an increase in population, *per capita* energy consumption and an increase in CO₂ in the atmosphere. The transition from hunter-gatherer to farmer involved forest clearance to make way for fields to grow crops. The total number of trees on Earth at the hunter-gatherer to agriculture transition was around 6 trillion, whereas the number on Earth today is around 3 trillion (Crowther, *et al.*, 2015).

Table 1. Showing Transitions in Mode of Living, including Dates, Global Population and per capita Energy Consumption.

Mode of Living	Date	Global Population (millions)	Per Capita Energy Consumption
Hunter-gatherer	200,000 years ago	Ancester group	300 Watts

Farmer	10,500 years ago	5	2,000 Watts
Mercantile Capitalist	1500 AD	500	2,200 Watts
Industrial Capitalist	1800 AD	950	4,000 Watts
Consumer Capitalist	1950 Ad	2,500	8,000 Watts

(Source: Lewis & Maslin, 2018)

Having outlined the development of human society since the dawn of history, It is interesting to examine the scale of human energy and power consumption at various points over the past three millennia. Table 2 below taken from the work of Smil (2017); clearly illustrates the exponential rise in energy use by mankind during this time.

Table 2. Power Ratings from a Candle to Global Power Consumption.

Examples and Dates	Power (Watts)
Small wax candle burning (800 BCE)	5
Egyptian boy turning Archimedean screw (500 BCE)	25
Dutch Tread-wheel powered by 8 men (1500)	800
Newcomen's atmospheric engine pumping water (1712)	3,750
Large Dutch windmill draining a polder (1750)	12,000
Calder Hall nuclear reactor (1956)	202,000,000
Rocket engine launching Saturn C5 rocket (1969)	2,600,000,000
Global commercial energy consumption (2015)	17,530,000,000,000

(Source: Smil, 2017)

Newcomen's engine is an interesting item in this list as it represented the first time in history that someone had devised a way of converting fossilised sunlight in the form of coal into mechanical power and Lovelock (2019) suggests this event as the start of the industrial revolution. The engine was installed to pump water out of a deep coal mine near Dudley in Worcestershire. This event really should be linked with another development that occurred only about 20 miles away in the Severn gorge at Coalbrookdale when in 1708 Abraham Darby first smelted iron using coke (non-renewable) instead of charcoal (a renewable material). The industrial revolution could not have happened without a plentiful supply of iron, and iron

production had been severely restricted by the limits placed on the cutting of timber to make charcoal. The ability to use coke 'liberated' iron-making from dependence on timber and helped stimulate the demand for coal and the need for pumps to keep mines clear of flooding.

We shall now examine various societies that have achieved sustainability and where we have the evidence, what effect contact with western civilization subsequently had on them.

Examples of Long-term Sustainability.

In finding case studies of sustainable societies, the work of Diamond (2006), and Norberg-Hodge (2000) has been most useful. These authors' treatment of the case studies was quite discursive, and so the main points will be summarised here. These societies were in various ways cut off from the main centres of population (Tikopia, New Guinea, Ladakh) or decided to cut themselves off from external contact (Japan) or never adopted agriculture and reliance on the land at all (NE Pacific Indian tribes of Alaska).

Tikopia.

- Small Pacific Island, near Vanuatu and Solomon Islands, area 1.8 square miles.
- Continuously inhabited for 3,000 years.
- Population kept at around 1,200 by various birth control measures.
- The people lived by agriculture and fishing.
- Society organized on a bottom-up basis.
- They have exercised excellent stewardship of their environment.

New Guinea.

- Large island in East Indies, first visited by Europeans 4 or 5 centuries ago.
- People have lived there sustainably for around 45,000 years.
- Until 1930's the interior was never explored and was believed to be uninhabited. Interior inhabited for thousands of years, with people living sustainably and independently from the rest of the world.
- Society organized on a bottom-up basis.
- Very sophisticated agricultural techniques developed.
- They have exercised excellent stewardship of their environment.

Japan.

- Large island archipelago east of China, completely cut off from the rest of the world during the Tokugawa Shogunate from 1603 until its end in 1868.

- Christian missionaries ejected and foreign traders only allowed access to small island in Nagasaki Bay by order of the Shogun.
- Society organized on a top-down basis, and it enjoyed peace and prosperity for the duration of the Shogunate.
- No external wars were fought during the Shogunate.
- Population very stable during the Shogunate.

Ladakh.

- Land-locked area under the Karakoram, in the trans-Himalayan region of Kashmir.
- It is a 2,000-year-old kingdom, an area of Tibetan Buddhism, originally of Tartar herders who have adopted agriculture.
- People live in villages, largely organised on a bottom-up basis.
- They have adopted policies to limit and control their population size.
- They have adopted a very collaborative culture.
- They have exercised excellent stewardship of their environment.

Indian tribes of North East Pacific in Alaska (studied by Dr. Jago Cooper).

- These tribes are interesting because they never adopted agriculture, rather they have always depended upon fishing.
- They never developed a sense of ownership of land in the way that the previous four peoples mentioned above did, and they survived the impact of Europeans very much better than the Indian tribes living to the South and East in the USA and Canada.
- They have retained their traditional skills, for example, building wooden houses and making boats from tree trunks.
- They have exercised excellent stewardship of their environment.

Discussion.

We have examined several societies that have lived sustainably for periods of time ranging from a couple of centuries to many millennia. Some were island communities, some located inland, all living by farming and just one set of coastal communities living by fishing. Because of their remoteness and inaccessibility they remained untouched by western civilization until well into the 20th century. The detailed information that we have is a result of prolonged contact made by a few people who took a great interest in them, who lived with them, befriended them and recorded their observations in detail. The work of Raymond Firth in Tikopia (1936 & 1939) and Helena Norberg-Hodge in Ladakh (2000) typify this approach

Most of these societies achieved sustainability by a bottom-up approach, i.e. they did it by collective decisions. Tokugawa Japan was the exception, and this was due to the remarkable

character of Tokugawa Ieyasu, who combined a certain military genius with an outstanding capacity for wise statesmanship. The leadership that he gave, and the decisions that he took ensured that the Japanese enjoyed a good standard of life and freedom from warfare for over two centuries, and Japan benefits from his legacy to this day.

Much of the literature on sustainability and the future of human civilisation today makes frequent reference to the problems posed by the Earth's burgeoning population. It is the multiplier that exacerbates all our problems. Remarkably, all the societies described in this study solved this problem, taking steps to ensure that there were never too many mouths to feed. Furthermore, following contact with western civilisation, these societies became non-sustainable, and they suffered rapid population growth. Norberg-Hodge (2000) describes this process very well. We have seen that human society passed through various historical transitions to reach its present form. Drawing on what we have learned from the case studies outlined above, we can see that the transition from hunter-gatherer to agriculture did not lead to a non-sustainable society though it did give rise to a modest increase in population. The next transition from agriculture to mercantile capitalism, did produce a society that was ultimately non-sustainable. It involved an increasingly intensive agriculture and the growing of cash-crops using slave labour. To make way for this, forests were cleared on an increasing scale, leading to an increase in atmospheric CO₂. The initial impact of the Spanish and Portuguese conquest of their American empires was to cause a population crash among the native Indians who succumbed to the European diseases against which they had no immunity. The number who died is not known but median estimates of around 50 million have been quoted (Lewis & Maslin, 2018). The immediate result of this was that Indian farmland reverted to forest bringing about a reduction in atmospheric CO₂. This may have helped bring about the mini 'ice age' noted in Europe. However, once the Spanish and Portuguese began growing cash-crops with slave labour, the situation was reversed again. These events illustrate just how sensitive our world is to changes that in former years were thought to be insignificant.

The transition to industrial capitalism, was enabled by the increasing use of non-renewable sources of materials and energy. Agriculture became increasingly mechanised, leading to migration of redundant farm workers to the towns which became centres of manufacturing industry. The overall social cohesion in the form that could exist in rural village communities was completely lost, and people could no longer take responsibility for their lives. We have now reached the point where over half of the world's population live in cities. Cities are covered in concrete and asphalt, which act as solar-powered storage heaters, leading to the 'heat island' effect. In this age of consumer capitalism, millions of tonnes of manufactured goods are transported around the globe in huge container ships, causing more atmospheric and marine pollution. Each development leads us further down the path of non-sustainability. Globalisation means that most nations around the world are now following the western development model,

but the chances of achieving global agreement on steps to reverse global warming are vanishingly small. We have entered a ‘development trap’ and it is not clear how we can escape.

The work on Ladakh reported by Norberg-Hodge (2000) is in general agreement with the descriptions of Tikopia, New Guinea and Japan reported by Diamond (2006), but it has the advantage of being a primary source. In it, she gives a very balanced and finely nuanced account of the impact of the west, pointing out all the advantages and drawbacks of each society. Both authors refer to the fact that western men automatically assumed a position of cultural superiority to the ‘undeveloped’ societies they discovered without taking time to study and understand them. This was usually unjustified, and in a few cases fatal. In New Guinea, westerners saw the vertical drainage channels used on the terraces where yams and sweet potatoes were grown. They ‘knew’ this was wrong and persuaded a few of the islanders to use horizontal channels. These retained water and during the next heavy rainfall the whole terraced system, crops and all were washed down the valley and into the river. Flannery (2019) also reports a conversation with New Guinea islanders. They were observed planting fruit and nut trees which took several decades to produce food, but which were known to attract game animals. The New Guinea people were asked why they did this when they would not live to obtain the benefit, and their reply was that they did it to ensure that their grandchildren had something to eat. This is inter-generational thinking, part of sustainable living. They were wiser than the westerners asking the questions. In 1845 Sir John Franklin led a well-resourced expedition to find the North West passage with 134 men. The crew had some contact with the Inuit whom they looked upon as savages, and they all perished because of this attitude. The Norwegian, Roald Amundsen, the man who succeeded, took the trouble to live with the Inuit for some months prior to his attempt and learned how to survive the Arctic conditions.

Clearly these apparently primitive societies had developed highly sophisticated agricultural practices. Their techniques were not wasteful and did not rely on huge tonnages of artificial fertilizers as are employed by western farmers. Soil fertility was maintained in a non-polluting way without the degradation produced by western ‘industrial agriculture’. Modern, industrial agriculture is thermodynamically less efficient than traditional farming, as illustrated in table 3 below.

Table 3. Production of Maize. Energy Inputs and Outputs for the years 1950 and 1970.

Energy Input Type	1950 (MJ/acre)	1970 (MJ/acre)	% Change
Labour	41	21	- 49
Machinery	1047	1758	+ 67
Gasoline	2578	3336	+ 32
Nitrogen	527	3938	+ 647
Phosphorus	64	197	+ 208
Potassium	44	285	+ 548
Seeds	169	264	+ 56
Irrigation	93	142	+ 52
Insecticides	5	46	+ 820
Weed-killers	3	46	+ 1,433
Drying	126	502	+ 298
Electricity	226	1298	+ 474
Transport	126	293	+ 132
Total Energy Input	5049	12126	+ 140
Maize - Food Energy – Output	16034	34177	+ 113
Ratio Output : Input	3.18	2.82	

(Data supplied by Prof. D. Bradley, F.R.S., University of Leeds)

The data is from the USA and relates to the growing of maize, a high-energy food crop. It shows a comparison between the total energy inputs and food energy outputs for the years 1950 and 1970. This is particularly interesting because 1950 was the year that industrial agriculture took off. The first thing to notice is that labour input was halved, while food energy output more than doubled, i.e. productivity has been quadrupled. This is the basis for claiming that this type of farming is more ‘efficient’ than the traditional methods. However, the figures also show that the ratio of energy input to output is lower than the traditional route (2.82 as against 3.18). This represents lower thermodynamic efficiency. The other factor to notice is the tremendous increase in use of artificial fertilizers (figures for nitrogen, phosphorus and potassium) and insecticides and weed-killers. It must be remembered that these figures relate to 1970, nearly 50 years ago, and industrial agriculture is pursued more intensely today. Another factor is run-off from agricultural land during rainfall. The excess fertilizers end up in streams and water courses, rivers and eventually the seas, where they cause algal blooms and eventually dead zones. The cost in biodiversity loss and loss of fish stocks is never taken into account, because neither the fertilizer manufacturer nor the farmer sees the results of this type of agriculture. The manufacturer of industrial chemicals just looks at his bottom line. The farmer just looks at the costs of operating his farm. There is no overall oversight, no-one can take responsibility for the system, and this illustrates the disconnection between action and results that typifies the

western world. This situation did not exist in sustainable societies; we have entered a 'development trap' of global proportions and therefore we do not have social sustainability.

This example is drawn from agriculture and not from construction and building, but it illustrates very clearly the importance of social sustainability. The evolution of mercantile capitalism, industrialisation and the consumer society leading to a human population explosion, have combined to drive the economy, society and the environment out of alignment.

Summary of Conclusions.

Certain conclusions can be drawn from the case studies of sustainable societies, as follows:

- These societies were free from outside influences.
- They had a finite area of land available to them.
- They knew that there was an upper limit to the amount of food they could produce, and this knowledge placed an effective upper limit on their population size.
- They devised strategies to keep their populations at a stable size.
- They adopted cultural attitudes that emphasised collaboration rather than the exercise and assertion of individual rights to ensure the survival of their societies.
- They exercised good stewardship of the environments in which they lived.

In the western, modern world we have placed too much emphasis on the economic bottom line, over-emphasised individual freedom and rights, and placed no emphasis on responsibilities.

- These societies have adopted a culture based on individual liberty and the exercise and assertion of individual rights.
- Little or no emphasis has been placed upon individual responsibilities or obligations to society.
- People are unable to take responsibility for their own lives. They increasingly rely on what others provide and cannot know where things come from, or whether they are obtained sustainably or in ways damaging to the environment.
- Because of this detachment, blame for the ills of society is often placed on the wrong people and money and resources are devoted to symptoms rather than causes.
- Western societies have exercised 'freedom to pollute' and did not exercise good stewardship of their environments.
- Adoption of western ways of living has always led to a large population increase.

The main conclusion to be drawn from this must be that without the achievement of social sustainability, overall sustainability cannot be achieved. Everyone in society must be involved, and this involvement must ultimately be global. This is often referred to as the age of ‘globalisation’, but ironically, we have globalised the drivers of non-sustainability, but not the social sustainability which is of such vital importance.

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Ecology

OBSTACLES OF SUSTAINABLE CONSTRUCTION PROJECT MANAGEMENT IN SOUTH AFRICA CONSTRUCTION INDUSTRY

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Keywords: Construction industry, Sustainable construction, sustainable construction project management, Mpumalanga Province

Abstract

Green building is mostly adopted by the private sector or the private property development companies who are enjoying the benefits of it. Hence the study will explore the obstacles impeding the implementation of sustainable project management in the public sector in South Africa. Structured questionnaires were distributed to different construction companies and construction professionals involved in the public projects. From 80 questionnaires distributed, 65 were brought back and they were all valid and usable. Findings from the survey results obtained from the chosen respondents revealed that there is resistance to change from conventional to green practices by organization employees, Lack of awareness of green building methods and technologies, absence of dependable exact cost data/ information, limited government involvement, the complexity of codes and regulations on green building and sustainable construction, high cost of green building material and also attracts a higher risk of delays in construction. From the findings the government of South Africa needs to play a huge role implementing sustainable construction project management in public buildings, which will benefit the government, and the end users and reducing the nation's carbon emission emanating from construction sector.

SUSTAINABLE DEVELOPMENT OF MANKIND THROUGH ECOLOGICAL SERVICES: A LITERATURE REVIEW

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Keywords: Ecological Services; Mankind, Remuneration, Sustainability

Abstract

A working ecosystem is a cornerstone to human prosperity. When ecological concerns are associated with the economic aspects, the challenge lies in addressing human issues without corrupting the environment. The presence of mankind and society relies upon the life support framework of the physical environment. Thus, the purpose of the study is to appraise the sustainable development of mankind through ecological services in developed and developing countries. The research relied on the use of credible past and present literature from the theoretical and conceptual analysis undertaken to form the fundamental concept which this study is formed upon. The literature revealed that the economic significance of ecological services to the sustainable development of mankind legitimizes the need to comprehend their value. Similarly, to understand the association between ecological services and the development of mankind as a component that supports policy decisions, different approaches can be implemented towards the remuneration of ecological services. These approaches are mainly through the market and governmental approach. Moreover, the study contributes to the body of knowledge on how ecological services could bring about radical sustainable development in developing countries.

THE STUDY OF IMPLEMENTING ECOSYSTEM SERVICES IN AN URBAN ENVIRONMENT

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Keywords: Ecosystem Services, Urban Environment.

Abstract

Urban Environments are constantly finding ways to improve and benefit the people living in them today. Progressive changes in Urban Environments mean spaces are having to adapt. Generally, this adaptation has been produced by intense global environmental changes which are swamped by the local environment, (Grimm, et al., 2008) and influenced by demographic imbalance. Over time a collection of populated areas will encounter a crisis in the changes of these environments, fabricating new economic development and master planning. Thus, affecting the surrounding natural environments and ecosystems.

Ecosystems are important in the natural and Urban Environment with many being prone to change by developmental needs of the human race. It is increasingly crucial to sustain and retrieve ecosystems to improve the overall balance of nature and urbanism. Ecosystem services construct the genesis to support ecosystems and provide a catalyst to evolve Urban Environments.

This study will explore the effectiveness of including specific services in the Urban Environment. A summary of the future behaviour of urbanisation will be summarised. Four types of Ecosystem Services; Supporting Services, Provisional Services, Socio-Cultural Services and Regulating Services will also be discussed. (Millennium Ecosystem Assessment, 2005) This will provide an analysis of their constructive abilities and the impact they offer on a working and functional Urban Environment. Two international cities which currently implement the use of services will be highlighted as case studies and used as a template for contemporary data of Ecosystem Services, allowing analysis on the types of services used. Using primary research methods, a survey will be used to collate data on the views and opinions of professionals towards Ecosystem Services. This will contribute to the methodology of this paper to produce an integral model for an ideal urban space. Using Leeds South Bank as the study area, the research on this paper and the results of the survey will construct an ideal design in South Bank for the use of specific Ecosystem Services. Overall, with the outcome of a more sustainable, functional environment to the community.

Education

DELIVERING ENERGY SAVINGS FOR THE SUPPLY CHAIN THROUGH BUILDING INFORMATION MODELLING AS A RESULT OF THE HORIZON2020 ENERGY BIMCERT PROJECT

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Keywords: building information modelling, Sustainability, Education, Horizon 2020

Abstract

The global buildings sector is now responsible for 40% of final energy consumption as well as accounting for 33% of energy-related carbon dioxide emissions. This has resulted in a growing urgency to address energy and emissions from buildings and construction, to meet restrictive 2020 targets as specified by the European Union (EU). To achieve these targets a number of funding initiatives have been put in place through Horizon 2020 with a focus on BIM, due to it having the potential to rapidly produce energy outputs that enable design teams to analyse and compare the most cost-effective, energy-efficient options. However, despite the recorded benefits that BIM can bring to the design, there is still a lack of understanding of how it can be used on site by the supply chain to impact energy savings directly. In order to address this industry-wide concern a Multi-International consortium, bid, won and then launched the Horizon 2020 Energy BIMcert project in March 2018 with the goal to educate all areas of the supply chain in the use of BIM, so as to achieve better energy efficiency during the design, construction and ongoing maintenance of an asset. An online platform will be launched in September 2019, which will deliver blended training that combines theory, practice, and eLearning that will enable workers to train more effectively. This paper will explore the initial stages of this project and will focus on how the findings from a survey and series of workshops conducted within the member states of the Energy BIMcert consortium has helped establish the training needs of the industry. These findings were cross-referenced with a state-of-the-art literature review on BIM pedagogy, which has resulted in the formation of the curriculum and learning outcomes for a number of BIM focused training units. Further

to this, the paper will discuss how the delivery of the blended training and associated materials will affect current energy saving targets

THE NEED FOR THE INCLUSION OF CONSTRUCTION HEALTH AND SAFETY (H&S) IN ARCHITECTURAL EDUCATION

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Keywords: architectural, construction, design, education, health and safety

Abstract

A disproportionate number of accidents occur in construction relative to other industries, the direct and indirect cost of which, contributes to the cost of construction. Construction is a multi-stakeholder process and consequently all stakeholders, architectural designers included, influence the construction process.

Design influences and impacts on construction H&S directly and indirectly. Directly through concept design, selection of structural frame, detailed design, selection of cladding, and specification of materials. Indirectly through the selection of procurement system, related interventions such as prequalification, decision regarding project duration, and selection of contractor.

Therefore, architectural designers should be empowered to contribute to construction H&S. However, the need for such empowerment is amplified by legislation in certain countries, such as the OH&S Act and Construction Regulations in South Africa. Despite the influence and impact of architectural design on construction H&S and the evolution of legislation, traditionally South African architectural designers have perceived construction H&S to be the responsibility of the contractor.

This paper reports on two descriptive surveys conducted among architectural academics, and a range of built environment practitioners to evolve a framework for firstly, tertiary architectural, and then secondly, tertiary built environment construction H&S education at Universities and Universities of Technology in South Africa.

The findings of the literature and descriptive surveys amplify the need for the inclusion of construction H&S as a module, and the addressing of a range of construction H&S aspects, as opposed to merely legislation, relative to architectural programmes.

DEVELOPING A BEST PRACTICE FRAMEWORK FOR DEGREE APPRENTICESHIPS IN CIVIL ENGINEERING: A REVIEW OF CHOSEN METHODOLOGY

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Keywords: Civil Engineering, Degree Apprenticeships, Industry-Academic Collaboration and Methodology.

Abstract

A research project is being undertaken to identify a delivery framework for managing, and successfully completing a degree apprenticeship in civil engineering. The research will investigate challenges, barriers and best practice experienced by the Employer, the Apprenticeship Training Provider (ATP) and the Apprentice: the tripartite stakeholders. Patterns of challenges, barriers and best practice will illustrate promising points of intervention to develop evidence to inform a supporting framework. As the Civil Engineering and Civil Engineering (Site Management) degree apprenticeship standards were approved for delivery in 2017, the first candidates for the End Point Assessment (EPA) are expected to be presented around January 2020. This means that research based specifically on successful degree apprenticeships in civil engineering is in its infancy so current performance data and insights are scarce.

This paper reviews the types of methodology that can be used to retrieve appropriate, accurate and valid data for the research, and presents findings of initial interviews using phenomenological methods that have been carried out with Small-Medium Enterprises (SMEs) about their initial experiences with the scheme. The discussion of the approach identifies time-bound considerations in relation to the main body of research and future investigations. Thus, the research parameters of the next phase of the research are identified and discussed.

ADDRESSING ACCREDITATION CRITERIA RELATED TO SUSTAINABLE CONSTRUCTION IN THE UNITED STATES: A CASE STUDY

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Keywords: Accreditation; Curriculum; Sustainability; Student Learning; Assessment

Abstract

The requirement to incorporate sustainability into the curriculum of construction management programs in the United States has only been required since July 2015. At this time the American Council for Construction Education (ACCE) introduced the revised Document 103: Standards and Criteria for Accreditation of Construction Education Bachelor Degree Programs. The curriculum requirements of the standards in previous versions had been prescriptive in nature, requiring construction programs to demonstrate the inclusion of a required number of credit hours of prescribed subject matter and topical content. The previous standard had no requirement to teach sustainability. A series of workshops was conducted with construction industry participants to gather data in order to develop a set of learning outcomes that would define the capabilities of students graduating from a 4-year ACCE accredited program. The new standard requires programs to demonstrate graduates of their program have achieved 20 Student Learning Outcomes, one of which is that upon graduation students should be able to "understand the basic principles of sustainable construction". The approach for delivering sustainable construction subject matter across the curriculum at an ACCE accredited university is presented, together with method of academic assessment of students during their senior year. Course learning outcomes addressing the principles of sustainable construction were developed and subject matter taught across several courses from freshman through senior level students. Academic assessment is achieved by senior students conducting an individual assessment of a project building to demonstrate understanding of how the design and construction of the building reflects the basic principles of sustainable construction. Students are set six specific tasks that address: LEED Certification; Erosion & Sedimentation Control; Building Commissioning; Environmentally Preferred Products; Construction Waste & Indoor Air Quality. Students are graded using a five criteria grading rubric. Results from academic assessment conducted since the Fall of 2015 suggest students are consistently meeting performance criteria.

WHO ARE THE 'MIDDLE ACTORS' IN SUSTAINABLE CONSTRUCTION AND WHAT DO THEY NEED TO KNOW?

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Keywords: Sustainable construction, Middle actors, Project networks, Skills, Knowledge.

ABSTRACT

This paper explores what knowledge and skills are needed, and how those skills and knowledge might be gained, in order to deliver more sustainable outcomes from construction, using the concept of "middle actors". "Middle actors" are the individuals who occupy the space between 'top down' policy and instruction, and 'bottom up' norms. In construction, 'middle actors' with influence on building performance include clerks of works, project managers, tradespeople and technical advisers.

There is a relentless drive for more sustainable buildings that use less energy, generate less waste during construction and use, and provide healthy environments for people to live and work in. This direction of travel can no longer be considered "new" and yet it remains far from the mainstream. To create buildings which are sustainable, we need to consider not only technology and design changes, but how to alter the wider system of construction. We use middle actors as the lens through which to examine these non-technical changes, and the skills and knowledge required to achieve them.

A review of the concept of middle actors as it has been applied to construction and an overview of skills and knowledge needs for sustainable construction is followed by identifying middle actors in new build and retrofit, commercial and domestic projects currently under way with one developer in Leeds, UK. The skills and knowledge needed by 'middle actors' to deliver more sustainable outcomes from their projects are described, based on empirical data gathered from project teams, and further structured by considering when in the project cycle they are needed, and what routes to gaining the required skills and knowledge might be most effective. This analysis reinforces that there is no single route to achieving more sustainable buildings and instead the activities, responsibilities and networks of individuals need to be carefully considered in developing training programmes for construction teams.

SUSTAINABILITY IN CONSTRUCTION MANAGEMENT EDUCATION: A CASE STUDY OF THE STUDENTS' ATTITUDES AND BELIEFS AT TWO CM PROGRAMMES OF STUDY IN IRELAND AND THE UNITED STATES

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Keywords: Construction Management, Education, Students' Attitudes and Sustainability

ABSTRACT

This study investigated the level of construction students' familiarity and interest concerning sustainability in the built environment, their ability to identify recognisable sustainable principles, the important areas of sustainable knowledge for students' employment, and factors affecting students' outlook toward sustainability. To accomplish its main objectives, this study employed a survey research method as a main method of data collection. The survey instrument was developed by the authors through in-depth literature review in the areas of sustainability, sustainable construction, sustainable education, and transformation of people's attitude and behaviour. The survey instrument was distributed to Construction Management students in all stages of the programmes of study at the Milwaukee School of Engineering and the Technological University Dublin. The results of descriptive statistics and Analysis of Variance (ANOVA) using SPSS version xx present the some interesting findings. CM students perceived that they had a relatively high level of familiarity with sustainable construction and sustainability. They identified that knowledge and understanding of the principles of sustainability were important however, a greater emphasis was placed on the knowledge of environmental rating tools. CM students also believed that general knowledge of sustainability would enhance their chances of securing a career in construction. Finally, several factors of the approaches to teaching and research in sustainability were addressed by the respondents where both US and Irish students' indicated that a programme approach to embedding sustainability would be a more favoured approach. They also acknowledged that 'practical experience related to sustainability would be very beneficial', and that 'workshops and seminars associated with sustainable development should be offered' that would contribute towards better students' attitude toward sustainability. Interestingly, there was a very close alignment of attitudes and responses to the survey questions between the two groups.

Sustainable Development and Urban Spaces

A COMMUNITY-DRIVEN NATURE-BASED DESIGN FRAMEWORK FOR THE REGENERATION OF NEGLECTED URBAN PUBLIC SPACES

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Keywords: Community-driven design, Nature Based Solutions, Design framework, Urban public spaces.

ABSTRACT

Nature based solutions are a popularising concept within current urban regeneration literature, exploring differing themes in the context of optimising public spaces. Focus on the adaptation of public space design, with the community at the forefront, has been documented to a limited degree, with few studies concentrating on possible design strategies.

This literature review revealed that the majority of nature based design frameworks, since 2017, have suggested the benefits of nature in public spaces to human health and wellbeing: whether physically or psychologically, and either within the full framework or as part of the framework's scope. There are however variations in the number and clarity of steps needed to follow each framework, and it is evident that the importance of community driven designs are understated within built environment literature. Many frameworks favoured the use of academic studies as a secondary source for their creation, with few using primary analysis of community acceptance and co-creation.

This paper explores the literature available on nature based solutions and their design frameworks. It maps out the existing studies, to date, and reports on the initial findings for this progressing PhD research. Public spaces are, in their very definition, a space for the public; despite this, development of these spaces, as well as the literature around the subject, are far more theoretical and professionally inclined, rather than community influenced. With an emphasis on sustainable development, this paper suggests that community views on nature based public spaces need to be the focal point of design frameworks for public urban spaces, which may then be used as a protocol for the production of optimal and effective nature-based public space regeneration.

SUSTAINABLE DEVELOPMENT AND MANAGEMENT OF LOW VOLUME ROAD NETWORKS IN AUSTRALIA

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Keywords: Low volume roads, Development, Management, Social, Sustainability, Communities

ABSTRACT

While low volume roads carry only limited volumes of traffic, they perform an essential social function through connecting communities, many of which are located in rural areas. These roads form a significant component of the Australian road network and should be constructed and maintained in a sustainable manner providing an ongoing effective, efficient, safe and reliable service. However, funding for them is often ranked at a lower priority than for roads with larger traffic volumes. Therefore, innovative and best practice network management strategies are required to ensure the productivity, safety, usability, social equity, sustainable environmental management, and resilience of these roads.

In order to further investigate current strategies for managing these roads, a survey was conducted of management practices for low volume roads and their networks in 38 local government areas, primarily located in the Australian state of New South Wales (NSW). The research found that enhancements to the current practices were possible and made several recommendations for improvement. The study was also successful in defining the term "low volume road" for both sealed and unsealed roads in NSW. It identified approaches to improve the level of service provided by these roads and their networks by improved planning, design, and construction practices, along with lifecycle management and renewal strategies. It was also found that additional information specifically relating to these roads is required to be collected, recorded, and made accessible to asset managers in a formal system that supports key renewal decisions backed by sound evidence. There was significant opportunity to increase the level of road safety reviews for these roads. Leveraging funding, ensuring that new low volume roads meet future traffic demands, and continuing to investigate best practices for life cycle based sustainable asset management; development and preservation were found to be the most successful strategies to meet these challenges.

DOES THE PLANNING SYSTEM IN ENGLAND DELIVER A SUSTAINABLE AND RESILIENT BUILT ENVIRONMENT? A STUDY OF THE EXPERIENCE OF TOWN PLANNERS.

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Keywords: Resilient Construction, Town Planners, Urban Planners, Professional Identity.

ABSTRACT

The case has been made in the reports of the Intergovernmental Panel on Climate Changes for the crucial role of the built environment in mitigating the worst excesses of a warming global climate and in protecting people through adaptation. Town planners are essential actors in delivering sustainable and resilient urbanism. Given that legislation is implemented by people, the study aimed to examine how town planners experienced and thought about the changing legislation and how they understood the concepts of 'sustainability' and 'resilience' in the built environment. Semi-structured interviews were conducted with 19 planners working in England who had at least seven years' experience. In the analysis, we explored meanings of sustainability and of resilience, and how these concepts were seen as incorporated in legislation. Sustainability was seen by the participants as embedded in regulations but its realisation varied substantially. Tensions were evident between the three pillars of environment, society and economy. 'Resilience' as a concept was poorly understood and legislative support was patchy at best: while flooding features extensively in local plans, wider issues of climate impact such as overheating are not comprehensively addressed. The conclusions are that planners are often frustrated in their attempts to develop a more sustainable built environment and that the current planning system is inadequate to deliver consistently sustainable and resilient outcomes. However, alignment between sustainability goals and professional identity were also noted, offering avenues to explore beyond the institutional constraints of legislation.

Project Management in Sustainability

EFFECTIVE MANAGEMENT OF HAZARDOUS ASBESTOS WASTE WITHIN A CONFINED WATERMAIN PIPELINE CONSTRUCTION PROJECT: MULTIPLE CASE STUDY REVIEW

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Keywords: Asbestos, confined site construction, critical space analysis, Irish construction industry, space scheduling, water-main.

Abstract

As urban sprawl continues to put pressure on cities across the globe, so too is the need to service those who live and work within these regions. The need to provide fresh, clean drinking water to each person is becoming increasing difficult and somewhat unsustainable. In the context of Ireland, this is no different, particularly with ageing and leaking services. To counteract such issues, there is a need to replace old and often hazardous asbestos watermain pipelines with more durable solutions. However, in doing so, the process unearths particularly hazardous material to those whom have the task of replacing it. There is an ever-growing need for advanced methods of materials management and space scheduling on confined construction sites with a considerable gap in literature accounting for the management and removal of hazardous waste. Therefore, the aim of this study is to investigate the effective management of such hazardous waste, within what is invariably a confined construction site environment. To achieve this aim, three case studies are identified, all of which involve the removal of old asbestos watermain, in a confined city centre environment. Three individuals on each case study are interviewed, using a semi-structured approach, to investigate how they effectively manage and mitigate the risks associated with the decommissioning, packaging and removal of hazardous asbestos waste from each of their respective projects. The findings indicate that, in order of importance, Space Scheduling, Critical Space Analysis, and Supply Chain Management, are critical in the safe identification, decommissioning, excavation, extraction, packaging and ultimate removal and disposal of hazardous asbestos waste watermain. This research is conducted with the ultimate viewpoint of increasing the efficiency of pipeline construction where hazardous waste is present, reducing costs on-site and,

ultimately, improving the health and safety, both of those working onsite, but also those in the vicinity of the removal of this hazardous waste.

AN INVESTIGATION INTO THE GAP BETWEEN PROGRAMME MANAGEMENT THEORY AND PRACTICE

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Keywords: Programme Management Theory; Strategic Alignment; Value and Benefits; Governance.

Abstract

The programme management approach was intended as a way of delivering organisational strategy and achieving beneficial outcomes through the coordination, prioritisation, and precise resources allocation of projects based on their relative 'value' contribution. Such coordination of projects would offer greater sustainable valued outcomes, and has been widely adopted in the U.K. Despite the intentions of the theory of programme management, and the fact that literature largely concurring on the themes and facets of 'programme management theory', as much as 53 % of programmes underperform in delivering their strategies and 34% of projects were found to offer no beneficial outcomes (NAO, 2016), suggesting that issues and flaws exist within this theory and that perhaps there is a gap in terms of the attention being given to the experience of managing programmes in practice. This study aimed to illustrate the challenges faced when exercising the theory of 'programme management' in practice and utilised a qualitative in-depth focus group discussion amongst programme and project experts to do so. The primary data findings concluded that there is indeed a gap between the two that especially manifests in regard to issues with: the lack of strategic focus leading misalignment of projects thus the distortion of strategic vision, the subjectivity of 'value' leading to conflict in the selection and prioritisation of projects and the rigid governance structures that prevent strategic decision making and hinder innovation. Several attributions were made as to the root causes of these issues as well as possible solutions based on interpretations of expert opinions and the overall data analysis. Following a critical discussion and comparison between the primary and the literature findings, this study hypothesises that programme management theory and practice are still at an embryonic stage and yet to meet one another and that governance might the missing link between strategy formulation and execution. This study further recommends more empirical and qualitative research be conducted in order to bridge the gap between theory and practice and suggests that elements a hierarchically flatter governance structure, a bottom-up approach to strategy, visualisation to aid prioritisation, and human behavioural errors are important aspects to be taken into consideration when doing so.

STAKEHOLDER MANAGEMENT: PROPOSAL FOR RESEARCH; DO SUCCESSFUL PROJECT MANAGERS EMPLOY 'INTEREST BASED NEGOTIATION' TO CREATE SUCCESSFUL PROJECT OUTCOMES?

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Keywords: Project Management; Stakeholder Management ; Stakeholder Engagement; Interest Based Negotiation.

Abstract

Increasingly the management of stakeholders is reported, by research on the management of projects, as being critical to the successful development of projects. Current research into the management of stakeholders charts a move from: classifying who stakeholders might be; to one of determining whether and how to manage them; to one of recommending 'engagement'. Stakeholders are seemingly important players in the project's environment because they are able to both: significantly influence the project's delivery and; because they may well be the arbiters of whether the project can be considered successful or not. This latter point indicates the role that stakeholders and those stakeholders that are beneficiaries of the project can have in determining how 'value' is interpreted. This research proposal identifies a gap in existing literature; that gap is in the final process of stakeholder management. Aligned to a risk management process, stakeholder management ends with the idea that the stakeholder will be managed. As writers show that 'engagement' might be beneficial, then 'interest based negotiation' (IBN) allows for a project manager to engage with these groups through IBN. Anecdotal evidence shows that elements of IBN might be unconscious components of successful project managers interactions with stakeholders. This paper proposes a study design that will allow for the hypothesis H1 "Successful stakeholder engagement can be correlated with project managers employing elements of interest based negotiation" to be tested.

CONSTRUCTION PROGRAMME FAILURE AND THE IMPACT ON WASTE, RESOURCE EFFICIENCY, AND NATURAL CAPITAL IN CONSTRUCTION PROJECT ENVIRONMENTS

Neil Pickavance, Andrew Ross and Damian Fearon

Keywords: planning, programme, sustainability, waste, resources.

Abstract

Delayed and disrupted construction projects contribute poor sustainability in construction project environments. UK construction documents an extensive history of project delay and disruption, with contracting organisations operating in environments with a prevalence of excessive sub-letting, fragmentation, poor integration of sub-contractors, build strategy dislocation, contractual-adversarial relationships, and poor adoption of project planning frameworks.

This investigation reviews the extent and impact of individual and team behaviours and cultures within a contracting organisation project and the influences on the success of Critical Path Method (CPM) project planning and scheduling. CPM remains the standard method of project planning and scheduling in the construction industry, despite newer systems such as Lean Construction, Last Planner® System, Agile Project Management, and PRINCE2.

Exploratory qualitative data was collected through a purposive sample of six semi-structured interviews with UK construction management personnel on a sample case study project. Experienced project managers and project planning staff from contracting and sub-contracting organisations were consulted on project planning, scheduling and programme development, co-ordination, integration, procedures, methods, techniques, training and development.

Results identify CPM planning operating in unstructured environments characterised by poor operating and application protocols, and poor understanding and ad-hoc engagement by project teams. Poor leadership and facilitation of programme development by senior project management could be associated with later project failure. It is concluded that fundamental problems with basic project planning and scheduling undermine sustainability in construction due to late completions.

OBSTACLES OF SUSTAINABLE CONSTRUCTION PROJECT MANAGEMENT IN SOUTH AFRICA CONSTRUCTION INDUSTRY

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Keywords: *Construction industry, Sustainable construction, sustainable construction project management, Mpumalanga Province.*

Abstract:

Green building is mostly adopted by the private sector or the private property development companies who are enjoying the benefits of it. Hence the study will explore the obstacles impeding the implementation of sustainable project management in the public sector in South Africa. Structured questionnaires were distributed to different construction companies and construction professionals involved in the public projects. From 80 questionnaires distributed, 65 were brought back and they were all valid and usable. Findings from the survey results obtained from the chosen respondents revealed that there is resistance to change from conventional to green practices by organization employees, Lack of awareness of green building methods and technologies, absence of dependable exact cost data/information, limited government involvement, the complexity of codes and regulations on green building and sustainable construction, high cost of green building material and also attracts a higher risk of delays in construction. From the findings the government of South Africa needs to play a huge role implementing sustainable construction project management in public buildings, which will benefit the government, and the end users and reducing the nation's carbon emission emanating from construction sector.

SUSTAINABLE DEVELOPMENT AND MANAGEMENT OF LOW VOLUME ROAD NETWORKS IN AUSTRALIA

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Keywords: Low volume roads, Development, Management, Social, Sustainability, Communities

Abstract:

While low volume roads carry only limited volumes of traffic, they perform an essential social function through connecting communities, many of which are located in rural areas. These roads form a significant component of the Australian road network and should be constructed and maintained in a sustainable manner providing an ongoing effective, efficient, safe and reliable service. However, funding for them is often ranked at a lower priority than for roads with larger traffic volumes. Therefore, innovative and best practice network management strategies are required to ensure the productivity, safety, usability, social equity, sustainable environmental management, and resilience of these roads.

In order to further investigate current strategies for managing these roads, a survey was conducted of management practices for low volume roads and their networks in 38 local government areas, primarily located in the Australian state of New South Wales (NSW). The research found that enhancements to the current practices were possible and made several recommendations for improvement. The study was also successful in defining the term “low volume road” for both sealed and unsealed roads in NSW. It identified approaches to improve the level of service provided by these roads and their networks by improved planning, design, and construction practices, along with lifecycle management and renewal strategies. It was also found that additional information specifically relating to these roads is required to be collected, recorded, and made accessible to asset managers in a formal system that supports key renewal decisions backed by sound evidence. There was significant opportunity to increase the level of road safety reviews for these roads. Leveraging funding, ensuring that new low volume roads meet future traffic demands, and continuing to investigate best practices for life cycle based sustainable asset management; development and preservation were found to be the most successful strategies to meet these challenges.

Biomimicry

FUTURE CITIES: THE ROLE OF BIOMIMICRY ARCHITECTURE IN IMPROVING LIVABILITY IN MEGACITIES AND MITIGATING CLIMATE CHANGE RISKS

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Keywords: Biomimicry architecture, Climate change mitigation, Future and sustainable cities, Livability.

ABSTRACT

Since the early start of universe and creation, man and creatures were enclitic by nature and well organized in harmony. Biomimicry as a concept is the mimicry and imitation of systems and strategies seen in the living world as a foundation for different fields, science and applications such as architectural field. Biomimicry has been applied through three levels, an organism level, behavior level, and an ecosystem level, in terms of its forms, materials, construction methods, processes, or functions. Biomimicry is source of innovation, particularly in creating more sustainable and potentially regenerative architecture. The problem is addressed according to the challenges that megacities face today, mainly high energy use, urban air pollution due to transport, large number of inhabitants' activities, CO₂ level and natural resources consumption in all sectors. So, improving cities' infrastructure, mainly buildings is one of the major steps needed to enhance livability in cities and mitigate climate change. The objective of this work is to assess the value of adopting biomimicry design concept, as a sustainable tool in architecture, due to its potential to create regenerative built environments. The research strategy is centred on a qualitative strategy and the method of data collection is a narrative and case studies' types. It is also depends on a deductive approach. In this paper, architectural examples are examined as a part of nature in order to explore the effect of nature on architecture. In addition, a comparative analysis of biomimicry approach depicting global applications of biomimicry in architecture is presented and discussed in terms of sustainability dimensions. Results of comparing the examined buildings show that the optimum building is CH2 Melbourne City Council House 2 in Australia which has the best sustainability features related to the biomimicry approach and linked to the climate change mitigation and adaptation.

Keywords: Biomimicry architecture, Climate change mitigation, Future and sustainable cities, Livability.

BIM and Automation

IMPROVING THE EFFECTIVENESS OF BUILDING AUTOMATION BY ADAPTION TO THE USERS CONTEXT

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Keywords: Home Automation, User Context, Effectiveness Improvement, Sustainable Development.

Abstract

The operations of either residential housing or commercial buildings are energy intensive, estimated to occupy around 40% of all energy consumed worldwide by the year 2030 (by GeSI - SMARTer2030). ICT-enabled smart home or building solutions are thus expected to contribute to sustainability gain in term of improving energy and resource efficiency. These technologies not only enable buildings to be automated and centrally controlled but also help to provide a healthier and more comfortable living or working environment. While studies in smart home system show good results in reducing the energy consumption of a building by automating tasks to tear down unused appliances, most of the applications are limitedly implemented based on fixed schedule reassembling user behaviour or routines, which is one of the main obstacles for home automation systems (HAS) to be widely acquired. As a solution for this matter, this study aims at exploring actual contexts of the user for HAS to adapt in real time in a more meaningful way so that not only the goal of reduced energy consumption is improved, but the user comfort is also taken care of in the best way. Using available studies on the expected reaction in HAS (in this paper we focus on German use case), a rule-based dictionary will be defined as a set of meaningful adaptions which can later be implemented in a home automation system. Then, the study will discuss possible ways to assess this model based on heuristic evaluation in comparison with available studies to prove an improvement in terms of energy efficiency

COULD RETROSPECTIVE IMPLEMENTATION OF BIM IN HIGH-RISE SOCIAL HOUSING PREVENT ANOTHER GRENFELL TOWER TRAGEDY?

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Key Words: BIM, refurbishment, social housing, Grenfell Tower

Abstract

On 14th June 2017, Grenfell Tower, a high-rise social housing block in North London caught fire, resulting in 72 deaths, (BBC, 2018a). A year prior to the fire, the tower had undergone refurbishment work to address the building's sustainability performance and improve its appearance, (Booth et al., 2017). Changing or refurbishing a building can compromise the existing 'system' of how a building works; to ensure refurbishment does not impact on building safety, Building Regulations must be strictly followed. A year on from the tragedy, it is evident that relevant regulations and procedures were not adhered to during this process, (Waite et al., 2017).

An independent review of Grenfell commissioned by the Government suggested several recommendations, including making Building Information Modelling (BIM) a stronger factor to improve building safety on existing and new high-rise buildings, (Hackitt, 2018). Currently, there is currently little to no evidence of BIM being used in the social housing sector. BIM has demonstrated to be a cost and time saver on projects, (Malleon, 2018) so it seems surprising to not investigate a process that could aid the current housing stock, particularly when the government's Decent Homes Standard on existing social housing shows 525,000 council dwellings do not meet a fit living standard, (Kentish, 2018), many of which are classified as high-rise buildings.

Using Grenfell Tower as a case study, this paper aims to address the failures throughout the refurbishment works. It examines how implementing BIM retrospectively to Grenfell Tower could have ensured superior futureproofing and improved the overall safety of the building throughout its remaining lifespan.

The research paper has been compiled through a desktop study, and includes secondary research using news articles, textbooks and academic journals. From this research, the paper establishes whether implementing BIM to the case study could have prevented the tragedy from occurring. The discussion concludes that BIM poses a good opportunity to retrospectively implement BIM into high-rise social housing for safer and more efficient refurbishments.

A FUTURE-PROOF CULTURAL HERITAGE: A HOLISTIC MIXED METHODS APPROACH

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Keywords: Building automation, energy efficiency, standby power

Abstract

Residential and commercial buildings are one of the major contributors to energy consumption in the EU, accounting for up to 40% of total energy consumed (European commission, 2015). As indicated by the Energy Performance of Buildings Directive, all new buildings after 2020 have to be nearly zero stock and overall the EU is moving towards zero stock energy use in buildings by 2050. With this in mind there is a need to lower current energy consumption in buildings. While many studies focus on the energy usage of households, few of them discuss energy use in a university and company context (i.e. commercial buildings). Within this area a low hanging fruit that could help decrease energy consumption is stand-by power, the consumption of power when a device is not in use. Stand-by power can consume up to 8% of a devices total energy use over its lifetime. To alleviate this problem this research, first collected data from other literature to understand the composition of an office building and with this data we created scenarios to calculate the time it would take for an automated system using different levels of automated to return a monetary value. The return on investment varies per country and scenario it is 400 days on average for Germany and 700 for Finland.

HAS BIM CHANGED THE ROLE OF THE ARCHITECTURAL TECHNOLOGIST?

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Keywords: Architectural Technologist, BIM, Architectural Roles

Abstract

BIM (Building Information Modelling) is a process for creating and managing information that is being adopted increasingly by practices in the construction industry (Morton & Thompson, 2011). This recently introduced a method of working that has altered the way that the design team works and communicates with one another (Czmoch & Pekala, 2015). This paper will discuss if the role of the Architectural Technologist has changed since the adoption of BIM compared to the traditional approaches. The literature review suggests that the AT's role changes during concept and detailed design stages. The emergence of BIM has provoked a breakthrough in technology and increased the capabilities of software which is suggested to have had an impact on the Architectural Technologists and the design team (Latiffi & Fathi 2016). Eastman et al. (2011) highlights BIM software's capability to automatically generate construction details, support imported pre-determined objects from BIM libraries and this paper will carry out research to find out if these have impacted the way that AT's detail and if there is a reliance on software.

Energy and Energy Efficiencies

LONG-TERM DURABILITY OF SOLAR PHOTOVOLTAIC MODULES

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Keywords: Durability, Solar, Photovoltaic, Ultraviolet Radiation

Abstract

Solar photovoltaic (PV) panels experience long-term performance degradation resulting in lower like-per-like efficiencies and performance ratios when compared with their initial performance. Manufacturers of solar photovoltaic modules usually guarantee the life span for more than 20 years. It is therefore necessary to track and mitigate degradation of PV modules over this period to satisfy such guarantees and beyond this period to identify maintenance and repair requirements. Degradation of solar PV modules makes them less efficient, less reliable and, ultimately, inoperative. This paper reviews relevant literature to discuss:

- causes of efficiency reductions in photovoltaic cells;
- ways to achieve long-term durability of solar photovoltaic modules;
- how viability of solar photovoltaic modules is affected by degradation;
- the remedies to solar photovoltaic (PV) degradation.

WASTE MANAGEMENT: THE CASE OF CONSTRUCTION AND DEMOLITION WASTE IN PORT ELIZABETH

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Keywords: Construction, Demolition, Environment, Materials, Waste.

Abstract

The construction industry has both positive and negative repercussions on the environment. One of the main negative impacts is waste generation. The huge amount of construction and demolition waste (CDW) entering landfills in Port Elizabeth, South Africa, has stressed the local environment. To alleviate its adverse impacts, the municipality and construction industry have adopted a set of measures.

A study was conducted to provide insight into CDW management practices in Port Elizabeth, to develop a response to the CDW problem. The objectives were to determine whether: CDW is indiscriminately disposed of; certain CDW is hazardous; there is a disproportionate amount of CDW, and generated CDW is often re-wasted. The sample included construction managers, site agents, and municipal officials in the employ of the Nelson Mandela Bay Municipality, constituted the sample strata of the study.

The study revealed that the number of CDW disposal sites is inadequate, which contributes to illegal dumping of CDW, and a culture of lawlessness engenders and leads to illegal dumping of CDW. Furthermore, illegal dumping of hazardous waste is a threat to human and environmental health. Lastly, the research determined that contractors manage their schedule of materials ordered, packaging of material, and recycle damaged or incomplete material, which mitigates CDW.

The challenges encountered during this research are beneficial to both researcher and industry practitioners, since they could develop further research and CDW management plans accordingly.

AN OPTIMISED MODEL FOR ENERGY EFFICIENT BUILDING PRACTICES

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Keywords: Building Commissioning; Energy simulation; Measurement and Verification process; Monitoring and control systems.

Abstract

The use of advanced energy-efficient building practices is widely increasing in the international marketplace. These include building commissioning, energy simulation, measurement and verification, carbon dioxide monitoring as well as controllability of artificial lighting and ventilation systems. These processes should not be looked upon in isolation because after all, they aim at achieving almost the same green goals but acting on different sustainable criteria or life stages. It is also noted that a common obstacle for adopting such practices in the marketplace is their perceived high cost owing to the additional time and expertise required. Hence, the study assumes that their optimized integration is the cornerstone to be able to reach high building performance. This is performed through a cohesive qualitative and quantitative methodology to develop an integrated model for the abovementioned green building practices. Relevant literature studies are cited, in addition to the result of an online questionnaire among worldwide practitioners to pinpoint interesting interrelations among some of these practices. Then the results are integrated into a causal-loop diagram to define interrelations and problematic areas according to four assumed integration loops; L1: procedure, L2: temporal sequence, L3: pros and L4: cons. The study uses systems modelling tools to represent the integration diagram proposed for such green building practices. Eventually, the results of the study present means of integrating advanced energy-efficient building practices as subcomponents of larger system integration model to reach higher building energy performance targets. This can be later developed in building management plans and applications.

A MULTI-DIMENSIONAL ANALYSIS OF SMART ENERGY SYSTEMS – TOWARDS DEVELOPING A COMMON FRAMEWORK FOR ASSESSING THE SUSTAINABILITY OF SMALL-SCALE RENEWABLES IN SELECTED SOCIETAL SECTORS

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Keywords: Smart energy systems, sustainability, assessment framework, stakeholders.

Abstract

The UK power sector is migrating from an old centralized network of large, mainly fossil-fuel based generating stations toward a more dynamic energy ecosystem with new entrants generating and actively managing their consumption. This is occurring at a time when electricity system participants are searching for solutions to tackle three criticalities known as the “energy trilemma”; de-carbonising, securing long-term supply resilience and affordability. The wider context is that energy is a fundamental part of UK society. The inability to access clean, reliable sources of affordable energy is a barrier to securing development which is sustainable. However, there is limited published research which takes a comprehensive approach to assessing whether the impact of changes to the UK power system are contributing to sustainable development. This research is therefore focused on an evaluation of sustainability through the investment decisions of stakeholders in respect of solar photovoltaics (solar PV), in the UK context. This research considers the “sustainability impact” within three sectors; the public, private and third sectors. Relevant metrics and benchmarks will be considered against the UN Sustainable Development Goals (UNSDGs) whilst also exploring the ‘real’ value to society.

Sustainable Materials

ARE BANANAS THE NEW BUILDING MATERIAL?

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Keywords: Waste, Material, Bananas, Sustainable

Abstract:

Every year humans produce 1.3bn tonnes of food which is wasted and this is around one third of food produced around the World. If any of this waste could be turned into a resources such as construction materials then this would reduce the CO₂ produced from the waste that would have otherwise ended up in landfills or incinerated (Food and Agriculture Organization of the United Nations, 2018). Due to population growth, the amount of waste produced worldwide will steadily increase unless there are actions taken to reduce it. The greenhouse effect is a natural process that warms the Earth's surface, however as the concentration of greenhouse gases continues to increase the Earth's temperature is rising. This could result in major long-term consequences such as abnormal weather putting millions of lives at risk. The idea of reusing organic waste tends to be associated with it ending up as compost helping other foods to thrive by providing them with nutrients through decomposition, however, the use of some organic waste products can create low-cost building materials making them sustainable and more eco-friendly than traditional construction materials. Bananas today are one the most popular fruits in the World with approximately 100 billion bananas eaten around the World every day (BananaLink, 2018). The use of bananas biomass waste within construction materials may be the solution to the use of waste bananas, rather than them becoming compost or worst put into landfills. Using construction materials made from organic waste would exploit an untapped resource which would have a positive impact on the technical and environmental side of the construction industry turning organic waste into a source of value.

The aim of this research paper is to review the benefits of using banana biomass waste as a construction material compared to traditional construction materials. This research paper will go through various examples of construction materials that contain bananas and the benefits in comparison to traditional building materials.

USING MACHINE LEARNING FOR CARBON-CONDITIONING RECYCLED AGGREGATE CONCRETE MODELLING

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Key words: Machine learning, Statistical techniques, Carbon-conditioning recycled aggregate, Recycled aggregate concrete, Optimisation.

Abstract

Environmental impact concerns are increasing in today's society globally. Greenhouse effect is known as a natural process that warms the Earth's surface. However, human activities in different industries are increasing the concentrations of greenhouse gases affecting the Earth's temperature. Carbon dioxide (CO₂) is the most common gas emitted and rapidly increasing around the world. Australia's emissions have risen in the past three years and emissions in 2020 are projected to be 551 Mt CO₂-e. The construction industry potentially can contribute to the decrease of CO₂ emission by the usage of sustainable materials such as carbon-conditioning recycled aggregate concrete. Recycled concrete is an eco-friendly material however it has not been typically used for structural applications. One of the reasons is the limited prediction models to obtain concrete mechanical properties, such as compressive strength. Since Machine Learning (ML) techniques have been used to computationally model the most varied types of engineering problems, this paper presents a study of some techniques to investigate how well they can model one of the main characteristics of recycled concrete aggregate (RCA), the compressive strength. The data set characteristics will be explained and what technics can be used for parts of these information to achieve better results. The contribution to the industry is the construction of programs to facilitate further studies and the concrete mixture optimisation.

A DECISION SUPPORT SYSTEM FOR AFFORDABLE AND SUSTAINABLE HOUSING DESIGN AND DELIVERY IN LEAST DEVELOPED COUNTRIES (LDC'S)

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Key words: Design Management, Decision Making, Sustainability, Post Disaster.

Abstract

Housing shortages in least developed countries (LDC's) continue to escalate beyond previous records and based on current projections this trend is set to increase. The resulting homelessness and poverty affect large populations in many LDC's. The main contributing factors are recognised as global population growth and natural disasters, which disproportionately affect LDC's when compared with developed countries. The challenge of how best to address these shortages in a sustainable manner while simultaneously building resilience against future disasters in to the communities has been a central debate in many LDC's. Many different actors, such as governments, non-governmental organisations (NGOs) and communities undertake housing provision projects in these contexts. However, the outcomes are often of poor quality, which can be attributed to a lack of a coherent and holistic design and delivery process with the community served and lack of a sustainable design ethos.

The aim of this research is to explore the complex area of the design and delivery of sustainable and affordable housing in LDC's and post disaster contexts. The research focuses on the design decision-making and delivery process for selected international housing organisations, which operate in the field of sustainable housing in LDC's. The research bridges the domains of architecture and project and design management and in particular, the aspect of decision support. A multi case study approach with nine leading international housing organisations operating in LDC's is undertaken. The study identifies key barriers and challenges faced in the design and delivery of sustainable housing in LDC's as well as key drivers for improvement. Key themes and considerations in the designer's decision making and delivery process are identified. A decision support system (DSS) tool for the design and delivery of sustainable housing in LDC contexts is developed directly from these results, which can then be applied in practice.

PERFORMANCE EVALUATION OF FIVE SEDIMENT BARRIERS USING A FULL-SCALE TESTING APPARATUS

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Key words: construction, sediment barrier, sediment control, and water quality.

Abstract

Erosion and sediment controls on construction sites minimize environmental impacts from sediment-laden stormwater runoff. Sediment is contained on project sites by installing sediment barriers. However, there is little performance-based testing data for the various designs, configurations, and materials for sediment barriers. To better understand sediment barrier performance, researchers at the Auburn University-Erosion and Sediment Control Testing Facility (AU-ESCTF) developed a full-scale testing apparatus to conduct performance testing on sediment barriers. Using this apparatus, researchers have evaluated five sediment barrier options to compare performance and identify possible shortcomings using standardized full-scale testing methods. This performance testing subjected sediment barrier practices to simulated field conditions typically experienced on-site without the variability of testing in nonstandard field locations or the limitations imposed by small-scale testing. Through testing, the researchers measured sediment barrier performance in the following areas: improvement in water quality by measuring turbidity, sediment retention, and structural integrity. The sediment barriers were installed using the same tools and techniques used for construction site installation. The full-scale testing apparatus exposed the evaluated sediment barriers to water and sediment loads expected to be encountered as the result of a two-year, 24-hour storm from central Alabama. Two nonwoven, wire-backed silt fence installations were evaluated with which the standard trenched method proved to capture a greater amount of sediment compared to the sliced-method of installation, which experienced significant undermining. The best performing practice was the ALDOT Sediment Retention Barrier that captured over 90% of sediment introduced without undermining. The worst performing practice was a wheat straw wattle that undermined so significantly, it was deemed to be a failing practice, resulting in the premature stoppage of each test.

Environmental Assessment

USER SATISFACTION OF A GREEN STAR-RATED LITERARY MUSEUM IN SOUTH AFRICA

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Keywords: Post-occupancy evaluation, Green building

Abstract

The main aim of this study is to determine a Green Star-rated literary museum's post-occupancy user satisfaction. This research employed a case study survey research design in which a BUS (building use studies) questionnaire was administered to a case to determine the satisfaction of users with the performance of the green building. The data analysis involved the calculation of means for factors of satisfaction, parameters of comfort, determination of tolerance of users with the green building and a comparative analysis with similar buildings from the BUS database. The benchmarking determined whether the study building was better, the same as or worse than similar buildings. Findings of the study indicate the perceptions of occupants regarding the building design rated highest in terms of satisfaction, attributable to the integrative design process of the Green Building Council South Africa (GBCSA) and elements of social design, whereas perceived health rated the lowest. In terms of the factors of comfort, the perceptions of occupants regarding the overall comfort of the building contributed positively, whereas noise was a concern. Findings of the study further indicate that the study building performed better than the benchmark in terms of factors of satisfaction and those of comfort. The occupants of the study building demonstrated tolerance with the building's environment, which may be attributable to pro-environmental behaviours. This information is beneficial to the facilities managers to enable occupants to exercise more control over the thermal conditions of the building. In terms of future designs and heating, ventilation and air conditioning (HVAC) control strategies, it would be beneficial to install systems that mimic the desired conditions of the occupants. Building owners and managers should consider introducing noise reduction strategies in traffic areas such as floor padding for noise attenuation. Benefits could arise from a noise awareness campaign and the installation of a visible or audible decibel warning system as additional strategies.

CONTRACTOR'S READINESS FOR LEED REQUIREMENTS IN IRELAND: FACTORS FOR CONSIDERATION

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Key Words: Contractor Readiness, Irish Construction Industry, LEED, Sustainability.

Abstract:

LEED (Leadership in Energy & Environmental Design) certification is becoming increasingly prevalent, not only globally, but also in the Irish construction industry. This paper investigates the current readiness of contractors in Ireland for achieving LEED certified construction projects, while identifying factors for consideration going forward. Objectives include evaluating the current readiness of Irish contractors respective to LEED and subsequently, highlighting factors for consideration, to better enable those working towards securing and delivering LEED certified construction projects. In achieving this aim, a qualitative methodology is undertaken, using three case studies as a basis for the study. Within each case study, three semi-structured interviews are carried out, with the results analysed, coded, with themes emerging for subsequent discussion. The key findings from the study indicate that Irish contractors are not adequately prepared to achieve LEED certification. In overcoming this, the study concludes that further education is essential, both at third level graduate level, but also for further/return to education prospects. Those interviewed unanimously agreed that further education and training is essential to bridge the divide to achieve higher Irish contractor conformance to the requirements set out when achieving LEED Certification. The findings represent value to Irish contractors as it shows a clear dearth in both knowledge and ability in achieving LEED certification, while providing proposed solutions, to better enable Irish contractors in attaining LEED certification through further education and training.

SUSTAINABILITY ASSESSMENTS OF URBAN RAILWAY SYSTEMS: CASE STUDY EVALUATIONS IN TURKEY

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Keywords: carbon emission, sustainability assessments, railway systems.

Abstract

With the increasing concerns on sustainability, there are ongoing efforts to control global warming potential (GWP) via reducing CO₂ emissions, which are mostly based on human activities. Due to the complexity of the process, a holistic sustainability approach is obligatory; ranging from the scale of cities to products. Life cycle assessment (LCA) is a versatile and flexible tool, which gives a wider perspective for spanning the project life cycle. Through carbon footprint (CFP) calculations, a clear picture of embodied CO₂ is provided. In general, developing countries mostly focus on reduction of operational carbon (OC), yet the impact of Embodied Carbon (EC) must be evaluated. In this study, the significance of EC estimation and reduction for infrastructure projects are interpreted and precautions are discussed. As a developing country, Turkey should adopt the principles of sustainability and constitute a frame in order to obtain a competitive advantage in the world.

In this study, the main motivation is that, railway systems within infrastructure systems should have applicable sustainability strategies. In addition, it is aimed that these efforts would accelerate sustainable development in Turkey. Since there is no certification systems, range or database, these efforts would be reference for the future works. That is why, this paper arises many questions that would be answered in future works of this research.

Research methodology is mixed as survey and case study so it is not comparison based. Literature has been reviewed and real cases were analyzed in order to have a better understanding of real projects. Three metro stations, which are located in Istanbul, were explored as case studies of urban railway systems - an important urban infrastructure. With the relevance of the study, it is anticipated that, Turkey will have further associated topics to investigate.

ARE CONSTRUCTION PROFESSIONALS EQUIPPED WITH THE KNOWLEDGE AND TOOLS TO ADDRESS THE SUSTAINABILITY DILEMMA?

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Keywords: BREEAM, Green building certification, Sustainable buildings.

Abstract

This study attempts to explore the depth of knowledge and understanding of sustainability issues across a range of construction professions and utilise this evidence to reveal if Building Research Establishment Environmental Assessment Method (BREEAM) is being delivered with due diligence across the industry. A range of construction professionals, key actors in achieving sustainability across the built environment through their advisory roles in design and specification were interviewed ($n = 7$). It became apparent that knowledge and understanding of sustainability was certainly below an expected level of competence suitable to deliver solutions across the multifaceted sustainability crisis, with many professionals failing to see beyond energy efficiency and carbon reduction. Furthermore, it revealed that planning policy changes incorporating BREEAM as a condition has had negative effects, leading clients and professionals to engage only when required. It was also evident that BREEAM schemes are being used with the goal to obtain development consents and cost was determining actions taken rather than best sustainability outcomes. This results in both BREEAM and Sustainability being perceived as an add-ons rather than core elements or drivers of a project and, in doing so, reduces the effectiveness of the design. Based on this evidence, it is proposed that there is a timely need to change construction professionals' perceptions to achieve a truly sustainable built environment. With BREEAM being one of many similar certification schemes it is worrying that these findings may the same elsewhere around the world.

PERFORMANCE EVALUATION BASED CLAIMS PROCESS FOR INSURING ENERGY PERFORMANCE OF NEW DWELLINGS

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Keywords: housing, energy performance, energy efficiency gap, insurance, energy performance gap.

Abstract

This paper describes the development and testing of a building performance evaluation based claims process that underpins a new insurance-backed energy performance warranty for guaranteeing the in-use performance of new homes in the UK. The insurance backed warranty is based on the principle that if there are deficiencies in the building fabric or energy systems (physical factors) of an insured dwelling which causes excessive energy consumption, the insurance will make good those deficiencies. However, excess energy consumption resulting from occupancy factors is not insured. To be able to accurately identify the cause (physical or occupancy factors) of excessive energy use, a socio-technical building performance evaluation based claims process is developed and tested for four low energy new-build flats located in a development in Southeast England. Data on energy use, environment (temperature, relative humidity, CO₂ levels) and occupant behaviour (opening-closing of windows, appliances' use) were collected using high frequency energy and environmental data loggers, questionnaires, interviews and activity logging diaries over a full heating season (October 2017 – April 2018). The influence of physical (form, location) and occupant factors (occupancy patterns, heating schedules, hot water requirement, use of electrical appliances) on in-use energy consumption was investigated for three end uses: space heating, water heating and electrical appliances. Results suggest that in the four low energy flats, occupant behaviour does not significantly affect actual space heating demand (which is mainly determined by physical factors), as much as hot water and use of electrical appliances, indicating that in low energy gas heated dwellings, excessive gas use is more likely to be eligible for an insurance claim than high electricity use. In future research the claims process could be less invasive using smart meter data to identify the influence of physical or occupant factors.

PERCEPTIONS OF TELETUBBYLAND: PUBLIC OPINIONS OF SUDS DEVICES INSTALLED AT ECO-DESIGNED MOTORWAY SERVICE AREAS

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Keywords: BREEAM, Drainage, Runoff, and Natural landscapes.

Abstract

Sustainable buildings, sustainable businesses and sustainable behaviours are befitting of modern society. Combining these ideals has been realised in the UK's greenest motorway service areas (in Gloucestershire) where public perceptions towards the installation of sustainable drainage devices has been studied. Whilst the planning of sustainable drainage systems has gathered momentum (since the late 1990s), it is readily acknowledged that there is a deficit of community awareness and knowledge of the purpose, function and wider potential benefits derived from devices used to manage and minimise surface water. Until there is a comprehensive shift away from the traditional approach of underground piped drainage, blue-green infrastructure will remain a relatively unknown entity for the populace and a concomitant shortfall in demand will be encountered. Therefore, public opinions of the motorway service area eco-designed amenity buildings (green roofs) and their surrounding landscapes (swales and ponds) were sought through questionnaire surveys ($n = 86$) completed by visitors to both the southbound and northbound M5 Gloucester motorway service areas. Results reveal the public share unanimous support for the eco-design sustainable buildings (designed to achieve BREEAM Excellent), and an overwhelming enthusiasm for the aesthetic landscaping of the sites. However, it was clearly evident that visitors were not forming a link between the appearance of the motorway service area features and their associated role in contributing to the sustainable surface water management of the sites, despite the architect's design intention for the landscape to be readily understood. It is concluded that a shift from 'grey infrastructure' will require the involvement of all stakeholders and changing public perceptions of 'blue-green infrastructure' will remain an obstacle until awareness of its value is far-reaching and celebrated beyond the confinements of architectural drawings and planning applications.

Flooding

CASE STUDIES OF THE 2014-15 FLOODS IN MALAYSIA: THE ROLE OF COMMUNITIES IN THE MANAGEMENT OF NATURAL HAZARDS

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Keywords: Resilience, Disaster, Risk Management, Flooding, Community role

Abstract

Flooding is one of the most dangerous natural hazards in Malaysia occurring nearly every year during the monsoon season and affecting almost 4.82 million people, which is around 22% of the total population of the country. The floods that hit Malaysia between December 2014 and January 2015 were the worst disaster in decades when 21 people were killed and 200,000 people were affected or displaced. During these events, many local members in rural and urban areas volunteered to help vulnerable people within their local communities. However, lack of facilities, equipment and poor communication and coordination with local authorities and other government agencies meant their efforts were often ineffective and many flood victims continued to endure harsh realities post-disaster. The aims of this paper are; 1. To showcase community learning on risk management that took place during the 2014-2015 events and identify ways in which the community response to flood can be improved, and 2. To critically review current state-led policies and strategies for risk communication and education and post-disaster asset management. The study is based on a social survey of 80 households in Kelantan state and Temerloh in Central Pahang, Malaysia where many communities affected by the worst flooding in 2014-2015 are located. Survey results are used to identify community hazard learning, the adaptation needs of communities and the limitations of current local authority policies. While it is clear that households and volunteers in small urban areas and villages gained valuable experience and learning that has enhanced their ability to protect themselves and their assets. local authorities and agencies need to prevent people from developing new buildings near flood-prone areas.

Health and Wellbeing

URBANISATION AND THE BUILT ENVIRONMENT: EXPLORING HOW THE BUILT ENVIRONMENT CAN ENHANCE THE HEALTH AND WELL BEING OF THE PEOPLE LIVING IN URBAN SLUMS

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Keywords: Urbanisation, urban slums, built environment, health and well-being.

Abstract

Recently, there is a phenomenal growth in the rate of the urbanisation of most countries of the world. As revealed by statistics, more than 50% of the world population already reside in cities, and this will rise to about 68% by 2050. This rapid growth represents a situation where most previously small cities are fast becoming megacities, and most previously megacities have continued to increase rapidly. Some of the immediate resultant effects of this unusual growth are both pressures on the already existing urban built environment, which consequently leads to its continuous expansion; and a remarkable increase in the population of people living in urban slums. The former and the latter effects that are the central focus of this study are worrisome situations that call for concern. The reason is that there is already a consensus among scholars that the built environment can have weighty negative impacts on the health and wellbeing of the people. The argument is that the level of these impacts hugely depends on the differences in the planning, structuring, and designing of the built environment in urban settings. With this, it may not be difficult to conclude that if living in urban centres where there are standard built environments that can affect people's health and wellbeing negatively, it may automatically mean that the impacts of living in urban slums/sub-standard built environment can be much more endangering. Accordingly, this study explored the built environment, health, and wellbeing of the people living in urban slums. As a literature-based study, it reviewed relevant literature that highlights essential issues on the urban built environment, the health and wellbeing of the people in slums. The review produced an analysis demonstrating the possible characteristics of the built environment, show how the environment can be structured and designed to enhance the health and wellbeing of the people living in urban slums. The recommendation emanating from the detailed analysis is that those who make decisions on the plan, design, and maintenance of urban built environments should start focusing on incorporating people's health and wellbeing in their subsequent plans and designs. In addition, they should pay particular attention to the planning, structuring, and designing of the urban slums built environment.

Sustainability and Stakeholders

IMPACT OF PUBLIC CHARGING INFRASTRUCTURE ON THE ADOPTION OF ELECTRIC VEHICLES IN LONDON

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Keywords: *Behaviour Change, Public Charging Infrastructure, Electric Vehicles.*

Abstract:

The discussion on the importance of public charging infrastructure is usually framed around the ‘chicken-egg’ challenge of consumers feeling reluctant to purchase without the necessary infrastructure and policy makers reluctant to invest in the infrastructure without the demand. However, public charging infrastructure may be more crucial to EV adoption than previously thought.

Historically, access to residential charging was thought to be a major factor in potential for growth in the EV market as it offered a guaranteed place for a vehicle to be charged. However, these conclusions were reached through studies conducted in regions with a high percentage of homes that have access to residential parking.

The purpose of this study is to understand how the built environment may encourage uptake of EVs by seeking a correlation between EV ownership and public charging points in an urban and densely populated city such as London.

Using a statistical approach with data from the Department for Transport and Zap Map, a statistically significant correlation was found between the total (slow, fast and rapid) number of public charging points and number of EV registrations per borough – with the strongest correlation found between EV registrations and rapid chargers.

This research does not explicitly prove that there is a cause and effect relationship between public charging points EVs but challenges some of the previous literature which indicates that public charging infrastructure is not as important as home charging. The study also supports the notion that the built environment can influence human behaviour.

THE TROUBLE WITH CLIENTS LIKE US: HOW ‘MULTI-HEADED STAKEHOLDER’ CLIENTS MAKE PROJECTS LESS VALUABLE

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Keywords: Construction Consultants; Stakeholders; Innovation; Procurement

Abstract:

This study reports on interviews with teams representing Construction Engineering Consultant firms in the UK. This study examines the responses to the question: “What is the trouble with clients like us?” This question referred to a typical client organisation for the sample group that was a large corporate private/public/third sector type. The study provided an opportunity to examine how consultants, undertaking: Architectural; Building Surveying; Quantity Surveying; Project Management; Building Service Engineering, roles perceived the difficulties and challenges of corporate clients. The respondents revealed in the interviews that they had their own term for such organisations and generally referred to them as: “multi-headed stakeholder” organisations. Problems with the ‘brief’ dominate the responses but these are nuanced and analysed further to reveal the difficulties that the client organisations of this type create for their consultants. Client organisations may have out-of-date interpretations of the separation of consultant professional roles that may compromise their procurement processes when engaging construction engineering consultants. The data also reveals how the difficulties that these clients present for consultants also detract from the potential creation of more valuable project outcomes. Recommendations are made to address this issue including: Access to the earlier stage of the decision making for the whole team; recognition of the ‘sunk cost error’ problem in the client authorisation processes; and the use of facilitated workshop approaches. For consultant firms, the paper recommends the habitual use of such techniques as ‘interest based negotiations’ to assist consultants in navigating multi-headed stakeholder clients. The research indicates that ‘latent value’ exists in corporate projects remains unrealised due to the difficulties described. Hypotheses are proposed: H1 “Design and project management consultants tend to be appointed too late in the feasibility process to add value to the client’s project”; H2 “Early decisions in the project lifecycle, pre-consultant appointment, are unlikely to be reversed when evidence of their unviability is discovered”; H3 “Internal stakeholder interests in an organisation tend to

prevent/limit value adding initiatives by design/project management consultants"; H4 "Project management consultants tend to be more strategic benefit orientated than large corporate client organisations"; H5 "A procurement/contract strategy that supports value adding initiatives from the interactions between consultants and organisational interests is required to exploit latent value in the project"; H6 "Latent value is left unexploited, in large corporate sized client organisations, due to a combination of the H1 – H5"; H7 "'Interest Based Negotiation' approaches would allow for differences in stakeholder interests to be positively addressed by project teams".

SERIOUS GAMES FOR THE BUILT ENVIRONMENT - ECO MATERIAL TRUMPS

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Keywords: *sustainable construction materials, environmental impact, game-based learning, experiential learning, teaching and learning resource.*

Abstract:

This paper describes the research, development, design, production and analysis of a prototype teaching and learning resource entitled 'Eco-Material Trumps'. A card game intended to be used within an educational setting and as a source of reference for built environment professionals. The set of cards contain data on the sustainability credentials of common building materials and the aim is for the game to be used to stimulate debate on how, in practice, decision-makers need to balance the differing criteria that are used to establish the environmental impact of construction materials. This research has revealed that there is a disparate body of existing knowledge from a wide variety of industry and academic sources related to the subject matter which until now has not been collated into a single resource. One of the main barriers to the development and uptake of games in a learning context is the lack of empirical data to support the hypothesis for its effectiveness, as well as a lack of understanding about how these games might be used most appropriately in practice. This study used a questionnaire to investigate participants' perceptions of the value and importance of the active learning and cooperative activities they undertook during interactive and experiential workshops and the results and analysis are presented within this paper. Findings from the feedback elicited from workshops shows that this resource enables the processing of complex sets of data, brings together data from disparate sources, encourages interaction and discussion, promotes learning through visual and tangible presentation of data and encourages sustainable thinking about and beyond the subject matter

EXPLORING RESILIENT CHARACTERISTICS, SOCIAL-ECOLOGICAL RESILIENCE AND ADAPTIVE CAPACITY: AN ENVIRONMENTAL VOLUNTEERING CASE STUDY

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Keywords: Environmental Volunteering; Social-Ecological Resilience; Impact Measurement; Focus Group Interviews.

Abstract:

Engaging in civic ecology practices like environmental volunteering has been shown to offer a range of benefits, such as food production and social connectivity. There has been a growth in studies exploring the potential impact that engaging in these practices has on people's social-ecological resilience. However, none have fully explored those characteristics which can promote and support such relationship. The study aims to provide further understanding about social-ecological resilience and examines how engaging in environmental volunteering has the potential to promote as well as strengthen social-ecological resilience. This relationship is explored through the lens of four characteristics regarded as key attributes fostering resilience in social-ecological systems: activity, self-organisation, connections and skills and knowledge. To examine these characteristics, the study used focus groups interviews, hybrid thematic and descriptive analytical methods. This study is reported from the perspective of local community groups in Greater London (UK) who engaged in environmental volunteering activities as a case study. Overall, this study finds there to be variability in these characteristics explored amongst local community groups. This suggests that the relationship between social-ecological resilience and environmental volunteering is rather complex.

STUDYING RESOURCE EXCHANGE THROUGH ACTOR INTERACTIONS IN THE SMART CITY SERVICE ECOSYSTEM, USING THE SERVICE DOMINANT LOGIC

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Keywords: Sustainable City, Smart City, service dominant logic

Abstract:

The detrimental effects of rapid urbanization have led to the urgent need to reconstruct the way in which cities operate and utilize resources. Smart cities have emerged as a possible solution towards more efficient urban environments. They are considered imperative for a sustainable future. While there is a plethora of research focusing on the technological, as well as the urban aspects of smart cities, there is a dearth of literature on the organisational and managerial issues arising by this rapidly emerging concept. Service dominant logic is applied as the theoretical framework, which views the target domain as an ecosystem. This research studies the interactions in the smart city ecosystem, that is, how smart city actors, namely the university, government, industry and civic society, exchange resources between them through interactions at organisational level. In order to identify these resources, exploratory qualitative interviews with 17 senior staff from representative organisations from the university, government and industry have been performed, while interactions with the civic society have been drawn upon from collected data of the other three groups. These were used to map the dyadic interactions that occur between organisations within the smart city ecosystem.

Early indicative findings of this study, suggest that university actors use urban data sourced from citizens and planning authorities, and funding from industry, to analyse and develop models and theories, while industrial actors appear to use this output and user data to create consumer services. The government appears to be both a regulator and an active player, by addressing emergent topics and providing funds and data. The civic society data has behavioural influence on the institutional norms under which the ecosystem operates.

The mapping of resources exchanged between these actors allows for a more efficient management of smart city organisations and consequently to managerial and organisational urban innovation, which may lead to the improvement of quality of life and well-being for citizens.

Lifecycle Assessment

A LITERATURE REVIEW ON SOCIAL LIFECYCLE ASSESSMENT STUDIES: POTENTIALS, CHALLENGES AND LITERATURE GAPS

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Key Words: life cycle assessment, social sustainability, literature review

ABSTRACT

Society keeps companies responsible of their social impacts on various stakeholders. Many different tools to evaluate social responsibility schemes have been developed and utilized by companies in corporate level. With these tools, a step to standardization of Social Life Cycle Assessment (SLCA) has been taken. While these tools were focused on managing production processes, individual SLCA studies were conducted and tested worldwide in 2000s.

Since there are no global standards for SLCA method and framework individual SLCA studies in the literature are investigated. To understand the development of the method, studies are examined in chronological order. The stakeholder and impact categories in the literature were collected whenever they are available to create the framework of the designated SLCA methodology.

This literature review was conducted to understand the potentials and challenges of SLCA methodology to utilize the method within a holistic sustainability assessment framework that covers ecologic, financial and social impacts of products. Findings of the literature review were used to develop a SLCA methodology to evaluate sustainability of building materials. While the methodology development study was focused on building materials, literature review covers SLCA studies from different industries and since the findings were to be utilized as quantitative inputs for the designated methodology, the literature review was conducted in a systematic way.

DEVELOPING A SOCIAL LIFE CYCLE ASSESSMENT METHODOLOGY FOR HOLISTIC SUSTAINABILITY ASSESSMENT OF BUILDING MATERIALS

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Keywords: sustainability, life cycle assessment, social impact assessment

Abstract

The study aims to develop social life cycle assessment categories for building materials according to databases in the literature for a holistic sustainability assessment methodology. Each decision that is taken to improve energy efficiency of buildings reveals new impacts on society, environment and economy and eventually on sustainable development of the country. Monitoring all these impacts of buildings on sustainable development is a challenging subject. In environmental sustainability domain, life cycle assessment (LCA) method is being performed on buildings as a benchmarking and decision-making tool to measure environmental impacts of a product, service or activity primarily. Although recent LCA studies mostly define sustainability as a holistic approach, they only focus on environmental impacts. Nonetheless, sustainability assessment framework is not complete unless other aspects are included in the assessment as well.

"Three pillars of sustainability" approach has been designated to form a foundation to Life Cycle Sustainability Assessment (LCSA) method that covers environmental impacts that are defined in Life Cycle Assessment (LCA) method, cost implications that are defined in life cycle costing (LCC) method and social consequences that are defined in social life cycle assessment (SLCA) method. Among them, SLCA methodology has the greatest need for development and adaptation. For this reason, the study aims to build a SLCA method based on the guidelines and define assessment parameters based on the databases in the literature. SLCA method has been adapted from LCA to allow performing it within the framework of LCSA.

Sustainability

PRODUCTION OF BIOGAS FROM KITCHEN WASTE

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Akoka, Yaba, Lagos, Nigeria.

Keywords: *Kitchen waste, Biogas, Cow dung, Anaerobic digestion.*

Abstract:

This work dealt with the production of biogas from different sets of kitchen wastes and various tests were run on it. The biogas was produced through anaerobic digestion. The plant that was adopted in this project was the fixed drum types and there were three sets of kitchen waste. The prototype biogas digester was constructed with a paint bucket of 20 litres and the experiments lasted for a combined time of 27 days. From the results obtained, the kitchen waste of set 2 which was mixed with cow dung and water in the ratio 2:5:7 (kitchen waste: cow dung: water) produced 250.69% more gas than set 1 kitchen waste with cow dung and water in the ratio 6:1:7 and 67.5% more gas than set 3 with only cow dung and water in the ratio 7:7. Kitchen waste is the best alternative for the production of biogas as it costs nothing because it help to recycle waste produced in the kitchen.

THE APPLICATION OF VIRTUAL REALITY TO RECREATE AN INTERACTIVE WW1 CAMP

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Keywords: *Cultural heritage, Virtual Worlds, Local history*

Abstract:

It is now one hundred years since the end of the First World War. There has been much interest shown in visiting the battlefields and commonwealth war graves during this anniversary. We must never forget this terrible period of our country's history. However, our own local history seems to be rapidly forgotten. Many areas where the "Pals" units had training camps, or where German prisoners of war were interned are now forgotten, mainly due to housing development and expansion of towns and cities since then.

The application of Virtual Reality (VR) to enable the immersion and recreation of archaeological sites is well known. From ancient Mayan temples to the virtual immersion within a cave in order to interact with cave art by Native American Indians. More recently our museums are digitising fossil collections to put on line, so that they can be viewed in VR, or 3D printed, from anywhere in the world, thus sharing knowledge.

This paper illustrates how, VR can be used to recreate an immersive experience of the WW1 camp at Raikeswood in Skipton. This started as an initial archaeological dig by local school children as part of the curriculum for local history. Subsequent funding received by Skipton council, enabled the production of online web and VR artefacts. The images and information used came from, camp plans and sketches, mainly produced by the prisoners themselves. This information has shown the layout of the camp, prison life, the characters involved and events that took place there.

The funding has resulted in a detailed web site, which shows a time line of WW1 and the events within the camp. There are numerous images and extracts from diaries, including sketches by the prisoners. The VR model of the camp illustrates exactly where the camp was located geographically, the construction and function of each of the buildings and what took place within each major building.

This paper will show how our local history can be conserved and preserved through the application of VR to create a virtual world of the camp.

REDUCING REPEAT OFFENDING BY IMPROVING PRISON ARCHITECTURE

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Keywords: Architecture, Design Influence, Inmate Behaviour, Prison Architecture.

Abstract:

This research paper explores whether improved architecture to prisons is the answer to reducing rates of repeat offending. The aim of the research paper is to investigate the importance architecture plays in reforming and rehabilitation and the effects it imposes on individuals currently incarcerated, and those previously imprisoned. Assisting with the completion of this research paper explores both, the history and evolution of prison architecture and, how these institutions influence the inmate's emotions, thoughts and behaviour. The premise underpinning this study pays attention to the historical and modern design and design approaches of British prisons and the contrast between prisons in the UK and in neighbouring European countries. The data collected in this research paper comprises of both qualitative and quantitative data techniques, sourcing material from Her Majesty's Prison (HMP) Government Statistics and the National Database Statistics (NDA). Qualitative data consists of exploratory research, including interviews and questionnaires gaining knowledge and understanding behind the reasons why inmates reoffend, the opinions of prison staff and the general public, also addressing what motivates the architects to design the prisons the way they have. Interviews will encompass a semi-structured style, identifying trends alike and differences between those interviewed. Reviewing the evidence and examining the British prisons, the study concludes that the physicality and sociology of prison's and their immediate surroundings are spartan and uncivilised, as the study would suggest, prison design is a contributory factor which coerces inmate's into reoffending. Prison researches have identified with statistical analysis that architectural design is associated with misconduct of inmate's behaviours in prisons (Morris, 2010). Fundamental change is obligatory to reducing crime and reoffending inside and outside of prison. Architecture and the design of prison's can be a solution to the sentiment which define and surround imprisonment, reinstating its sole purpose of rehabilitation, reintegration and inspiration.

Retrofit

UNDERSTANDING FACTORS INFLUENCING OVERHEATING: THE UK'S FIRST LARGE-SCALE DOMESTIC PASSIVHAUS RETROFIT

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Keywords: *Climate change, Overheating, Passivhaus, Occupant Behaviour.*

Abstract:

Overheating in dwellings is a major consideration affecting buildings in both temperate climates like the UK, as well as in warmer climates. At the same time, it is recognised that the impacts of global warming and climate change are affecting weather patterns in the UK resulting in many changes, including long periods of hot weather in the summer and warmer wetter winters (Lowe et al., 2018). In order to reduce global CO₂ emissions, fabric improvements are being made to buildings to make them more energy efficient. To achieve these improvements the thermal insulation and airtightness of the building is often improved. The combination of these factors not only serves to retain heat energy during winter heating periods, but it can also result in excessive rises in internal temperatures during the summer, resulting in overheating. This can result in the building occupants' experiencing discomfort and they may even be exposed to temperatures that pose serious health risks for the most vulnerable in society. In order to provide a safe and healthy environment for occupants, we must provide energy efficient dwellings that consider not only current but future climate scenarios. The paper presents the initial findings of a study investigating the risk of overheating in the UK's first large-scale Passivhaus retrofit.

RESPONSIBLE RETROFIT MEASURES FOR TRADITIONAL LISTED DWELLINGS: AN ENERGY SIMULATION VALIDATION STRATEGY

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Keywords: *Building Energy Simulation, Calibration, Cultural Heritage dwellings, Energy retrofit.*

Abstract:

Energy and carbon retrofitting of traditional listed dwellings (TLDs) in the South-East England is much required but faces a multi-faceted and complex suite of issues and problems. A research project has been designed to specifically address those problems. It utilises a mixed methods approach centred around multi-staged dynamic Building Energy Simulations (BES) for selected case studies of TLDs in Brighton and Hove. The cases have been surveyed, modelled and simulated to assess their current energy performance and thermal behaviour as well as potential benefits of responsive and effective retrofit interventions. The use of simulation implies the need for a thorough validation strategy to ensure that the data generation and analysis tool is reliable, valid and replicable in similar or identical contexts. Case studies research allows for an empirical validation, based on the calibration of simulated models with monitored data. For this on-going research project, a calibration strategy has been devised, based on the findings of a critical review of literature. It utilizes energy consumption data as well as temperature and relative humidity data for each case study.

Providing a brief overview of the methodological framework of the research, the paper describes in detail the approach utilised to ensure that the datasets, collected and generated using different sources, corroborate each other. Such validation process aims to generate virtual models capable of accurately representing the real case studies in their status-quo energy performance and thermal behaviour. The calibrated models can therefore be reliably used during the following stages of analysis when the impacts of selected retrofit interventions are to be evaluated.

A SOUTH AFRICAN EXPERIENCE OF BUILDING ENERGY RETROFIT PROJECT CHALLENGES AND SOLUTIONS

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Keywords: *Building, Challenges, Energy and Retrofit.*

ABSTRACT

Delivering building energy retrofit project will bring about economic gains, while enhancing social wellbeing and engendering sustainable development. However, building energy retrofit projects encompass additional considerations and requirements in terms of process, material, expertise, and technology. All these factors constitute complexities in the delivery of the project. In addressing this problem; the paper presents how stakeholders understand implementation challenges in the delivering of projects amongst South African service providers. The case-based study highlighted the challenges, and solution concerning the methodologies that are appropriate in ameliorating the situations.

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