ATTITUDES TOWARDS SUSTAINABLE CONSTRUCTION AMONGST CONSTRUCTION CONTRACTORS

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ABSTRACT

Sustainability is most commonly associated with preservation of the Earth's environment. A common misconception is that sustainable development usually involves the sacrifice of profit for environmental gain. In absence of comprehensive government regulation, this misconception limits potential for wide spread sustainable development. Development that is sustainable from an environmental perspective can benefit users, workers and society, and have positive short or long term economic benefits, a concept known as 'the triple bottom line'. It is the opinion of the authors that, with adequate awareness and education, the social and economic aspects of sustainable development will ultimately drive a comprehensive shift towards sustainable development.

This paper presents the results from two pilot studies that examined the attitudes towards environmental, social and economic benefits of sustainable construction from a 'grass roots' construction contractor perspective. The studies are conducted in the form of questionnaires, asking contractors to rate their opinion and the extent of their practice on a variety of sustainable principals. The questions focus on the environmental aspect in the first study, and on the social and economic aspects of sustainable construction in the second. 55 contractors responded to the questionnaires which consisted of 25 questions each. Attitudes towards the social and economic aspects of sustainable construction were overwhelmingly positive, with around 60% of responses demonstrating positive attitudes. Recent graduates displayed significantly more positive attitudes than experience contractors while questions regarding client demand and attitudes of construction workers were identified as weaknesses. More positive responses from recent graduates may indicate the effectiveness of greater emphasis on sustainability during their time at university in recent years while poorer client and worker awareness may be a product of lack of education regarding the concepts. The results also show that some of the drivers of sustainable development and construction are the availability of green material; financial incentives to clients and contractors; government policy for implementation; and overall environmental awareness within the industry. Furthermore, the barriers identified are high cost that is involved in the process; as well as limited knowledge and low demand of sustainable facilities.

Keywords: Sustainable construction, Australia, environmental, economic and social aspects of sustainability, contractors

1. INTRODUCTION

The ability to build infrastructure enables the human race to manipulate its surrounding and create the optimum environment to progress and flourish. The built environment inherently contributes to the way in which we live our lives, including health, safety, and quality of the surrounding environment. The building industry is a primary driver of our economy and a large creator of employment. Building in a responsible manner with consideration to the social, economic and environmental implications is therefore critical to the progress of mankind and the preservation of our planet.

While environmental consciousness was the original driver behind movement towards sustainable design and construction, the concept of sustainability has been expanded to include environmental,

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social and economic aspects. This concept is known as the 'Three Pillars of Sustainability' or the 'Triple Bottom Line'. The United Nations General Assembly in 1987 defines sustainability as “meeting basic needs of the public and extending opportunities to satisfy their aspirations for a better life without compromising the ability of future generations to meet their own needs”.

The two pilot researches have revealed that sustainable construction can have short and long term environmental, social and economic benefits to users, investors, contractors, workers and society as a whole. It is the research team’s opinion that, through market forces, social and economic factors are likely to drive greater demand for sustainability than environmental consciousness and government policy. Awareness of social and economic factors in relation to sustainable construction is, therefore, critical to wide industry transition from conventional to sustainable construction practices.

The first pilot study investigates the general awareness of construction contractors with regards to environmental aspect of sustainable development. The second pilot study seeks to investigate awareness and attitudes towards social and economic aspects of sustainability amongst construction contractors in Melbourne, Australia. The literature review reveals limited awareness of the social aspects of sustainability, and the research team believes that sustainability is commonly associated with 'financial loss for environmental gain'. The research question seeks to examine the accuracy of this hypothesis and make recommendations to the construction industry and educational institutes based on the findings.

The literature review examines a number of case studies, research papers, news paper articles and government as well as international resolutions in order to identify key elements of sustainable construction. The literature review investigates current knowledge in these areas with focus on past research and the most current state of thinking. The findings will be used to identify areas where the scope of research can be expanded or extended to contractors in the Australian construction industry.

2. SUSTAINABILITY AND CONSTRUCTION

Definitions for sustainable development are abundant in scope and term. According to UN world commission on environment and development (1987), “Sustainable development is development that meets the needs of the present without compromising the ability of future generation to meet their own needs”. According to Bossel (1999), sustainable development is all about ensuring a better quality of life for everyone, now and for generation to come. Sustainable development and construction responsiveness and awareness are escalating around the world. ‘Agenda 21’, introduced in 1992 by the UN summit on environment and development, was the stepping stone of realisation by world leaders and scholars that the environment must be protected for future occupants through the concept of sustainable development (Parkin, 2000a, 2000b).

The growing concerns of the impact that buildings have on the environment in Australia have eventually raise the awareness of the construction industry to implement sustainable practices into the construction process. Implementations of sustainability measures in construction will as such drive sustainable construction in Australia. Sustainable construction is generally described as the application of sustainable development to the construction industry. PAC (2009) refers sustainable construction as "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles".

The construction industry involves a vast amount of stakeholders and these stakeholders are usually referred to as those who produce, develop, plan, design, build, alter and maintain the built environment. Building material suppliers, manufacturers, clients, end users and occupiers are examples of stakeholders that are involved in the construction industry. Based on the brief explanation made above and according to Langston and Ding (2001), it is thus apparent that sustainable construction can be best described as a subset of sustainable development, which encircles matters such as tendering, site planning and organisation, material selection, recycling, and waste minimization.

The construction industry makes many positive contributions to society, but it also has negative impacts on the environment. These include soil erosion, sedimentation, flash floods, destruction of vegetation, dust pollution, depletion of natural resources and the use of building materials that can be harmful to human health (Klang et al. 2002; CIDB, 2007). While these findings demonstrate the significant adverse impact that the construction industry has on the environment, they also reflected the traditional focus on cost control, time and quality over environmental and social performance. The realisation of these impacts has led to the growth of studies on solutions for practicing sustainable

construction across a project life cycle (Tam and Le, 2006). However, the effectiveness of sustainable construction methods has been limited in practice. This limitation is partly due to the profit driven culture in the industry; where cost, quality and scheduling have been the determinants ensuring maximum benefits to the construction firms. Zainul Abidin and Pasquire (2005) outline a number of sustainable principals concerning the construction industry. These include:

- Showing concern for people by ensuring they live in a healthy, safe and productive built environment in harmony with nature.
- Safeguarding the interests of future generations while at the same time, meeting today's needs.
- Evaluating the benefits and costs of the project to society and environment.
- Minimising damage to the environment and its resources.
- Improving the quality of buildings and services and promoting social cohesiveness.
- Using technology and expert knowledge to seek information and in improving project efficiency and effectiveness.

Widespread agreement on sustainable construction does not necessarily result in widespread implementation of its practices. It was argued that although many construction practitioners agreed with sustainability principles, many are yet to grasp their meaning and fewer have translated sustainability into action (Ashley et. al., 2004).

Due to growing global concerns of the issues of sustainability, the government and the construction industry in Australia have taken innovative sustainable initiatives to encourage sustainable construction and development within Australia. Through these sustainable practices, positive outcomes are being realised by building occupiers, users and various stakeholders. Hence, the implementation of sustainable elements in traditional construction is resulting into sustainable development and awareness by different construction participants. The basic aim of the study conducted and reported in this paper is to see level of awareness regarding the sustainable construction of different participants involved in construction industry at various phases and examine awareness and attitudes towards these factors from contractors' point of view as well as the implication for contractors and employees.

3. RESEARCH METHODOLOGY

The pilot studies examine awareness and attitudes of construction contractors towards environmental, social and economic aspects of sustainable construction. A pilot study can be defined as "a small survey taken in advance of a major investigation. The pilot study may show up problems in the organization of the intended major study. It can also give information about response variability that will help determine the size of the major study" (defined in http://www.answers.com/topic/pilot-stud (viewed on 21/11/2010)). Conclusions are based on how respondents answer questions regarding environmental, social and economic merits of sustainable construction and the extent to which these aspects influence decision making within construction firms. By measuring current attitudes and awareness, recommendations were made to the construction industry and measure the effectiveness of the education sector. The study was conducted in the form of a written questionnaire which was sent to respondents in hard copy. Respondents were allowed to fill in the questionnaire in private, and return the questionnaire in person or via mail. Respondents were informed of the confidentiality of the questionnaire and all sections were optional.

The additional reasons for selecting questionnaire survey method of collecting data were:

- **Ease of analysis** – Generic questions make it more efficient to assess and evaluate responses.
- **Time constraint** – Questionnaires allows for a large amount of information to be recorded in the time frame set for this pilot study.
- **Familiarity with questionnaires** – Most people have completed a questionnaire, making the procedure a familiar one.
- **Creates openness** – encourages people to expand on their responses to give in-depth answers.
- **Reduced bias** – The interviewer cannot interfere and be seen as one sided resulting in a non-bias questionnaire response.
- **Less disturbance** – Participants can complete the questionnaire in their own time.

A total of 150 questionnaires were distributed amongst project and site managers working for contractors in greater Melbourne area. Of these, 55 were filled in and returned. Respondents represent a diverse range of age, experience in industry, gender and sectors of the firms. Around half of the respondents have more than 10 years of experience within the construction industry. The studies were conducted in the form of two questionnaires containing 25 different questions each.

The questions were developed through the extensive literature review and authors experience within the industry. The questionnaires focus on environmental, social and economic aspects of sustainability and asks participants to either rate their opinions on a scale from “strongly disagree” to “strongly agree” or rate the extent to which they utilise various sustainable practices from “never” to “always”, based of question presented using a five-point Likert Scale.

4. RESULTS AND ANALYSIS

The first pilot study investigates the general understanding and perception of contractors regarding the environmental aspect of sustainable development. Below mentioned are some of the questions with discussion and analysis.

The responders were asked regarding their perception of the biggest driver of sustainable development. In contractors perception the financial incentives and availability of green materials are the biggest drivers. On the other hand, government policies have been rarely considered in sustainable developments. Although sustainability initiates from the design stage, builders are pushed to utilize green materials in their development stages despite the availability. Building a sustainable development is expensive and for builders to make use of green materials, financial incentives must be granted. Such example includes the insulation rebate to encourage insulation companies to not only promote their business however to market the free insulation rebate from the government.

The question which talks about the importance of the sustainable development, an unanimous response was received from all respondents who agree that by incorporating sustainability into their mission statement, it provides them with a goal to achieve. Some contractors declared that if society fails to reduce greenhouse emissions, it will lead the environment to acceleration of climate change. Although Victoria has its own regulation (starting from July 2004, all new homes will be required to meet the new 5 star standard’), the companies will need to accept these regulations as well as incorporating the significance into the company itself to enable the environment to advance to a “greener” future.

The next question explores the projects in which the sustainable initiatives have been overlooked due to cost. 75% of contractors responded that sustainable initiatives have been argued upon the bases of costs involved, as such they could not add any further sustainable initiatives due to sales performance. From the data obtained, it is assumed that the other 25% do not look at the costs involved and focus only on the future and its effect on climate change.

Another question investigates from the respondents their involvement where sustainable initiatives have been used. Contractors unanimously mentioned that they have incorporated sustainability initiatives into their past projects however it is not all doom and gloom. Many contractors perceive that by complying with the legislation can offer significant reductions in the bottom line of costs while at the same time significantly improving the negative effects on the environment and amenity/comfort of any facility. The next question explores the determination of the respondents to incorporate sustainable initiatives into their future developments. From contractors’ perspective, 50% stated that they would implement sustainable initiatives into future developments, while 50% stated that they did not know, or were unsure.

The next question was about the perception of the respondents about whether the government intervention and mandate should be implemented in Australia in regards to sustainable buildings. The response from the builders was mix and 50% stated in favour of government intervention and mandate while 50% stated they were unsure. One respondent stated that it all depends on location, which is not comparable to the question.

One of the questions explores whether the government incentives provide a good reason for the respondents to invest in sustainable initiatives. All responded stated that they believed government incentive provides good reason for them to invest in sustainable initiatives in partnership with their clients. One respondent commented that they could reclaim the cost and offer their clients better service at a better price. Here, they could see that incentive translates into dollars. 100% of the builders and subcontractors stated yes to government incentives. They commented it would help with

rebates on rendering and cost effectiveness. They can translate the cost effectiveness and rendering to mean dollar to end sales revenue.

For the question that investigates the availability of sustainable material in the market, 25 % of the contractors stated that sustainable materials were readily available on the market, while 75% stated they were not. The two comments stated that they were too expensive and one commented that it was too expensive compared to other countries. This shows that Australia may be lagging in sustainable buildings due to cost to implement these green practices.

The next question explores the perception of the respondents about the return on investment of sustainable buildings compared to conventional buildings. 75% of contractors believed that sustainable building provides good return compared to conventional buildings and 25% said they did not. This could be due to many reasons, such as experience in the field, skill set to make this informed decisions, location of the builder and personal experiences and personal ownership status.

The last question explores any mechanism that was in place in the companies to capture good practice/lessons learnt and the process of feed these back to subsequent projects. 50 % of the clients are not sure as to whether their companies have mechanisms in place to capture good building practices and collect lessons learnt due to the clients being the occupier of the building. However, some clients think that by having good mechanism in place will help better the sustainable design concept in the industry. The builders' responses states that majority of the building industry (50%) have not got any sort of mechanism in place in there company to capture good practice standards due to the time limitation and financial constraints they face in their business. More emphasis should be given in the sector due to the major area which implements the building methods. However, 100% of the developers think that they have mechanism in place. 50% of the Professional said that there did not have any mechanisms in place in the company for good practices and lessons learnt. Whereas 25% of the Professionals in the sector said they had set mechanisms in place such as 'A' graded buildings methods and standards. The remaining of the 25% of the respondents said that there were not sure if there is any mechanism that there company have to capture good practice standards.

Based on the response from the respondents obtained through the first pilot study, it is evident that there are many reasons that underlies the low level of sustainable development and sustainable construction within Australia. The following will as such briefly describe the elements that drive as well as prevent the rapid growth of sustainable development and sustainable construction within Australia. The results were used as the basis for the following findings.

- ***Drivers of Sustainable Development and Construction***

Through the findings, the researchers identified that the drivers of sustainable development and sustainable construction vary between different contractors in the industry within Greater Melbourne. This is because of the different sector and areas that the contractors deal with. For instance, builders who deals with the construction process of the sustainable construction believes that green material availability and availability of financial incentives are two factors that will increase the total number of sustainable construction within Australia. Other drivers that were discussed and are believed to be significant aspects of sustainable development and sustainable construction includes government policy, environmental awareness, stakeholder preference, social issues and financial savings.

- ***Barriers of Sustainable Development and Construction***

The analysis of the result portrays that the main barrier of sustainable development and sustainable construction is the high cost that is involved in the whole construction process as well as the lack of government financial incentives and rebates. Other barriers that all the contractors believed that hinders the increase of sustainable construction and development within Australia includes the limited knowledge about the term sustainability, lack of general sustainability awareness, insufficient green materials in the market and low demand of sustainable development. Apart from the above drivers and barriers findings, the research study also found that limited sustainable initiatives have been implemented by the different industry stakeholders in today's construction of buildings. This is purely due to the overall reasonable awareness and know-how of the issue of sustainability in the development and construction sector as well. As such, there is a need to provide a more in-depth education and training for industry stakeholders in general in relation to the fundamentals of sustainability in construction. The researchers perceive that with the increase of education, training and understanding of the issue of sustainability within the key stakeholders in the industry, it will eventually enhance the integration of sustainable practices in the future construction and development.

The data from second pilot study indicates overall positive attitudes towards the social and economic aspects of sustainable construction contractors. Attitudes towards the social aspects of

sustainable construction were slightly more positive than attitudes towards economic aspects. This contradicts claims in the literature review that there is little awareness of social aspects due to difficulty in measuring them. However, the 'guilt factor' may have influenced respondents into ranking social benefits of sustainability higher than economic benefits.

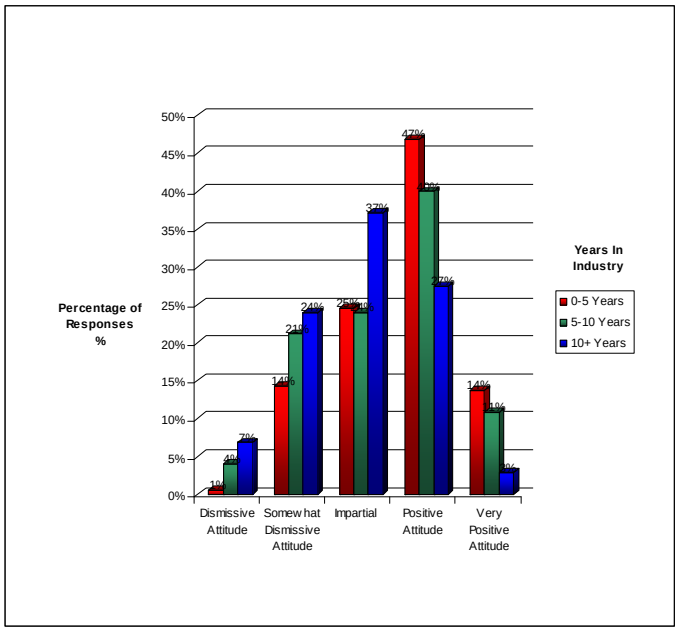

Figure 1: Impact of years in industry on attitudes towards social and economic aspects of sustainability amongst construction contractors

Respondents with fewer years of experience in the construction industry demonstrated a more positive attitude towards social and economic benefits to sustainable construction. A large portion (68%) of more experienced contractors were either impartial or hold negative/dismissive attitudes. Cultural changes and a higher emphasis on sustainability in the education system over the last decade may explain these findings. In the following sections, some of the questions are presented along with their response and analysis from the authors.

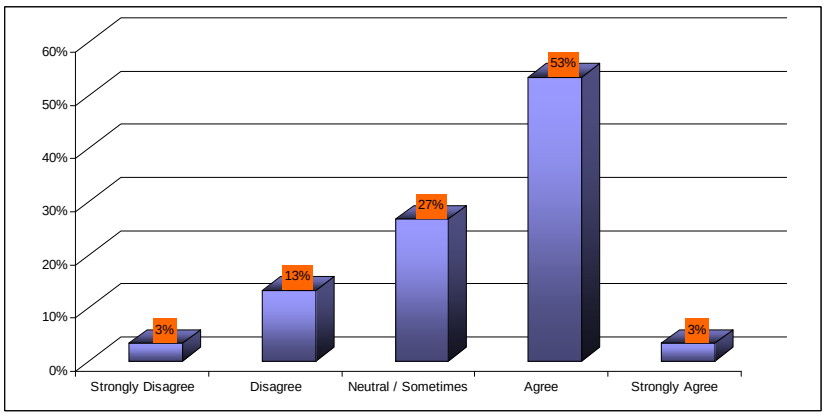

Figure 2: Question 1: Commitment to sustainable construction practices is an important factor in the selection of sub-contractors

Results show 56% of contractors surveyed agree that sustainability is an important factor in the selection of sub-contractors which is positive feedback, however although that is a strong percentage there is room for improvement throughout the industry. This figure is showing a positive attitude towards sustainability and, although it is the supply chain of the construction process, it can be argued that this is extremely effective. It is a direct and effective way for builders / project managers to make a substantial difference in their sub-contractors on-site actions and forces a positive change in their behaviour & culture in regards to sustainability. 27% deemed themselves to be 'neutral' while 16% disagreed or strongly disagreed. This may be due to their lack of knowledge & awareness on

sustainability or possibly their company does not have a stance on the issue. This demonstrates room further education within the industry on sustainability and sustainable practices.

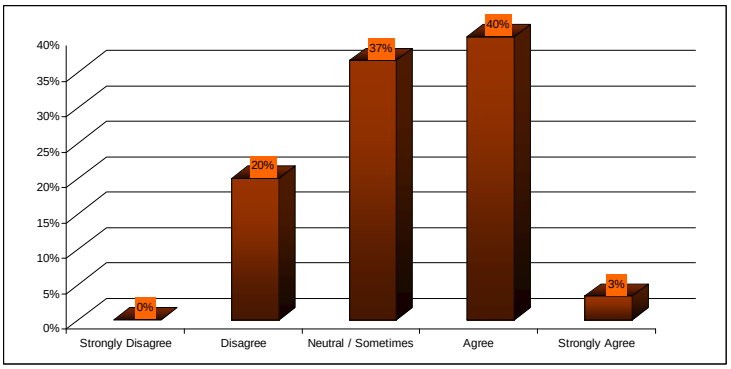

Figure 3: Question 2: Sustainability is incorporated in all aspects of the design process.

Incorporating sustainability into all aspects of the design process lays the foundations for all stake holders & contractors involved from the beginning. This is the most proficient and effective way of outlaying sustainable principles & practises throughout the project because it captures everything from the beginning and creates a standard of the expectations for all involved. From a construction point of view, it makes easier incorporation of sustainable features in the proposed building as well as assisting waste management, recycling of materials, etc. 43% of respondents agreed that they incorporate sustainability in all aspects of the design process, this is a substantial figure although there is still opportunity for improvement in the industry.

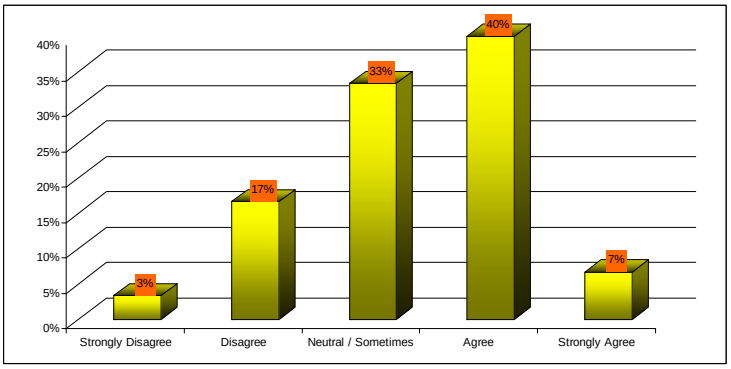

Figure 4: Question 3: Clients drive demand for sustainable construction

The largest portion of contractors answered in either ‘agree’ or ‘strongly agree’, being 47%, compared to the 20% of contractors who answered in ‘disagree’ and ‘strongly disagree’. Our results support overseas studies, such as Zainul-Abidin and Jaapar (2010), who investigated the awareness and application of sustainable construction concept by Malaysian developers. In Victoria, like in Malaysia, it is believed that substantial demand for sustainable construction comes from the client. The 33.3% of contractors who remained neutral presumably did not have a strong opinion on the matter. This could be due to the wording of the question. Another way the statement could have been worded is; “Sustainable construction is driven by the client”. If neutral was not an option, the results may have been different. The neutral response may have also been due to a lack of knowledge on the topic.

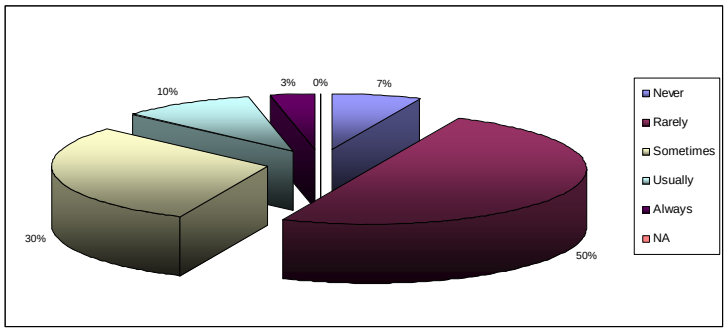

Figure 5: Question 4: Your company would sacrifice profit to achieve wider social & economic sustainability objectives

From the results to this question it is evident that in Australia, particularly Victoria, contractors are not willing to sacrifice profit to achieve wider social and economic sustainability objectives. Given the answers to another question, that the clients are not willing to pay premium prices for sustainable practices, it falls back on the contractor to make this sacrifice to their profit in order to achieve sustainable construction. With the contractors being hesitant to make this sacrifice, government policy is necessary to drive sustainable construction.

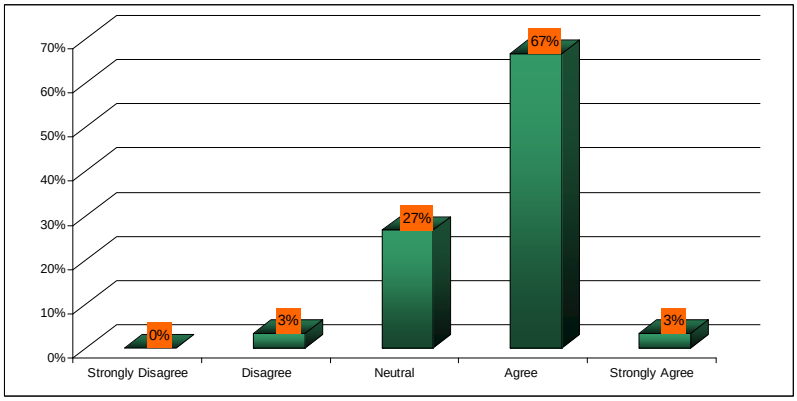

Figure 6: Question 5: Sustainable buildings have a reduced life cycle cost

These results suggest some consensus amongst contractors that sustainable buildings do in fact have a reduced life cycle cost when compared to similar but non sustainable buildings. Zero respondents stated they strongly disagreed and only 3% disagreed and thought that sustainable buildings had higher life cycle costs than non sustainable buildings. 70% of those surveyed either agreed or strongly agreed. These responses are consistent with the findings of a 2003 study conducted by Kats et al., into the life cycle cost of sustainable commercial buildings. The challenge for the contractor is to communicate these long term financial benefits to the client in order to encourage short term financial sacrifice for long term economic gain.

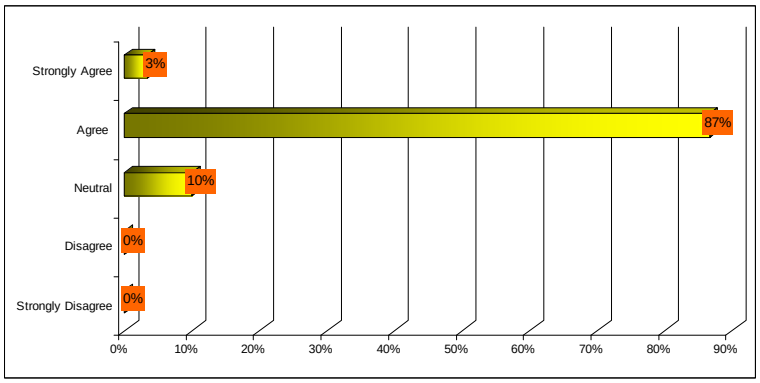

Figure 7: Question 6: Social and environmental consciousness has brought innovation within the construction industry

This question produced the most uniform results of the survey with 90% of the contractors agreeing with the statement. This result indicates a positive overall attitude amongst contractors towards sustainable construction. 10% of contractors did however disagree with the statement. This indicates that some contractors completely dismiss the merits of sustainability, which is somewhat surprising given the current state of research and media coverage on the issue.

No respondents disagreed with the statement in Figure 8. There was a significant number who either returned neutral replies or didn't respond at all (38%). The remaining contractors survey (64%) either agreed or strongly agreed that sustainable buildings have a higher rate of return on the initial investment when compared with non sustainable buildings. These results support those of Question 5 regarding the life cycle cost of sustainable buildings. This indicates potential for a large market for sustainable buildings. As the awareness of sustainability increases, so will the competitiveness of the market forcing prices up and resulting in even higher return on the initial investment. This is also likely to push supply and create larger industry shift towards sustainability. The responses reflect positively on contractor awareness of economic aspects of sustainability.

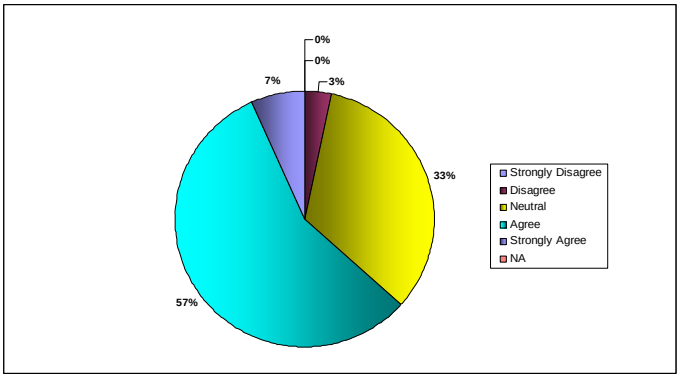

Figure 8: Question 7: Sustainable buildings have higher return on investment compared to those of non-sustainable buildings

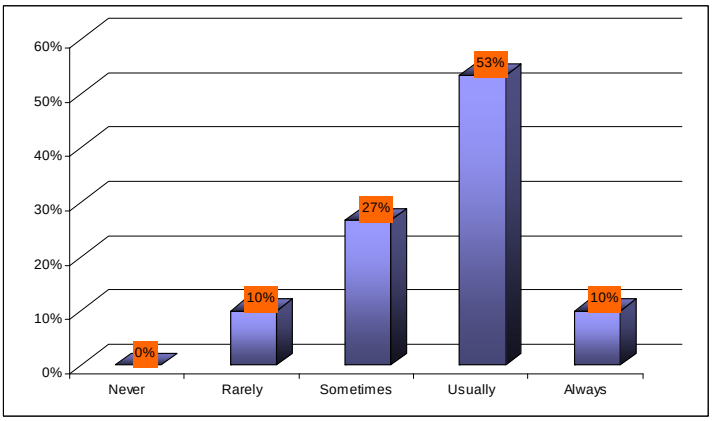

Figure 9: Question 8: We help employees and sub-contractors to update and acquire new skills

This question gauges the contractors opinions of themselves and whether or not they, as a company, help and encourage their employees or sub contractors to further their education and keep updated with acquiring new skills required for the job. 63% of respondents feel that they did assist employees with acquired new skills and continuing their professional development in the industry. 20% of contractors surveyed returned a negative reply, these contractors believing that they were not doing enough in helping employees learn knew skills. The fact that they recognise this problem is somewhat encouraging. Khalfan (2006) recognises employee development as a social aspect of sustainability.

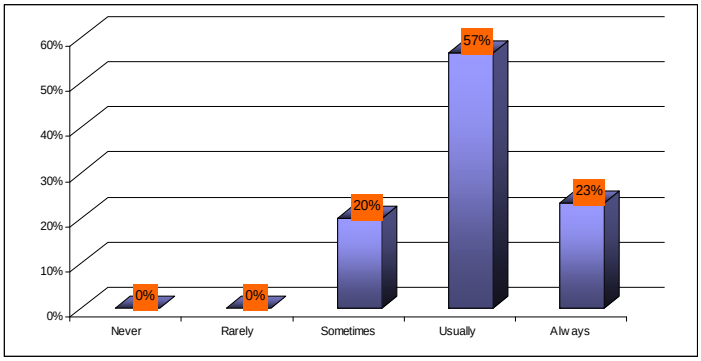

Figure 10: Question 9: We involve local sub-contractors and suppliers on our projects

The use of local sub-contractors and suppliers can also be more environmentally sustainable than non-local ones. Non-local labour and materials implies the need for extra transportation with causes excess emissions. This can be seen clearly in the journal by Morel, et.al. (2001) who stated that the use of local materials in their case study reduced the impact of transportation by 453%. 80% of responses to this question said they 'usually' or 'always' involve local sub-contractors and suppliers on their projects. There were zero response for both 'rarely' and 'never'. This is again a very positive result which demonstrates that construction contractors are using local sub-contractors and suppliers in their projects. The use of local sub-contractors and suppliers promotes local economic growth and provides construction organisations with other economic benefits such as improved public image and relations;

These figures are also very positive from an environmental sustainability point of view. Our literature review reveals that the use of local materials in a project can significantly reduce emissions mainly due to the reduction in transport. Using local materials also ensures that materials are coming from sustainable sources that utilize proper extraction methods as opposed to international materials that may have less strict guidelines and therefore may be cheaper. Further research is required to discover whether or not the local suppliers being utilised by contractors are indeed using local materials. Data would also need to be gathered on whether or not local materials are being used would affect the decision making of contractors when selecting a supplier for a project.

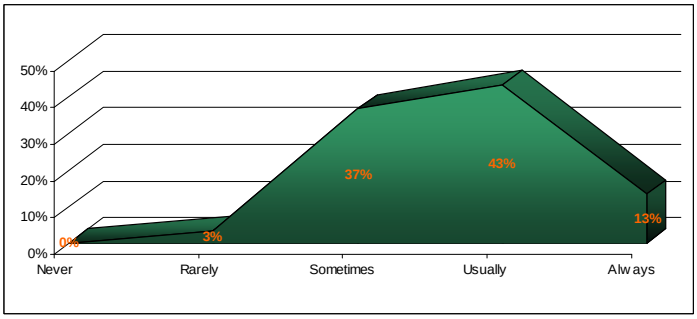

Figure 11: Question 10: We aim to create jobs for local people on our projects

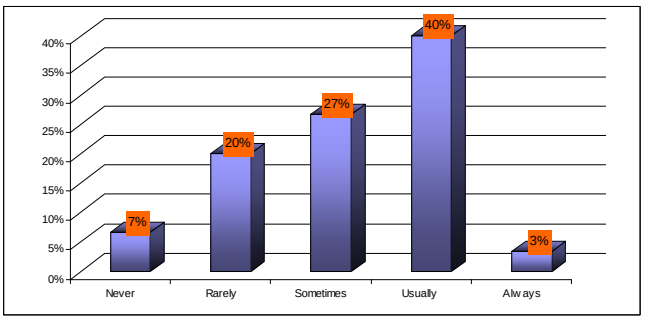

Figure 12: Question 11: We create trainee positions for people from the local community on our projects

The results of question 10 show that almost all contractors aim to create local jobs on projects

'usually' or 'always'. Only 1 contractor responded that they 'rarely' try to do so. The results of question 11 show an almost perfectly even spread of data. It is difficult to draw conclusions from this data and therefore further research from a larger sample pool is required.

Overall the results of these two questions suggest that the majority of construction contractors do have an awareness of economic sustainability and do have a positive attitude towards it. It also shows that there is plenty of room for improvement as there were still a large proportion of 'sometimes' and 'rarely'. Community development is typically seen as the responsibility of the government which may lead to some organisations rarely actively contributing towards it.

Education of the benefits of creating local jobs and trainee positions such as business development and public image should be portrayed to those contractors that rarely or sometimes aim to contribute towards economic development. Further research is needed to understand why contractors would not always aim to create local jobs and trainee positions on projects so that the trend can be reversed.

The majority of responses to question 12 were for 'usually' and 'always' with a combined 62% of responses. Some contractors did respond with 'rarely' and 'never' with a combined 17%. These results show indicate that the majority of organisations from which the surveyed contractors are from do have equality and diversity policies in place which shows awareness and a positive attitude towards social sustainability. The research from our literature review showed that social aspects of sustainability are often ignored so this result is somewhat surprising. The fact that Australia is such a diverse country and has much stricter laws regarding to social equality than other countries may explain why our results differ from our research gathered from international journals.

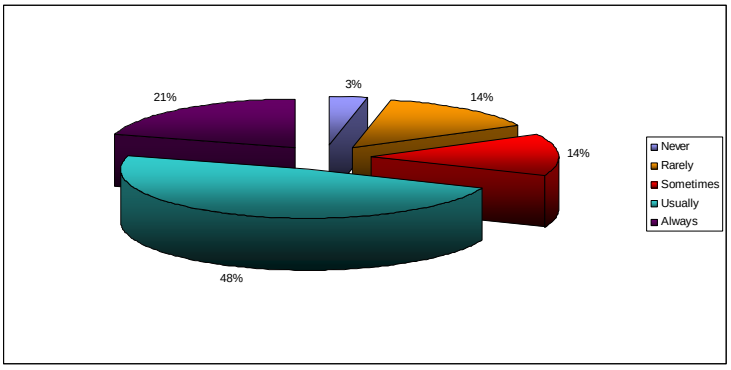

Figure 13: Question 12: We have equality and diversity policies in place, which is also translated on our on-going projects

While the results indicate that social policies are common in the construction organisations surveyed it is unclear how they are maintained or if they are maintained at all. Further research would be required to better understand how these policies are policed and how they impact on other aspects of social sustainability such as job security and job satisfaction.

The study found an overall positive attitude and fairly high level of awareness towards the social and economic aspects of sustainable construction. The majority of respondent agreed to 16 out of 25 statements that favourer social and economic aspects of sustainable construction, while also claiming that they usually utilise these practices. 5 of the statements received an overwhelmingly 'neutral' approach while 4 received a negative or 'disagree' response.

Respondents demonstrated positive attitudes to the use of recycled materials and effective waste management. They recognised the cost effectiveness of using locally sources labour, and claimed commitment to the practice. Life cycle cost benefits of sustainable design were recognised and respondents claimed that sustainable practices improve their competitiveness. The majority of respondents also claimed that they have adequate knowledge in sustainable construction, that they are active in education employees and sub contractors and that they are committed to sustainability. The majority of these areas of sustainability have positive financial implications to the contractors, which may explain the high level of awareness and positive attitudes towards these aspects. These finding may imply that free market forces are a strong driver to a broader shift to sustainable construction.

Particular areas of poor performance include workers attitudes towards sustainable construction, the incorporation of sustainability in the design phase, and the willingness of clients to pay premium price to implement sustainable practices. A possible explanation for these results is a lack of education amongst both clients and workers in regarding sustainability. These factors pose significant challenges

to the future of sustainable construction within Australia and can only be mitigated through broader education. From the observation from this pilot study and our literature review, our research team can make the following recommendations.

5. CONCLUSIONS

Higher education sector should take greater measures to educate workers and sub-contractors about sustainable construction practices. As workers and subcontractors rarely have a share in the cost saving aspect of sustainability, contractors should provide extra incentive for workers to actively seek these practices.

While the surveys reveal significant financial benefits of sustainable design to the end user, responses reveal a lack in client demand for sustainable buildings. Contractors should take measures to improve client awareness of these benefits which should also be advocated in the higher education system and through government campaigns. It is also important to obtain sustainable design prior to the commencement of the construction in order to create green buildings. Sustainable design assists in making the right construction solutions, for instance in terms of materials selection, building orientation, costs and lighting system. In order to identify the building performance of buildings in Australia, an array of building assessment tools have been developed in Australia.

Responses also indicate a lack in incorporation of sustainability in the design phase. Past research reveals that early incorporation of sustainability is the deciding factor in construction cost. This has significant bottom line profit implications for contractors who should take greater measures to ensure early incorporation of sustainability.

It is clear that sustainable construction is a vital aspect when creating sustainable development. As such, cyclical construction lifecycle should be adopted instead of the traditional linear construction process. The triple bottom line which involves the social, environmental and economic factors are fundamental issues that needs to be identified and incorporated in sustainable construction to ensure that a sustainable development is formed. Sustainable development and green building provides a large amount of benefits as it has minimal environmental impact, enhances indoor environment quality to improve the well-being as well as productivity of the occupants and it also allows for great financial savings. Due to its many advantages, Australia should as such further increase its awareness and concern of the incorporation of sustainability practices in conventional construction.

Besides that, it is also important to obtain sustainable design prior to the commencement of the construction in order to create green buildings. Sustainable design assists in making the right construction solutions, for instance in terms of materials selection, building orientation, costs and lighting system. In order to identify the building performance of buildings in Australia, an array of building assessment tools have been developed in Australia based on UK’s BREEAM methodology. This building assessment system provides the stakeholders and building occupiers with an analysis of the building characteristics and performance. In addition to environmental aspect, social and economic aspects of sustainability as discussed in this paper should not be ignored.

Hence, sustainable practices must be adopted by stakeholders within the construction industry to ensure that more sustainable development is achieved in the future. The Australian Government must play its part and move towards the realization that sustainable issues are not just a notional debateable issue, but a minimum standard of living for every Australian in the public, private and community sector. Development Agencies, sole developers, builders, subcontractors, designers, architects, clients and many more in the whole construction industry must be rewarded through fiscal and economic policy for implementing sustainable policies and initiatives in construction, development, refurbishment and design.

According to the responses provided, the majority of the contractors are aware of the issue of the triple bottom line (social, environmental and economical), sustainable development is still regularly neglected in Australia due to the involvement of high construction cost and the lack of readily available green material in the market. Hence, in the future, when there is an increase of green materials in the Australian market together with the availability of government incentives as well as rebate, the construction cost will be reduced. These factors will ultimately boost sustainable construction and sustainable development in the near future in Australia.

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