

University of Southern Queensland
Faculty of Health, Engineering and Sciences

**Critical Factors Affecting Sustainability in Australian Civil Construction
Industry: An Investigation into Sustainability Culture**

A dissertation by

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Abstract

Keywords: Environmental Sustainability Culture, Organisational Culture, Civil Construction

The civil construction industry has a negative effect on the environment through the use of raw materials, energy consumption, waste production and CO2 emission output (Marrero et al. 2020).

The aims of the research were to:

1. Determine the status of environmental sustainability culture, at an operations level.
2. Identify root causes of any deficiencies in the environmental sustainability culture.
3. Identify and recommend potential solutions.
4. Develop a best practices policy for environmental sustainability.

A focus on organisational culture is key to an organisation achieving high performance at all levels. When an organisation develops a weak environmental sustainability culture, environmental incidents unconsciously become an acceptable norm among the members of the organisation.

This research investigates environmental sustainability culture at an operations level rather than at management level. The participants are currently employed by a civil construction and labour hire company and working on civil construction projects within Australia.

Quantitative and qualitative data was collected through a survey and one on one interviews with operations level civil construction employees. The interviews were done using zoom. Each participant was asked five semi-structured questions in order to collect the required information with limited prompting. The responses were collated, categorised into common themes and analysed.

The research has determined that the current environmental sustainability culture is a reactive culture with some elements of the more pro-environmental, active culture. The research has identified several root causes leading to the current sustainability culture within the Australian civil construction industry and made a number of recommendations for improvement.

Although there are several issues relating to sustainability culture within the Australian civil construction industry, there is a growing trend and consciousness towards sustainable practices.

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I further certify that the work is original and has not been previously submitted for assessment in any other course or institution, except where specifically stated.

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Chapter 1 - Introduction

1.1 Outline of the study

This qualitative study investigates the level of environmental sustainability culture within the civil construction industry. The need for this study was identified as a result of experiences as an operations level employee working on civil construction projects for the mining industry in remote areas of Western Australia.

The focus of the study is on the experiences and perceptions of operations level employees i.e. those employees who do the physical work required for a project. A civil construction company that provided labour hire, was identified and approached for participation in the study. Twelve operations level employees working for this company and working on various projects were enrolled in an interview-based survey that investigated their understanding of environmental sustainability; the training provided by the company to educate them in environmental sustainability and their perception of the importance the company placed on a culture of environmentally sustainable development. The research objectives are detailed in 1.4 Research Objectives.

1.2 Overview

Globally, the construction industry is one of the major polluting industries with between 30% and 40% of the global environmental burden being the result of the construction industry as a whole (residential, commercial, and civil) (Marrero et al. 2020). This negative effect on the environment results from the use of raw materials, energy consumption, waste production and CO₂ emissions (Marrero et al. 2020). In 2013, the Australian civil construction sector produced 58.1 Mt of CO₂ emissions. This accounts for over 55% of the Australian construction industries emissions and over 10% of the country's total carbon footprint (Yu et al. 2016). Current research on climate change shows that if action is not taken to reduce the human-induced impact on the environment, the environment will suffer irreversible damage (Solomon et al. 2009).

In order to minimise the impact of construction projects on the environment, many of the leading construction companies, both Australian and international, have environment policies and environment management plans in place in an attempt to achieve environmental sustainability. However, these will not have traction unless the company develops a pro-environmental sustainability culture. It is therefore important that all facets of the construction industry address the issues of environmental sustainability and that all participants recognise their role in this. A positive environmental sustainability culture, on all levels, is important in the effort for civil construction companies to truly achieve sustainable development. As identified by Cameron and Quinn (2011),

focus on organisational culture is key to an organisation achieving high organisational performance at all levels of the organisation with a total quality management approach.

As with any learned behaviour, when an organisation develops a weak environmental sustainability culture, environmental incidents such as oil spills or over clearing of land, unconsciously become an acceptable norm among the members of the organisation (Aarts & Dijksterhuis 2003).

For many years environmental sustainability appears to have been neglected by the civil construction industry. There may be a number of reasons for this including a strong focus on workplace health and safety, budgeting constraints, time constraints, lack of education on the issue of sustainable development and/or not being a priority for the client. By neglecting the importance of conscientious sustainable practices, organisations develop a weak environmental sustainability culture.

Following several years working on construction sites, I have identified the need to investigate the current status of environmental sustainability culture within the civil construction industry. In many instances, the difference between the desires of the client, the policies of the head contractor and the actions taken by those working at the operations level did not align. The purpose of this research is to determine why this occurs and what can be done to improve the situation.

This study investigates the current understanding of, and attitudes towards environmental sustainability within civil construction companies. I propose that without a positive environmental sustainability culture within the organisational culture, and effort from all members and major stake holders, the negative environmental impact of projects will increase significantly.

1.3 The Problem

Many elements of a construction project can have major negative effects on the natural environment. These issues can include waste generation, emissions from machinery, damage to flora and fauna, contamination of waterways, oil spills, noise pollution, and more (Kulahcioglu, Dang & Toklu 2012). It is important that all practicable efforts are made to reduce the negative effects of these activities, and in many cases to adopt practices that reduce a project's impact on the environment. The burden of minimising these negative effects needs to be shared among the stake holders of each project. This includes, but is not limited to, the client and the head contractor, but also all members of the construction team (Pitt et al. 2009).

The broader aim of the research is to identify the current status of organisational environmental sustainability culture at an operations level within the civil construction industry. Further aims of the research are to identify the cause/s of any perceived deficiencies within an organisation's culture. For example, is the company saying

it is at the forefront of sustainable development when in fact it is pushing employees, behind closed doors, to get the work done no matter the cost or consequence. Or is the responsibility for maintaining sustainable development considered 'outside my pay grade' by operations level employees. Or is the education and knowledge level of operations-level employees inadequate on the topic of sustainable development.

Through the identification of the current status of organisational culture in relation to sustainable development and the identification of any deficiencies, it will be possible to develop an action plan. The action plan will aim to make improvements to organisational culture, in relation to sustainable development. Therefore, potentially reducing the negative effects of civil construction projects on the natural environment.

1.4 Research Aims

The aims of this research are to:

- 1. Determine the current status of the environmental sustainability culture, at an operations level, in relation to sustainable development:** Organisational culture plays a major role in the way employees adhere to regulations and policies. This paper aims to determine the current status of environmental sustainability culture at an operations level.
- 2. Identify root causes of any deficiencies in the organisational culture in relation to environmental sustainability:** There is always room for improvement within any organisation. This paper aims to identify any deficiencies in the environmental sustainability culture and investigate the root cause leading to each deficiency.
- 3. Recommend potential solutions:** Through an understanding of the current level of environmental sustainability culture and a comparison with the current industry standards and environmental sustainability best practice policy, the research aims to develop strategies to improve levels of environmental sustainability culture and build upon strategies that currently produce high level environmental sustainability culture.
- 4. Develop a best practices policy for environmental sustainability:** Different construction companies place importance on different elements of sustainable development. This paper aims to take the highest standards of each element of environmental sustainability from several large Australian and international companies and compile them into a best practices policy for environmental sustainability within the civil construction industry.

Although the literature review has identified these aspects to be of great importance to the environmental sustainability. The paper does not aim to determine the physical effects and quantitative data of a construction project on the environment. This data set would become too broad and its role in determining the environmental sustainability culture at an operations level is limited.

Research of a similar type would be useful at all levels of the supply chain in civil construction projects to identify any other areas requiring improvement. This, coupled with implementation of the recommendations for improvement, would allow for a reduction in a current research gap. Recommended future research will be expanded upon in Chapter 4 – Results and Discussion.

The outcomes of this study will be used for the development of educational material to help minimise the negative environmental effects of civil construction project through the improvement of an organisation's environmental sustainability culture.

Chapter 2 - Literature Review

This literature review introduces and analyses the relevant material currently available on the different aspects of organisational culture, sustainable development, the activities within civil construction projects that may have an effect on the natural environment and the current environment standards and practices that are adopted by civil construction companies both in Australia and internationally.

The literature review will also be used to determine the most appropriate data collection methods and criteria for analysis for this research.

2.1 Organisational Culture

The term organisational culture and its key components can be ambiguous. For the purpose of the research the most fitting description is that of Schein (2017, p. 6)

“the culture of a group can be defined as the accumulated shared learning of that group as it solves its problems of external adaptation and internal integration; which has worked well enough to be considered valid and, therefore, to be taught to new members as the Correct way to perceive, think, feel, and behave in relation to those problems. This accumulated learning is a pattern or system of beliefs, values, and behavioural norms that come to be taken for granted as basic assumptions and eventually drop out of awareness.”

Organisation culture plays a significant role in any organisation, whether there is a deliberate focus placed upon it or not. An organisation’s culture is identified not only by the values held by people within an organisation, but also by the way they act, think and feel. Organisational culture is shaped by the socially shared ideas, beliefs, and desires of the individuals and the organisation as a whole (Alvesson 2012).

2.1.1 Characteristics of Organisational Culture

There are many different characteristics that account for an organisation’s culture, Robbins (2019) has identified seven primary elements that encapsulate this. These are:

1. Innovation and risk-taking
2. Attention to detail
3. Outcome orientation

4. People orientation
5. Team orientation
6. Aggressiveness
7. Stability

Although comprehensive, this list neglects to include the organisation's environmental sustainability orientation. The definition of environmental sustainability orientation developed for this research is: The degree to which management and employees focus on engaging in environmentally sustainable practices.

As social awareness of environmental factors grows, organisations are required to act to address these issues. Identifying environmental sustainability orientation in terms of an element of organisational culture and adding it to the seven primary elements of organisational culture, allows not only for an organisation to place a greater focus on environmental sustainability, but also allows for research and analysis into the current status of an organisation's sustainability culture.

As organisational culture is the collective perception of the organisation's members across all levels of involvement, it would be easy to consider organisational culture as being uniform (Frost et al. 1991). This however becomes increasingly difficult to maintain as organisations become larger or decentralised. The strength of an organisation's culture can determine an organisation's long term success or failure. Malhotra, Majchrzak and Rosen (2007) identify the keys for building stronger culture in line with the organisation's values as including: articulating a vision, communicating the organisation's vision with passion, setting an execution plan for the organisation's vision, forming coalitions of believers, aligning members of the organisation with the organisation's vision, and moulding the organisation's culture by articulating operating values.

Understanding how cultures can vary between different departments within the same organisation, or when members are decentralised, can help to identify why there are any shortfalls within an organisation's environmental sustainability culture. This is particularly relevant within civil construction due to the nature of the work, where projects can be spread far and wide, vary in length, and project teams are comprised of not only direct employees of a company but also sub-contractors and labour hire workers.

Decentralised organisations must place greater importance on a strong, positive organisational culture. Employees working in teams remote from the central hub of the organisation are at risk of developing a sub-culture and greater allegiance to their team rather than that of the organisation (Malhotra, Majchrzak & Rosen 2007).

2.1.2 Informal vs Formalised Organisational Culture

Formalising organisation culture can make an organisation's culture feel unauthentic and forced, however the use of mission statements and other written policies on topics such as environmental sustainability provides clear guidelines on the desired direction of the organisation's culture. The use of formalised documents that define an organisation's position on environmental sustainability would greatly benefit research and analysis of the current position of an organisation's sustainability culture. It would also provide insight into areas that are potentially the reason for shortfalls between the desired position and the actual position (Schein 2017). Informal organisational culture is less structured. This allows members to feel like they are not being told how to think, feel and act. Although natural organisational culture lacks formalised documents, it is still able to be influenced. This can be achieved through the influence of leaders at different levels of the organisation (Schein 2017).

The organisational culture is defined by the actions and behaviours of its members. The way members behave in particular situations are referred to as situational norms. As suggested by Cialdini, R.B. and Trost (1998) situational norms are influenced by the way people believe others will perceive their actions. For this reason, members of an organisation will act in a way they believe fits the current situation or environment based on the influences around them. Cialdini, Robert B., Reno and Kallgren (1990) used 3 scenarios to determine how people would dispose of litter. Each scenario provided an environment with different amounts of litter already present, and participants were observed to see how participants would dispose of their litter.

Organisational culture, once embedded into the daily activities of a company, can result in developing the 'situational norm' (Aarts & Dijksterhuis 2003). This is a response generated by an association between the environment a person is in, and the normative behaviour that is associated with it. Aarts and Dijksterhuis (2003) use the example of people having an automated response of becoming silent as they enter a library. This situational norm could be compared to construction workers no longer requiring prompting to use personal protective equipment in the working environment. This research will be used to determine the way in which operations level employees behave in relation to environmental sustainability and inform how an organisation's environmental sustainability culture can be developed such that consideration of the negative and positive effects of construction practices on the environment becomes accepted practice by all participants of the construction company.

2.1.3 Defining the Desired Culture

An organisation's culture develops from the ways, beliefs and visions of its founding members. The founding members provide the foundation on which the organisation's culture is built and are responsible for the

direction it takes as the organisation grows. When an organisation first starts out, it is possible for them to clearly define their core values and their desired culture, whether it be in a formalised document or not (Schein 2017). However, many long-standing industries, such as the civil construction industry, already have underlying organisational cultures set in place in larger construction firms and the industry as a whole. This leaves little opportunity for starting from scratch and changing undesirable cultural traits. Leaders need to be proactive in their approach for an organisation to take measures that will redefine their culture and to adjust and advance beyond the current status quo.

A clearly outlined 'desired' culture is required for companies to undertake research in order to collect and analyse the data on an existing culture. A review of the formalised documents of a number of the civil construction industry's leading companies, such as environmental policies and mission statements, and 'ISO 14001 2015 Environmental management systems, a best practices model', shows that tools are available to assess the current status of the organisational culture in reference to environmental sustainability.

2.1.4 Building Organisational Culture

As an organisation's culture develops it begins to reflect not only the theories and assumptions initially brought to the group by the founding member or members but also the collective experiences of the members of the organisation. This may be a learned group experience, or the experiences and influences of the individual members (Schein 1983).

Employees learn culture through a number of different activities including storytelling, rituals, material symbols and language. These methods of learning are facilitated by management and organisational leaders being visible role models, communicating ethical expectations, providing training, rewarding the desired behaviours and providing protective mechanisms (Robbins 2019).

The building of organisational culture, as depicted in Figure 2.1 shows the need for organisations to encourage the desired culture and the breaking down of organisational and personal barriers in order to develop environmentally sustainable behaviours. Figure 2.1 also shows the potential for positive effects on employees' domestic green behaviours (Yuriev et al. 2018).

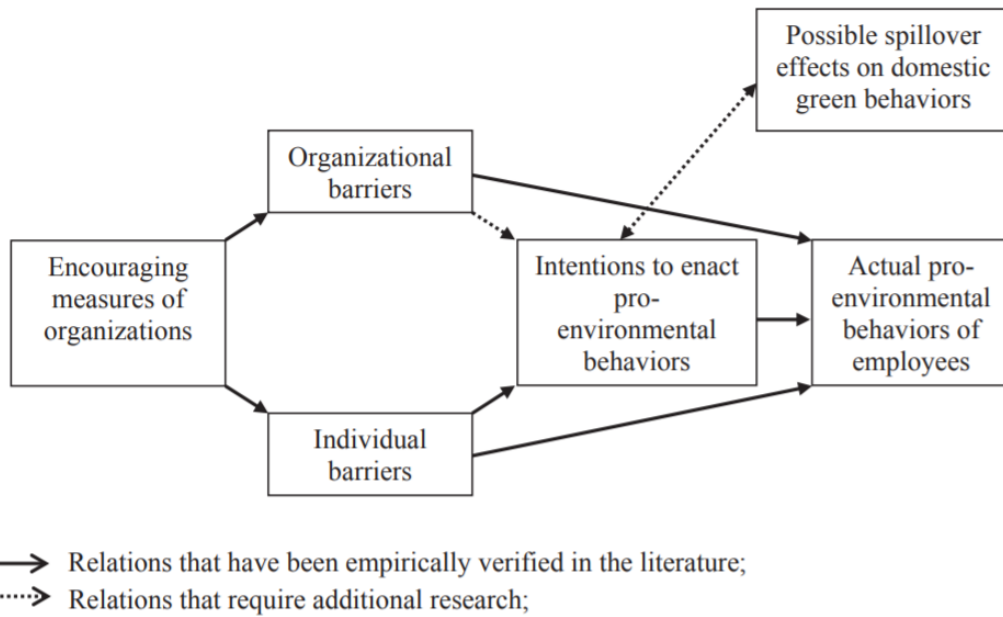


Figure 2.1: The role of organisations in the promotion of voluntary pro-environmental behaviours of employees* (Yuriev et al. 2018).

Organisational culture needs to be monitored and managed for it to be maintained. The leadership team within an organisation is responsible for not only monitoring the organisational culture to maintain it, but also to assess whether elements are becoming dysfunctional or outdated (Schein 2017).

Continual monitoring of an organisation’s culture allows the leadership team to not only proactively approach any elements of the organisations culture that are becoming out dated or no longer fit the organisation’s values, but also react to the environment in which they exist. For example, a push from end users for a cleaner environment will require an organisation to either react and adapt or fall behind its competitors (Robbins 2019). It is also possible to maintain organisational culture through active recruitment of individuals with the desired knowledge, skills and abilities, while simultaneously building on their current employee’s strengths (Robbins 2019).

Adapting the current organisational culture requires diversification of the member base, high levels of differentiation and integration, and creative synthesis in order to take on a new and more complex form. It is possible to achieve this through systemic promotion of members who have the core aspects of the current culture, with the foresight and a better grasp on the changing external realities (Aldrich & Ruef 2006). The adaptation of the culture can be met with resistance if:

- The primary culture creators are still present
- The culture helps define the organisation and facilitates their style of operation

- Elements of the culture have been learned through organisational struggles in order to maintain itself (Schein 2017)

2.1.5 Organisational Culture Compliance

Compliance with the desired organisation culture falls into two categories. The two categories, according to Ramus and Killmer (2007) are in-role, and extra-role.

In-role behaviours are those that are an ordinary part of the job. Failure to adhere to these behaviours could result in penalties. For example, failure to follow correct procedure, resulting in harm could lead to prosecution (Ones & Dilchert 2012).

Extra-role behaviours are behaviours that go beyond the minimum required. These behaviours, while desired are neither required nor rewarded formally. Most employees are not required to perform in an environmentally friendly way. These behaviours are deemed as being extra (Van Dyne, Cummings & McLean Parks 1995).

2.1.6 Determining and Analysing Organisational Culture

Aarts and Dijksterhuis (2003) suggest that, although valuable, the measurement procedures commonly used in studies of human behaviour, for example correlational data obtained by self-reports in a questionnaire setting, make it difficult to conclusively determine genuine reaction to situations. This is due to the participants being aware of and having the ability to identify the expected action for a particular situation. For this reason, Aarts and Dijksterhuis (2003) used a series of images of different situations to determine how participants would act in the given environment.

The research on pro-environmental culture by Piwovar-Sulej (2020) adapted the human resource management concepts to assess the cultural level of an organisation. The details of the four levels of the cultural level are detailed in Table 2.1.

Table 2.1: The four levels of environmental sustainability culture (Piwowar-Sulej 2020).

Current Level	Description	Type of Employee Motivation
Level 1 – “zero level” “culture, of high risk”	Environmental issues are not important. Nobody cares about them. There is lack of communication in this area. Pathological behavior is accepted.	No motivation
Level 2 – “reactive culture”	The only motivation for environmentally sustainable activities is fear of punishment. The company focuses on ensuring the compliance of internal documentation with the relevant general legal rules. Nobody cares about communication in this area.	Negative motivation
Level 3 – “active culture”, “systematic culture”	The company undertakes more activities than are required by law. There is a formal environmental policy and environmental system. The flow of information and the procedures are effective. Environmental sustainability goals are formally set for individuals and teams. Environmental sustainability performance is a subject of assessment.	Positive but extrinsic motivation
Level 4 – “continuous improvement culture”	The company undertakes more pro-environmental activities than are required by legal regulations and has a formal environmental policy. Employees are involved on an individual and group level in different activities related to risk assessment or improvements in working conditions, for example they help each other and share knowledge about environmental sustainability issues. They are not only involved but truly engaged in these activities and believe that together they can "change the world." The company participates in global pro-environmental programs and shares best practices with other companies.	Intrinsic motivation

Stanitsas, Kirytopoulos and Leopoulos (2021) performed an extensive review of the current literature and consolidated a list of environmental sustainability key indicators for construction projects. Several of the key indicators focus on more technical data and managerial applications that are beyond the scope of this research.

Table 2.2 details the environmental sustainability key factors that are of particular relevance to this research and were adapted for use in the methodology.

Table 2.2: Environmental Sustainability Key Indicators. Adapted from (Stanitsas, Kirytopoulos & Leopoulos 2021)

No.	Indicator	Description	Score
1	Environmental efficiency	Refers to environmentally sustainable practices regarding services and products. Construction materials, environmental footprint, and energy consumption.	
2	Sustainable use of natural resources	Refers to minimizing resource usage, primary material input and output, waste recovery and disposal.	
3	Environmental impact assessment reporting	The process of evaluating the likely environmental impacts of a project.	
4	Environmental management systems/policy implementation	Refers to meeting environmental obligations, procedural practices to minimise negative environmental effects, implement and preserve strategies for environmental protection.	
5	Environmental education and training	Skills such as critical thinking, problem-solving, and effective decision-making are cultivated through education and training, in order for individuals to expand their viewpoint around environmental issues.	
6	Environmental incident reporting	The process of reporting environmental incidents that have occurred during project operations.	
7	Environmental incident investigation and follow-up	The investigation and follow-up actions to prevent repeat incidents.	
8	Environmental management plan monitoring	Effective environmental management and monitoring ensures the environmental objectives of the project.	
9	Environmental responsibility	Refers to developing equity between members of different generations, and to the cooperation for the improvement of environmental quality.	

2.2 Environmental Sustainability

Environment is a broad term with many applications. Throughout this report the terms environment, environmental and environmentally will be used in relation to the natural environment unless otherwise stated. It has been defined by Merriam-Webster (n.d.) as:

“the complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival.”

2.2.1 Sustainable Development

Sustainable development is a concept that has been developed and expanded since the topic was first formally documented by Gro Brundtland, the former Minister for Environment (Norway) and Chairman and Director-General of the World Health Organization in 1987, in her World Health Organization's Report of the World Commission on Environment and Development: Our Common Future.

As a result, the World Health Organization has defined sustainable development as; Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (Brundtland 1987, p. 37)

The World Health Organization's findings presented in this 1987 report have laid the foundation for this research by highlighting the environment, its limited resources and the way we use them, as a vital factor in the progression and sustainability of both developing and developed nations.

2.2.2 Triple bottom line

The practice of sustainable development is encompassed by the principles of the triple bottom line (Figure 2.2). To achieve project success and a well-balanced triple bottom line, a project must take into account not only the economic aspects of a project, but also the social and environmental aspects (Elkington 1997). This means that for a project to be successful in the terms of sustainable development, it must encompass more than just financial success. It must be a well-balanced combination of three key elements. These are financial, environmental and social (Carvalho & Rabechini 2017).

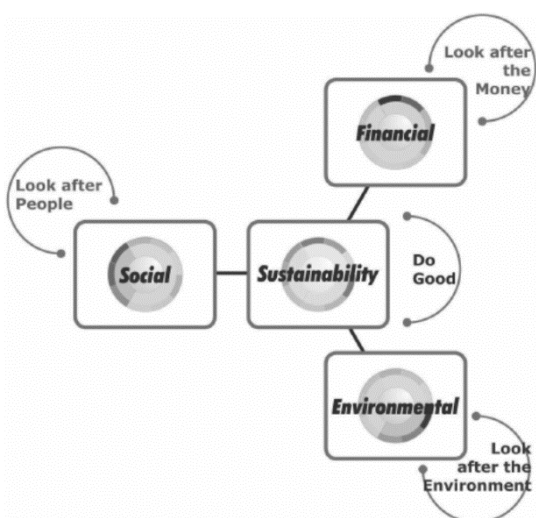


Figure 2.2: Sustainability: The Triple Bottom Line (Willard 2012)

The listed measures of the environmental element of the triple bottom line are in direct relation to construction activities. For example, pollutants emitted could be used as a measure to determine the expected total CO₂ emitted from machinery used throughout the construction phase of a project.

Table 2.3 (below), shows the typical measures by which the sustainable development of a project team is able to set, track and report on project goals and targets.

Table 2.3: Typical measure of the triple bottom line (adapted from Savitz (2014))

	Economic	Environmental	Social
Typical Measures	Sales, profits, ROI	Pollutants emitted	Health & safety record
	Taxes paid	Carbon footprint	Community impact
	Monetary flows	Recycling & reuse	Human rights; privacy
	Job created	Water & energy use	Product responsibility
	Supplier relations	Product impact	Employee relations
	Total	Total	Total

2.3 Environmental Impacts of Civil Construction

2.3.1 Land Clearing and Excavation

A major component in the early stages of most civil construction projects is the clearing of land which results in loss of vegetation, changes to the land profile, alterations of natural water flow and alteration in rates of precipitation in extreme cases. Land must be cleared not only for the area where the project is physically located, but also for laydown areas for machinery park-up and maintenance, haul roads and access roads, water storage, material stock piling, and excavation of fill materials.

Understanding the effects imposed upon the environment as a result of land clearing is important for this research as it not only helps to identify issues resulting from civil construction operations but also set targets and goals for environmental sustainability management.

2.3.1.1 Release of stored carbon

Trees and vegetation absorb carbon dioxide from the air and store the carbon from the surrounding environment in a process known as carbon sequestration (Busch 2018). When land is cleared, the vegetation that has been removed begins to decompose and as a result of the decomposition process the carbon that has been stored is released back into the environment (Fargione, Plevin & Hill 2010).

A summary by SiCirEc (2009) states that, depending on several factors including: climate, maturity of the plant or tree, soil types, and type of vegetation a single hectare of trees has the ability to capture and store between 1 to 10 tonnes of carbon annually. This means that over a 10-year period, the effect of clearing one (1) hectare of land could result in up to 100 tonnes of carbon not being captured, as well as the release of previously stored carbon back into the environment.

2.3.1.2 Threats to wildlife

A study by Tilman et al. (2017) which investigated the effects of land clearing upon wildlife determined that non-agricultural development poses a threat to over 40% of animals and birds through habitat loss. The research shows that whilst Australia has a low to medium diversity of mammals and birds per hectare, the threat imposed upon them is at the higher end of the of the global scale due to the population density of wildlife in areas of high population density of humans (Tilman et al. 2017). This can be seen in Figures 2.3 and 2.4

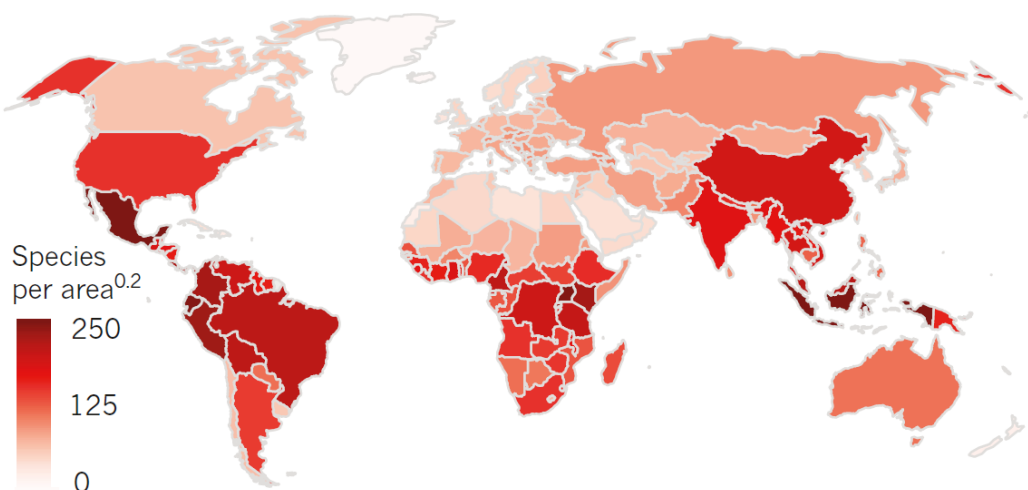


Figure 2.3: Global mammal density (Tilman et al. 2017)

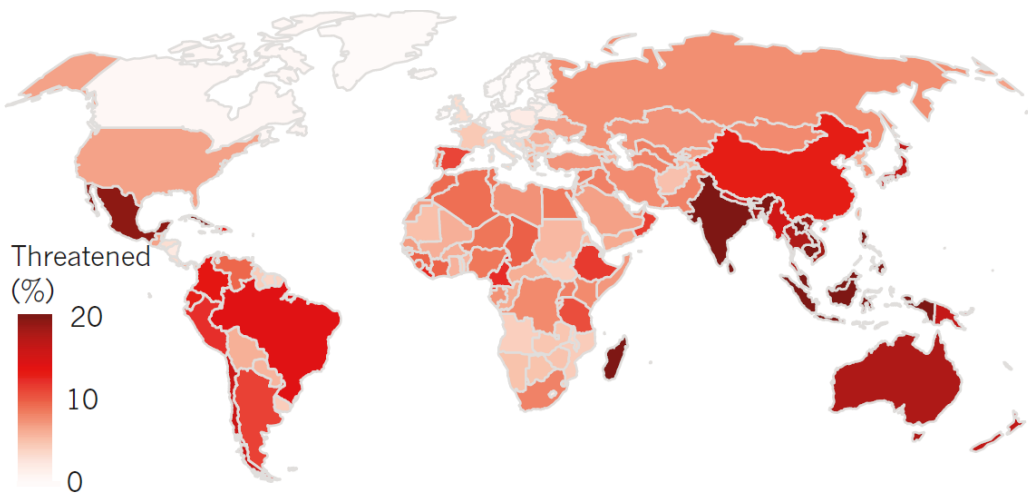


Figure 2.4: Threat to mammals due to land clearing (Tilman et al. 2017)

2.3.1.3 Altering water runoff and soil erosion

The effects of land clearing have been widely researched with the identification of profound impacts on waterways. It is stated that land clearing not only affects the water balance through a reduction in the surface aerodynamic roughness, the leaf area and also the shallower rooting depths of new growth, but also the long-term increase of streamflow through a decrease in the rate of evapotranspiration (Costa 2005).

The change in surface aerodynamics and rooting depth of vegetation is shown to lead to an increase in soil erosion through an increase in water runoff speed and a reduction in the strength of the soil structure (Trenouth et al. 2013).

2.3.1.4 Reduction in precipitation

Andrich and Imberger (2013) analysis of empirical data of rainfall in south-west Western Australia showed a decline in rainfall of 15-25% over a 40-year period from 1969. The analysis determined that up to 55% of the decline in rainfall was a result of land clearing.

The scale of individual civil construction projects is rarely large enough to result in an impact upon the level of precipitation, and even less so the minimal effects of over clearing. However, it is worth noting the correlation between land clearing and reduced precipitation, due to cumulative size of civil construction projects nationally.

2.3.2 Waste Management

Monier et al. (2011) reported in 2011 that within the 27 EU member countries, there was an annual total combined solid construction waste burden of 970 million tons. A study by Zanna, Fernandes and Gasparine (2017) tracked the waste generation of a civil construction project and determined that 70% of the waste generated was raw material waste. Construction waste can be minimised by a number of ways: provisions for waste minimization within the contract, maximisation of materials reuse, effective logistic management, and waste segregation (Ajayi et al. 2017).

2.3.3 Hydrocarbon Spills

The requirement to use heavy plant on the civil construction projects poses a risk to the environment due to diesel and oil spills. Unlike crude oil, the hydrocarbons used in heavy plant are refined. Due to their chemical constituents such as aromatic hydrocarbons, hydrocarbon spills from heavy plant can result in residual waterway and soil contamination problems (Guerin 2000).

Over a 14-month period, Guerin (2014) determined that 40% of the 86 reported hydrocarbon spills were from excavators and loaders, while 50% of these spills were as a result of hydraulic issues. The study identified four (4) root causes that explained 60% of the hydrocarbon spills. These included: “Equipment Parts Defective”, “Incorrect Procedure Followed”, “Impact With an Object” and “Design Did Not Anticipate Conditions”.

2.4 Organisational Environmental Practices

It is important that all practicable efforts are made to reduce the negative effects of construction activities, and in many cases to adopt practices that reduce a project’s impact on the environment. It is legislated that all organisations adhere to the Environment Protection and Biodiversity Conservation Regulations 2000 (Department of Agriculture Water and Environment 2020b) outlined in the Environment Protection and Biodiversity Conservation Act 1999 (Department of Agriculture Water and Environment 2020a).

2.4.1 Environmental Management Systems

An environmental management system is one that facilitates an organisation’s desire to reduce its environmental impact (Li, B & Wu 2017).

External stakeholders (regulators, consumers, lobbyists) have been applying continued pressure on, and have criticised construction organisations for their practices that result in environmental pollution and ecological damage (Berrone et al. 2013). In order to address these concerns, many construction organisations have committed to ISO 14001:2015 and gained certification (Li, D, Tang & Jiang 2019).

ISO 14001:2015 aims to reduce and minimise an organisation's environmental impact and improve its environmental performance (Inoue, Arimura & Nakano 2013)

These standards, as summarised by (Tibor & Feldman 1996), enable an organisation to:

- Establish an environmental policy appropriate to the organisation.
- Identify the environmental aspects of the organisation's products, services and activities to determine both impact and significance.
- Identify priorities and establish objectives.
- Establish a programme to implement these policies and objectives.
- Facilitate planning, control, monitoring and changes to ensure policy is complied with and remains appropriate for the organisation.
- Be ready to adapt to changes in the business environment.
- Identify the relevant legislative and regulatory requirements.

ISO 14001:2015 certification not only benefits environmental performance of an organisation but can also facilitate enhanced performance in other aspects of an organisation. As summarised by (Vastag & Melnyk 2002) these benefits can include:

- improved public relationships and corporate image
- improved document control
- appropriate response to increased customer
- reduced costs of doing business abroad
- reduced costs of doing business within the supply chain
- addressing peer pressure
- improved risk management and liability
- creation of a common ground
- reduced inspection frequency
- improved bottom-line performance and enhanced internal efficiencies

2.4.2 Environmental Policies

Many leading construction companies, both Australian and international, have environmental policies and procedures, and environmental management plans in place in an attempt to achieve environmental sustainability. A review of a number of leading civil construction company's environmental sustainability policies showed a varying emphasis on different elements of environmental sustainability.

2.4.3 Incident Reporting

Over an 8-year period, from 2008-2016, Andrić et al. (2019) collected data on reported environmental incidents from over 200 construction sites Australia wide, as provided by 3 leading construction companies, and found the number of environmental incidents as per state Table 2.4. Andrić et al. (2019) also analysed the actions immediately after the reported incident as detailed in Table 2.5.

Table 2.4: The number of reported environmental incidents in Australia per state and year (Andrić et al. 2019)

State\Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Queensland	5	8	20	14	39	21	17	10	0	134
New South Wales	1	5	9	16	31	27	17	9	3	119
Western Australia	1	4	11	23	24	21	10	6	1	101
Victoria	1	5	12	8	8	6	4	11	10	65
Northern Territory	0	0	0	0	13	21	4	0	1	39
South Australia	0	0	0	6	12	11	0	4	0	33
Australian Capital Territory	0	3	0	1	2	0	0	0	0	6
Tasmania	0	1	1	0	0	0	0	0	0	2
Total:	8	26	53	68	130	107	52	40	15	499

Table 2.5: Immediate actions following incidents (Andrić et al. 2019)

Immediate actions	Descriptive statistics
Cleaning and clearing	47%
Shut down of operations, equipment and plants	31%
Notification	24%
Repair damage	12%
Investigation	11%
Reporting	9%
Building of temporary structures for mitigation	5%
Removal of substances and contaminants	5%
Monitor environment	3%
Wildlife protection and removal	3%
Archaeological protection and removal	2%
Extinguish fire	2%
Vegetation protection and removal	2%

The study highlighted the need and benefits of root cause analysis of environmental incidents and the training of construction industry employees surrounding environmental incident procedures (Andrić et al. 2019).

2.5 Civil Construction Organisational Structure

The organisational structure of a civil construction project aims to divide organisational units into their respective roles. This allows for a division of labour through task allocation, and the identification of formal reporting relationships, flow of information, lines of authority and a hierarchy of control (Figure 2.5) (Uher 2004).

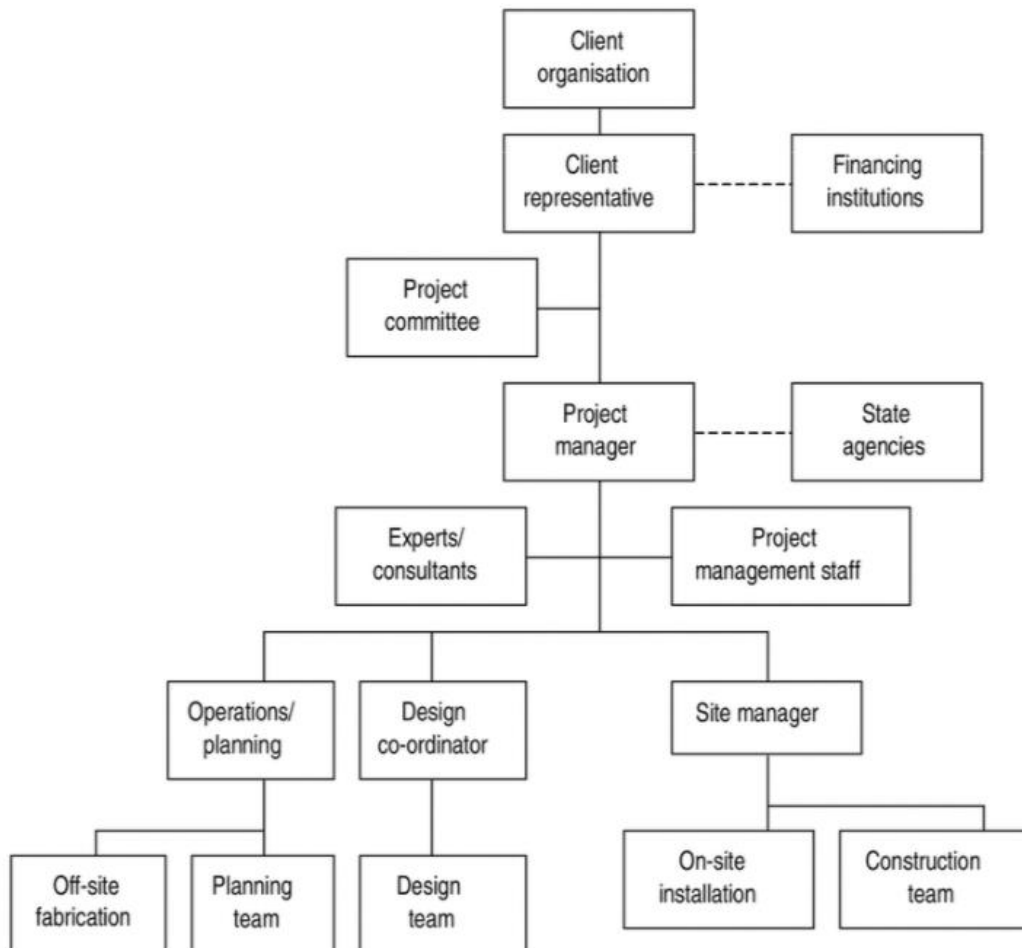


Figure 2.5: An example of a civil construction project team hierarchy. (Uher, 2004)

Operations level employees are responsible for the physical undertaking of the construction task and include machinery operators, trade qualified personnel and labourers. As this is the level at which the work is physically undertaken, it is at this level of the construction organisation that this research will focus.

2.6 Conclusion

The recognition of the importance of an organisation's environmental sustainability culture and the necessity for its efforts to meet ongoing pressures to operate in an environmentally sustainable way is evident through the growing, yet still limited, volume of literature. There is currently no available literature related to the environmental sustainability culture of operations level employees. The literature review highlighted several environmental hazards that have the potential to be managed and reduced through the conscious actions of operations level employees. These identified factors provide a research gap that is relevant and requires further investigation.

The exploration of the current status of the environmental sustainability culture within the Australian civil construction industry at an operations level, will help to give a starting point from which the industry can build and improve. The collected data will have the potential to develop strategies that can be implemented when civil construction companies are in the process of consciously adapting their organisational culture with a focus on environmental sustainability.

Chapter 3 – Methodology

3.1 Introduction

The review of the current literature relevant to the topic of sustainability culture has highlighted a need to investigate sustainability culture at an operations level, and how it affects civil construction projects.

The research aimed to answer three major questions in relation to environmental sustainability culture:

1. What is the current status of environmental sustainability culture at an operations level within the civil construction industry?
2. What are the root causes of any perceived deficiencies within an organisation's culture?
3. What can be done to improve the current environmental sustainability culture?

The research worked towards determining the 'what', 'why' and 'how' of environmental sustainability culture. This was achieved through an interview, mixed method-based survey designed to capture the views, opinions, and experiences of operations-level employees in the civil construction industry.

3.2 Description of Methods

In order to collect the appropriate information participants were required to take part in an interview-based survey. The research used a mixed-method approach to data collection in an attempt to reduce the identified literature gap. Mixed-method research is the combined use of both quantitative and qualitative data (Mason 2018). This research was undertaken using data collection surveys (quantitative) open-ended interviews (qualitative). It was determined that a mixed-method approach would best suit the research as it provided a quantitative value to research aim 1 and the subsequent qualitative assessment for the further aims of the research.

3.3 Sampling Methods

A list was compiled of leading Australia based civil construction companies that fulfilled the desired criteria (civil construction company, company location, and annual turnover) of the participating company, in order to identify potential participants. This was done using the HIA-CoreLogic Construction 100 document. While

this research only required the participation of one company, an invitation to participate was sent to several companies at a time, until a commitment to participate was made.

The company was then asked to select operation level participants in a random manner, including but not targeting those that may be vulnerable or identify as being from a minority group. This was achieved by assigning each potential participant with a number and using a computer based random number generator. This also removed the potential for the participating company to perform candidate vetting that may alter the validity of the research. The participating company then provided the research team with contact details for the selected participants.

The target sample size was 12 participants. This sample size was identified as being appropriate, as it allowed for the opportunity to collect data from the varied demographic that are represented in the civil construction industry. Due to the data collection being interview based, it was possible to keep the target sample size to this more manageable number of participants as opposed to written survey responses that would have required a great number of responses. This was achieved by engaging a company that had sufficient employees and a willingness to participate.

3.4 Ethical Considerations and Validity

Due to the nature of the research requiring human participation, a USQ ethics application was submitted and approved prior to conducting any interviews or data collection. From an ethical standpoint, the research was deemed low risk, however a number of measures were taken to ensure ethical research practices. In order to protect the participants and the company they work for, all data was de-identified. The de-identification of the data provided participants with an opportunity to speak freely, without fear of repercussions as a result of their responses. This also increased the validity of the data collected. In order to improve the quality and validity of the data, all interviews were recorded and transcribed prior to analysis.

Human ethics approval for the project was obtained through the University of Southern Queensland Human Ethics Committee – approval number H20REA177 (Appendix B).

During the early stages of development, an industry professional recommended that I, as the interviewer, be prepared to read the questions for the participant and write down the answers they provided. They informed me that in some (rare) instances some participants struggle with literacy, but that their input is still valid. During the pilot interviews it was necessary to give explanations and clarify several points. Due to this, it was decided that to ensure consistency of the information provided to the participants, question 1.1 would be presented to the participants prior to the individual interviews in the virtual presence of the interviewer.

Observation of the actions of operations level employees in relation to environmentally sustainable practice in real world scenarios may have created more accurate data. However, there are many associated risks both for participants and the environment and this was deemed inappropriate. As such, it was determined that collection of data through structured interviews was the best way to collect highly valid data while protecting participants and the organisation. Accordingly, for this research, the data was collected through a series of questions relating to the key indicators of environmental sustainability culture and the industry experiences of the participants.

3.5 Data Collection Development

3.5.1 Interview procedure

The participants were interviewed individually. All interviews were undertaken via a zoom meeting. Prior to the interview participants were provided with the research information sheet (Appendix C), participant consent form (Appendix D), and the participant information form (Appendix E). The participant information form was used to identify information such as, the participant's age, gender, industry experience and current and previous roles within the civil construction industry.

At the start of each interview, the participant was asked to acknowledge that they had read, understood and signed the aforementioned forms and were willing to participate in the interview. It was also deemed necessary that all participants complete the question 1.1 form prior to the recording of the interview. This was done in the virtual presence of the interviewer, so that the participants could request clarification if required. These methods were necessary in order to fulfil the requirements of the Human Ethics approval. The use of audio recording only and de-identification of the participants and the company they worked for, fulfilled the remaining requirements of the ethics approval. Each interview took between 5 and 10 minutes.

The audio recordings of all interviews were transcribed and the responses reviewed. Once this was completed the participants were given the option to review and amend the transcript prior to the information being analysed.

The use of Google Forms for the collection of participant information forms and applicable quantitative questions was deemed appropriate for this study. Google forms provided several advantages including: ease of use for both participants and researcher; a mandatory question function that meant that all environmental sustainability key factors were rated by all participants; automatic generation of the question forms, participant demographic data; and analysis and auto generation of tables and graphs.

The research was based on a concurrent mixed-method questionnaire design that incorporated quantitative data supported by a qualitative clarification. The research questions are listed in Table 3.1.

Table 3.1: List of research questions used for the questionnaire

No.	Question
1a	Complete the table of environmental sustainability key indicators listed above.
1b	What do you feel are the major factors contributing to the current environmental sustainability culture?
1c	What recommendations would you make to help improve the current environmental sustainability culture?
2	Within the civil construction industry, who is responsible for ensuring environmentally sustainable practices are maintained?
3	Does the company you are working for have an environmental sustainability mission statement?
4a	Have you ever witnessed, or been involved in a reportable environmental incident?
4b	Provide details and if the incident was reported. If not reported, why not? (Names of people/companies involved are not required)
5a	Have you ever been instructed to undertake a task that you feel is conflicting with environmentally sustainable practices?
5b	Provide details of the task and if you undertook the task. (Names of people/companies involved are not required)
6	Is there anything else you would like to add regarding environmental sustainability culture in the civil construction industry?

In order to minimise the effects of interviewer bias and presumption of results due to industry experience, all questions were reviewed and modified with the assistance of civil construction industry professionals.

Once the questions were finalised, several pilot interviews were performed to refine the interview process and identify any areas that may need altering. This process proved valuable as a practice tool and improved the overall quality of the interview process.

The questionnaire used a concurrent design, as described by (Driscoll et al. 2007), whereby quantitative questions were asked alongside related qualitative questions. Concurrent mixed method data collection uses one type of data, quantitative, to validate another type of data, qualitative. This allowed the different data sets to be compared, in order to address the desired outcome (Driscoll et al. 2007). The benefits of concurrent design data collection were the ability for the contradiction of participant responses to qualitative questions to be explained through their responses to qualitative questions (Driscoll et al. 2007). For example, Question 1 is a combination of quantitative and qualitative data. This was achieved through the participant assessing the

environmental sustainability key indicators against the environmental sustainability culture table in question 1a (Appendix F). This was done to encourage the participant to consider the environmental sustainability key indicators, and quantify the current status of the environmental sustainability culture. It was possible that a participant rated a key indicator at a particular level, but when responding to the follow up question where they were required to give reasoning to their rating, they may have said things that suggest otherwise. By quantifying the current status of the environmental sustainability culture, the participant was presented with a value they were easily able to assess as positive or negative. This led into question 1b. and question 1c. where the participant was required to give their opinion without prompting. Due to the limited size of the data set, the use of in-depth statistical analysis was not possible.

The participants were then asked a series of questions about their experiences in the workplace that pertain to environmental sustainability. The participant was then given the option to openly discuss anything they felt was relevant and important.

3.5 Methods of Analysis

The collection of participant information and quantitative data from the interviews was tabulated and used to develop several pie and bar charts. Initially, this was achieved using the survey administration application, Google Forms, where it was possible to automatically tabulate charts. However, to account for the limitations of charts created in Google Forms, all data was subsequently processed using Microsoft Excel.

The quantitative data was tabulated and used to develop appropriate graphs. These graphs were then used to analyse and determine the current status of environmental sustainability culture in the Australian civil construction industry.

The analysis of the qualitative data required the responses provided by the participants to be interpretatively indexed using categorical indexing. This process, as described by Mason (2018), involves the manual sorting of similar responses into the appropriate category. The categories for question 1.2 included:

- Project management factors
- Communication factors
- Education and training factors
- External regulation factors
- Individual reasonability factors
- Established culture factors

The categories for question 1.3 included:

- Project management factors
- Communication factors
- Education and training factors
- External regulation factors
- Individual reasonability factors

Once all the data had been indexed, it was reviewed and analysed to identify consistencies in the participant's responses and potential trends.

3.6 Challenges

Over the life of the research there were several challenges that presented themselves and required that alterations be made to the research. Participation and authorisation to recruit from civil construction companies proved particularly difficult to obtain. This was due to a number of issues.

First, in the early stages of trying to obtain company authorisation to recruit participants, a number of companies responded with an apology that they were unable to take part due to the requirements for operations level employees, as participation in the research would take a significant amount of time.

Secondly, on three separate occasions, companies that had originally agreed to participate withdrew, stating that due to various reasons, including the current climate of the industry and the challenges presented by COVID-19 they would be unable to participate in the research. An attempt to find alternative methods of undertaking the survey was made but produced the same outcome.

Not only did COVID-19 present challenges related to participation, it also presented a number of challenges with both the data collection and research write-up. Due to the government-imposed restrictions in order to control the spread of COVID-19, the participating company decided that all interviews were to be undertaken remotely, via a zoom meeting. Although this was an easy problem to overcome, it was felt that the participants responses may have been less considered and that it was harder to build a rapport with the participant. The government-imposed restrictions also limited the access to on-campus resources for much of the life of the research. This required a concerted effort to work from home and maintain focus. It also meant that a portion of the literature only became accessible in the later stages of the research when it became available in physical form from the library.

Chapter 4 – Results and Discussion

4.1 Demographics

4.1.1 Age

The participant age demographic was categorised into six (6) age groups. All categories were represented in some capacity, however due to the research sample size some demographics may have been over- or under-represented (Figure 4.1). This has the potential for a distortion of the research results.

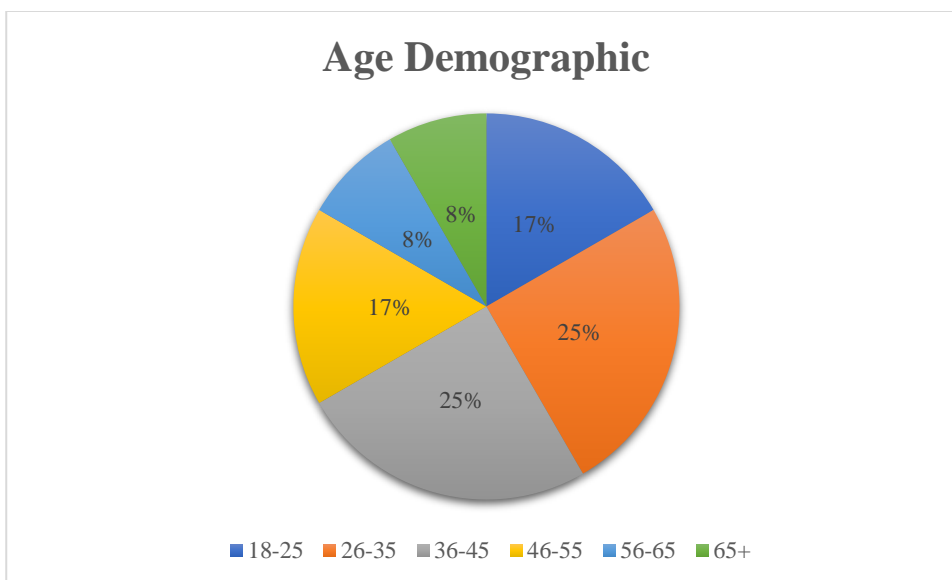


Figure 4.1: Age demographic

4.1.2 Gender

In 2018/19 the Australian Bureau of Statistics stated that 87.9% of construction workers employed in Australia were male. In this research the gender demographic consisted of 75% male participants and 25% female participants Figure 4.2. Due to the small sample size used for the research and the participants being selected at random, female participants were over-represented in the research. This over-representation of female participants also has the potential to have distorted the results if females view environmental sustainability differently to males.

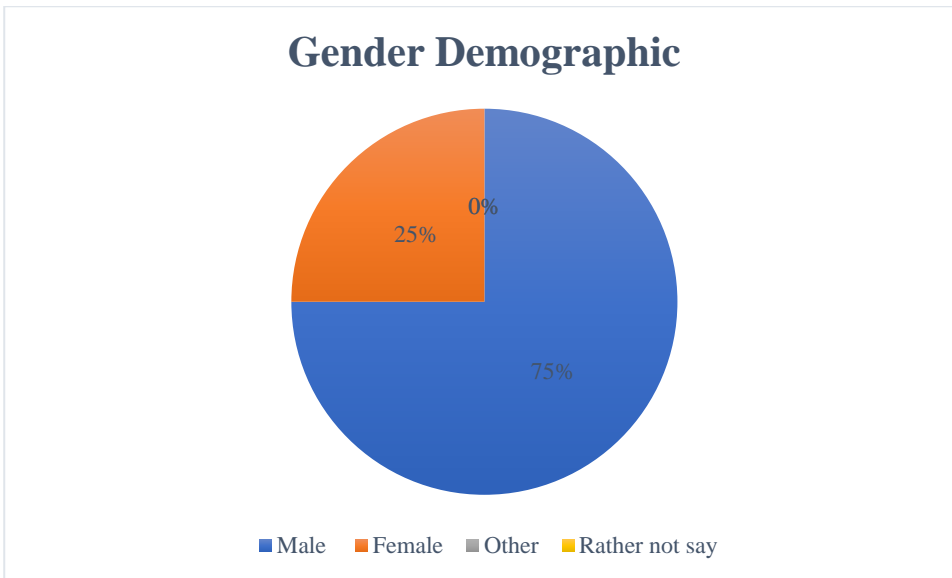


Figure 4.2: Gender demographic

4.1.3 Roles and Experience

The research participants also had a varying level of experience and were employed in different roles within the operations level of the civil construction industry. The current role and previous roles of the participants were categorised into 5 tiers (Table 4.1) and depicted in Figures 4.3, 4.4 and 4.5. Three (3) participants stated they had previously held roles in a tier higher than their current role.

Table 4.1: Levels of operation level employees

Level	Role
Tier 1	Labourer
Tier 2	Roller Watercart Dump truck
Tier 3	Loader Excavator Bulldozer Grader
Tier 4	Final trim operator Surveyor
Tier 5	Supervision

Participant Current Role

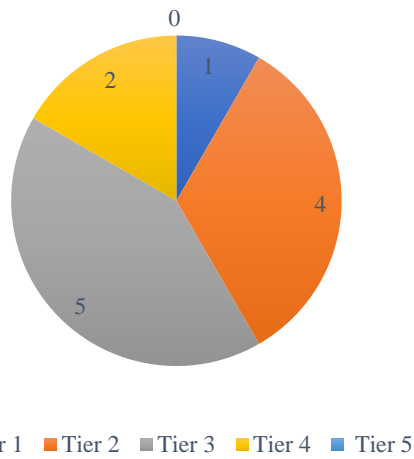


Figure 4.3: Participant current role

Participant Previous Role

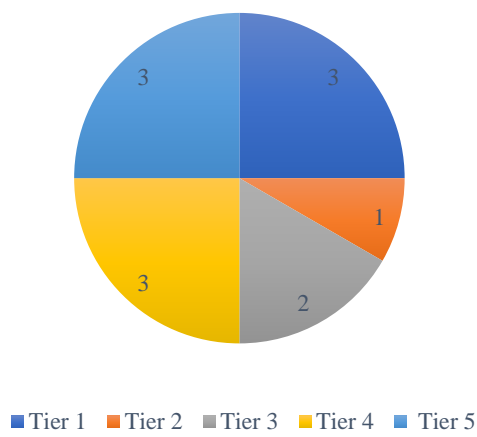


Figure 4.4: Participant previous role

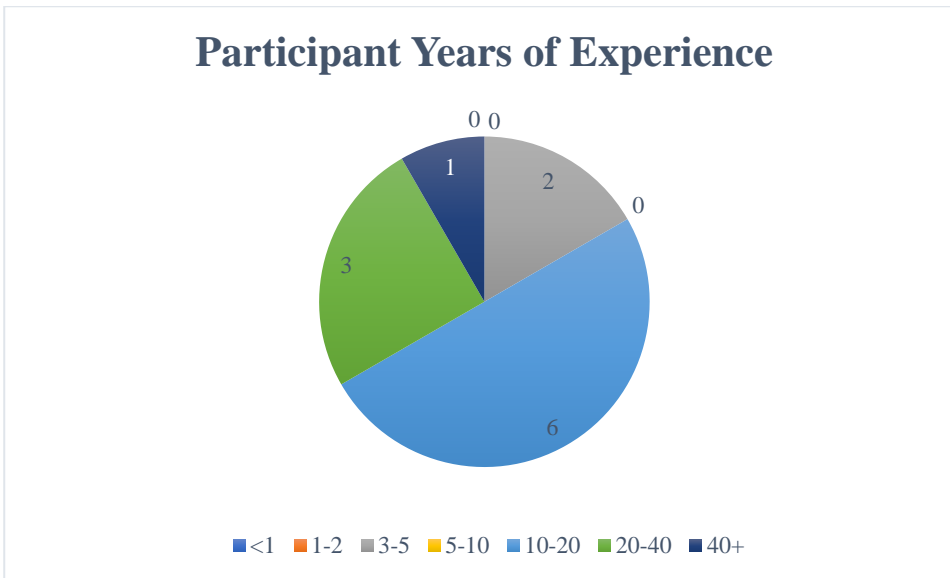


Figure 4.5: Participant industry experience

Due to the small sample size, it was not possible to draw conclusions, and differentiate responses in relation to participant demographics. There is a potential for any over or under representation of a particular demographic to have distorted the results of the research.

4.2 Survey and Interview

4.2.1 Environmental Sustainability Key Indicators (Q1a)

This question was designed to determine the current status of environmental sustainability culture in the civil construction industry. The participants were asked to rate the environmental sustainability indicators using the provided table of environmental sustainability culture levels (Appendix F).

The participant responses and the average level for each key indicator are as follows (Figure 4.6):

Key indicator 1 - Environmental efficiency:

- Score range - level 2 to level 4.
- 7 (seven) participants responded with level 2
- 3 (three) participants responded with level 3
- 2 (two) participants responded with level 4
- Average score = 2.58

Key indicator 2 - Sustainable use of natural resources:

- Score range - level 1 to level 4.
- 1 (one) participant responded with level 1
- 3 (three) participants responded with level 2
- 6 (six) participants responded with level 3
- 2 (two) participants responded with level 4
- Average score = 2.75

Key indicator 3 - Environmental impact assessment reporting:

- Score range - level 1 to level 4.
- 1 (one) participant responded with level 1
- 2 (two) participants responded with level 2
- 7 (seven) participants responded with level 3
- 2 (two) participants responded with level 4
- Average score = 2.83

Key indicator 4 - Environmental management systems/policy implementation:

- Score range from level 2 to level 4.
- 2 (two) participants responded with level 2
- 8 (eight) participants responded with level 3
- 2 (two) participants responded with level 4
- Average score = 3

Key indicator 5 - Environmental education and training:

- Score range - level 1 to level 4.
- 1 (one) participant responded with level 1
- 4 (four) participants responded with level 2
- 4 (four) participants responded with level 3
- 3 (three) participants responded with level 4
- Average score = 2.75

Key indicator 6 - Environmental incident reporting:

- Score range - level 2 to level 4.
- 5 (five) participants responded with level 2
- 3 (three) participants responded with level 3
- 4 (four) participants responded with level 4
- Average score = 2.92

Key indicator 7 - Environmental incident investigation/follow up:

- Score range - level 2 to level 4.
- 4 (four) participants responded with level 2
- 6 (six) participants responded with level 3

- 2 (two) participants responded with level 4:
- Average score = 2.83

Key indicator 8 - Environmental management plan monitoring:

- Score range - level 2 to level 4.
- 4 (four) participants responded with level 2
- 7 (seven) participants responded with level 3
- 1 (one) participant responded with level 4
- Average score = 2.75

Key indicator 9 - Environmental responsibility:

- Score range - level 2 to level 3.
- 6 (six) participants responded with level 2
- 6 (six) participants responded with level 3
- Average score = 2.5

Current environmental sustainability culture overall score:

- 2.77

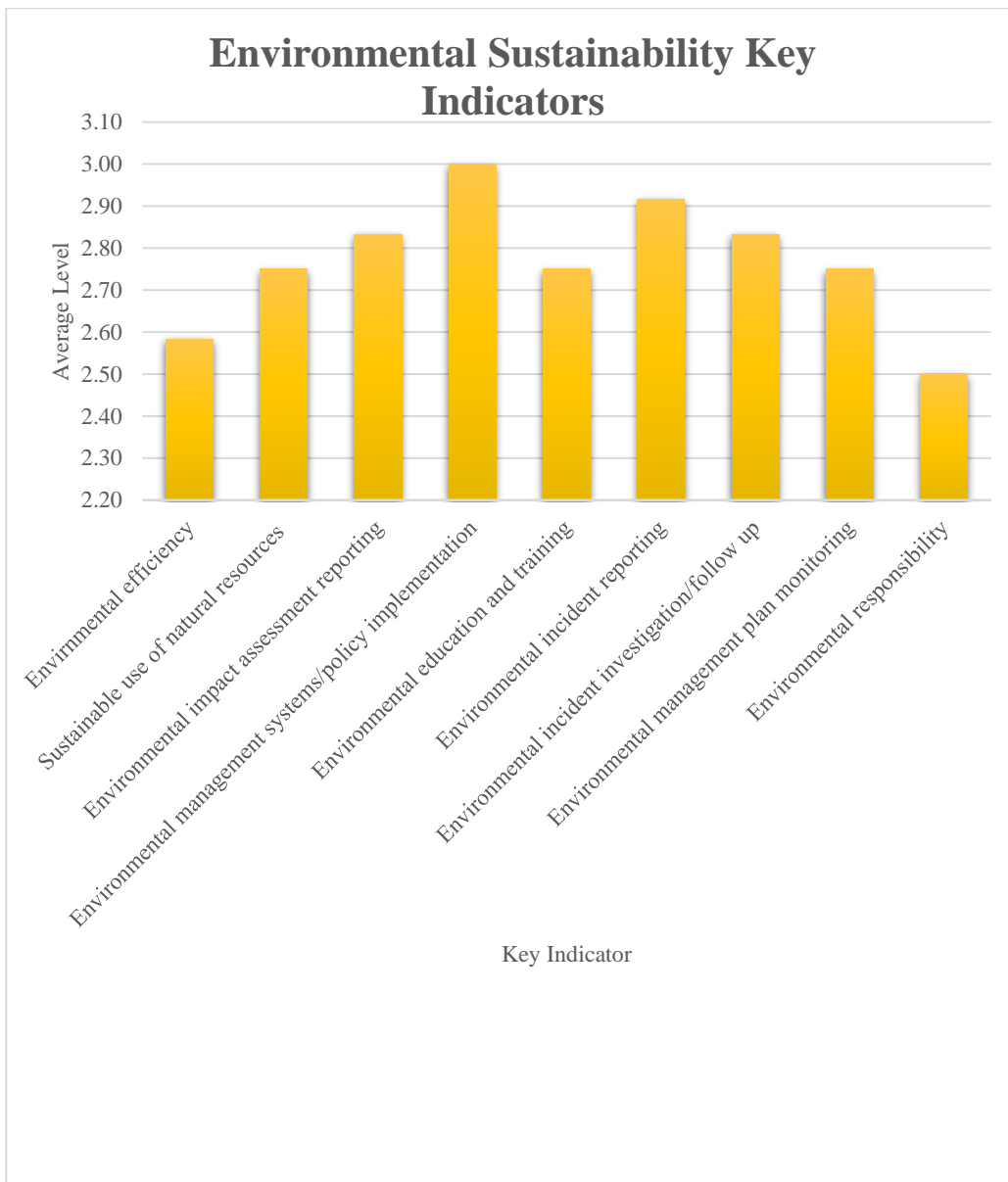


Figure 4.6: Average of participant scores for the 9 questions on Key Indicators of Environmental Sustainability. All questions could be scored from 1 – 4.

Key indicator 1, environmental efficiency ranged from a level 2 to a level 4 with an average rating of 2.58. Participants indicated they felt that in many cases the current environmental efficiency needs improvement as they believe the client and management want the project done in the most financially beneficial way and that this may be at odds with environmental efficiency.

Key indicator 2, sustainable use of natural resources, ranged from a level 1 to a level 4 with an average rating of 2.75. Participants indicated that the sustainable use of natural resources may have been due to the financial burden associated with excess usage and wastage, more than being concerned about the resulting environmental sustainability factors.

Key indicator 3, environmental impact assessment reporting, ranged from a level 1 to a level 4 with an average rating of 2.83. The results indicated that on the larger scale, the participants believed the companies they were working for were doing more than required in relation to environmental impact assessment reporting, with the identification of potential hazards related to a project and the communicating of these plans and required actions to the operations level employees through a number of methods.

Key indicator 4, environmental management systems/policy implementation, ranged from a level 2 to a level 4 with an average rating of 3. Participants identified key indicator 4 as the strongest environmental sustainability factor. They felt that the management systems and the policy implementation were well structured and that it was an area of management focus.

Key indicator 5, environmental education and training, ranged from a level 1 to a level 4 with an average rating of 2.75. Participants felt that the level of education and training provided varied, depending on the duration of the project and if they were employed through a labour hire company. A number of participants also felt the engagement level during training was often minimal.

Key indicator 6, environmental incident reporting, ranged from a level 2 to a level 4 with an average rating of 2.92. Participants indicated that the reporting process for environmental incidents was one of the most strongly enforced environmental activities on site. Numerous participants stated that even when minor environmental incidents occurred, the risk of not reporting them was too high to warrant covering them up.

Key indicator 7, environmental incident investigation/follow up, ranged from a level 2 to a level 4 with an average rating of 2.83. Participants stated they felt that in general, when environmental incidents were reported, the appropriate investigation measures were undertaken and the follow up recommendations were implemented.

Key indicator 8, environmental management plan monitoring, ranged from a level 2 to a level 4 with an average rating of 2.75. Participants suggested that the monitoring of environmental management plans was usually well managed by supervisors and management, but the operations level employees often fell short in their attitude to these processes.

Key indicator 9, environmental responsibility, ranged from a level 2 to a level 3 with an average rating of 2.5. This was the lowest rating of the nine key indicators. This question looked at the participants opinion on the engagement of operations level employees in environmental stewardship. The data showed that environmental responsibility needs improvement. A number of participants suggested that the equity between operators of different generations was insufficient, that is, older operators felt that younger operators lacked knowledge and understanding, while younger operations level employees felt the older generation showed a greater level of apathy towards environmental sustainability. Participants from different age demographics indicated that the

environmental sustainability issues and attitudes of other operation levels employees was the reason for the lower rating when scoring this key indicator.

The average overall score for the current environmental sustainability culture resulted was a level of 2.77. This indicates that the environmental sustainability culture is currently categorised as a reactive culture with some elements of the more pro-environmental active culture seen at level 3 (Piwowar-Sulej 2020).

Key indicators such as environmental education, environmental incident reporting, environmental investigation and environmental impact assessment reporting were determined to be of a higher level, with participants being more intrinsically motivated and willing to comply to the higher standards required at this level.

These elements resulted in the improvement of the overall level of environmental sustainability culture.

The scoring of the 9 key indicators was used to provide a quantitative assessment of the current environmental sustainability culture at the operations level of the civil construction industry. While this was achieved using scoring of 1-4, it was noted that there was a need for a level 5 rating. This was because some of the participants felt that they were having difficulty selecting either level 2 and level 3, as they felt it was between the two levels.

The inclusion of an additional level would be useful in providing a more accurate grading between level 2 and level 3 thereby providing a clearer representation of the current level of environmental sustainability.

4.2.2 Contributing Factors to Current Environmental Sustainability Culture (Q1b)

This question was designed to determine the factors that contribute to the environmental sustainability culture in the workplace. Participants were asked not to describe the current culture in their workplace, whether positive or negative, but rather to say what they felt were the factors that contributed to ‘why’ the current environmental sustainability culture was the way it is.

The participants were asked at interview ‘What factors do you feel contribute to the current environmental sustainability culture?’. Participants were permitted to give more than one response, although multiple responses from the same category were only allocated as a single response.

The participants returned 28 contributing factors. These factors were grouped into six (6) categories. The six (6) categories were as follows (Figure 4.7):

- Project management - 9 responses
- Communication - 2 responses

- Employee education - 5 responses
- External regulation - 2 responses
- Individual responsibility of the operations level employee - 5 responses
- Pre-established cultural - 4 responses

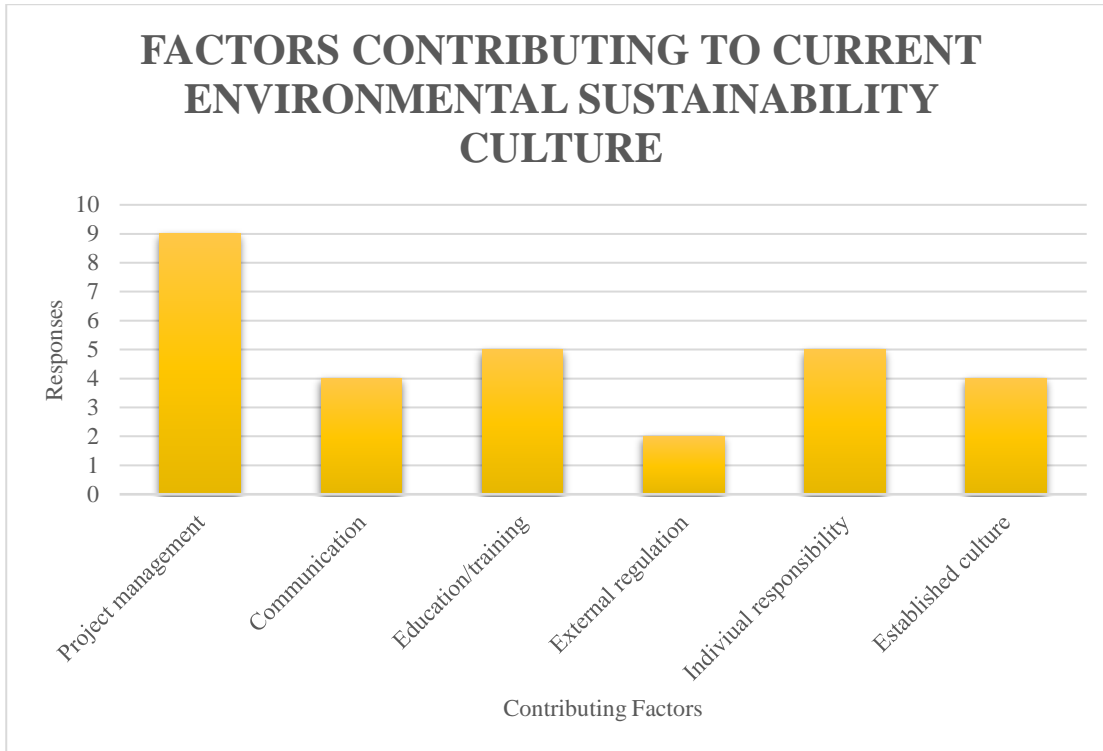


Figure 4.7: Total number of individual factors considered by the participants that contribute to the current environmental sustainability culture in their workplace.

1. Project management factors

Seventy-five (75) percent of the 12 participants indicated that project management factors contribute to the current environmental sustainability culture. The identified project management factors included:

- Level of importance placed on environmentally sustainable practice by management. Participants felt that the attitudes of the management team are reflected in the current status of the environmental sustainability culture, both a positive and negative.
- Provisions for employees to maintain a high standard of environmental sustainability.

Time and budget provisions were identified as a major contributing factor to the environmental sustainability culture. The allowance for the extra time and cost involved was stated as greatly affecting the level of environmentally sustainable practices.

- Dedicated environmental officer and management.

Participants stated that when they had a dedicated environmental officer, they were more likely to be aware of potential hazards and work in a way that helped to minimise these hazards.

- Policy and procedure implementation. For example, the reporting processes of an environmental incident.

Participants stated that for a number of smaller issues it was not worth the effort.

These results show that project management factors are the leading contributor to the current environmental sustainability culture within the companies surveyed, whether in a positive or negative way. This is likely due to participants feeling management is ultimately responsible for ensuring that environmentally sustainable practices are maintained, as supported by question 2 below. This has the potential for operations level employees to feel like pro-environmental practices are out of their control.

2. Communication

Four (4) participants (33%) discussed the importance of communication at different levels of the project hierarchy. One participant stated that on occasions they would be told one thing during the pre-start meeting that was pro-environmental sustainability, then when they were undertaking the task, they were instructed to do things in a way that did not meet the previously stated requirements. These mixed messages resulted in confusion and the participant being unsure of the best way to act. Another participant discussed the inability to voice their concerns without the fear of reprimand. The ability for people to speak up affects the environmental sustainability culture in a way that causes it to grow and improve, or remain stagnant due to fear of punishment.

3. Level of education on environmental sustainability

Five (5) participants (42%) stated that the level of education of operations level employees, on environmental sustainability directly affected the current status of environmental sustainability. These participants felt that when they were made aware of the impacts of poor environmental practices and told not only how these impacts could be minimised but why it is important to do so, they saw an overall improvement in the environmental sustainability culture.

4. Effects of external regulation

Two (2) participants (17%) highlighted the effects of external regulation on the way in which a project is run. External regulation refers not only to governing bodies, but also members of the public. One participant stated they felt that when they worked on a job that was more visible to the public and had a higher level of scrutiny, they were more likely to ensure they were working to the appropriate standards. This indicates that operations level employees have the potential to work to a high standard of environmental sustainability, if the motivation to do so is there.

5. Personal responsibility

Five (5) participants (42%) identified personal responsibility factors as being significant in the development of the current environmental sustainability culture. The most prevalent factor within personal responsibility that was highlighted by the participants was operator level employee attitude, with one participant stating that there is a high level of apathy towards environmental sustainability. Although the results from question 1.1 showed an overall current environmental sustainability culture level of 2.77/4, it was repeatedly stated that there are many operations level employees that just want to do their job and go home, and possess no desire to increase their level of engagement beyond the minimum requirement.

6. Pre-established sustainability culture

Four (4) participants (33%) discussed the pre-established environmental sustainability culture as being significantly responsible for the current status of the environmental sustainability culture. One participant felt that this is difficult to change as many of the operations level employees have been set in their ways for so long and they pass this attitude on to other younger members of the organisation. Although it is not an easy task to change a long-standing culture, there are a number of strategies identified by (Aldrich & Ruef 2006; Alvesson & Sveningsson 2016; Schein 2017) and recommendations made by participants as detailed below that indicate it is possible to build a stronger pro-environmental sustainability culture.

4.2.3 Participant Recommendations for Environmental Sustainability Culture Improvement (Q1c)

When asked ‘What recommendations would you make to help improve the current sustainability culture’, the participants returned 14 recommendations for improvements to environmental sustainability culture. These factors were grouped into five (5) categories. The five (5) categories were as follows and are graphed in Figure 4.8:

- Improvement in project management - 6 responses
- Improvement in communication – 3 responses
- Improvement in employee education - 5 responses
- Improvement in external regulations - 2 responses
- Improvement in individual responsibility - 3 responses



Figure 4.8: Total responses by participant for the five (5) categories of recommendations for improvement of environmental sustainability culture.

The participant responses to this question, ‘What recommendations would you make to help improve the current sustainability culture’, did not focus on current culture, whether positive or negative, but rather what initiatives could be implemented to facilitate the improvement of the current environmental sustainability culture.

1. Project management factors

Six (6) participants indicated that environmental sustainability culture could be improved through the implementation of project management strategies. These included, management placing a higher priority on environmental sustainability compliance, employee engagement initiatives, improved quality of supervision, and project planning that makes allowances for supporting operations level employees to work to a high standard of environmental sustainability. Through initiatives from management, such as placing a higher priority on environmental sustainability and ensuring that project planning allows for employees to work to the desired standards there is likely to be flow on effects down through supervision to the operations level. This will allow operations level employees to complete their duties without having to decide between working to appease the budget and time frame, or working to a high standard of environmental sustainability.

2. Communication

Three (3) participants discussed the ability for better communication to improve the overall environmental sustainability culture. These participants felt that through initiatives such as regular meetings and availability of information, team members would be encouraged to regularly think about the effects the tasks they are

undertaking and identify the potential environmental hazards before they result in an incident. Regular meetings such as toolbox meetings would also provide operations level employees with a platform to discuss issues that they feel are important and need addressing, without the fear of reprimand.

3. Employee Education

Environmental education and training were rated as being level 2.75 in question 1.1 and identified by one participant, in question 1.2, as being one of the leading factors that contributes to the environmental sustainability culture. This was further supported by 5 participants stating that employee education and training initiatives would further help to improve the environmental sustainability culture at an operations level. Continued education and training are essential to ensure employees remain informed on the most up to date and relevant practices. Participants discussed the importance of the training being a combination of how and why, and also practical application of the new or refreshed knowledge to help reinforce the learning process. A number of participants felt that the nature of labour hire employment reduced a company's willingness to educate workers as they were usually only there for a short period of time and would provide no long-term benefit for the company.

The use of a labour hire workforce has several negative effects on the civil construction industry. Due to the short-term nature of labour hire employment, civil construction companies are less likely to provide training and growth opportunities to operations level workers. This results in labour hire workers not having any skin in the game, or a sense of ownership beyond their contractual obligations. Whilst labour hire has its place in the civil construction industry, if mismanaged it has the potential for creating a shortage of skilled and competent operations level employees.

4. External Regulations

Two (2) participants felt that through stricter external regulations of the civil construction industry, pressure would be placed on companies to comply with a higher standard of environmental sustainability. This would potentially lead to a flow on effect to the operations level with compliance being required by all team members. Coupled with regular spot checks from external bodies such as the environmental protection agency, this should lead to an improved environmental sustainability culture.

5. Individual Responsibility

Three (3) participants discussed the importance for individuals taking responsibility for the role they play in the way project tasks are undertaken. It was stated that due to labour hire employment, operations level employees felt a disconnect from the company they were contracted to. This resulted in labour hire employees having no immediate buy-in to a project or the company image beyond keeping their short-term job.

4.2.4 Responsibility for Environmentally Sustainable Practices (Q2)

When asked who they felt was responsible for ensuring environmentally sustainable practices were adhered to, the participants responded as follows (Figure 4.9). Eleven (11) participants gave one or more responses.

- External governing bodies – Zero (0) responses
- The client – One (1) response
- Management – Nine (9) responses
- Supervision – Four (4) responses
- Everyone – Eleven (11) i.e. All participants responded with ‘everyone’

Additionally, 9 participants stated that although everyone as an individual was responsible, the efforts had to be instilled using a top down style starting with upper management.



Figure 4.9: Responsibility for environmentally sustainable practices responses

None of the participants identified external governing bodies as being responsible for ensuring that environmentally sustainable practices are followed. This was unexpected. It is possible that the participants required further information to engage in this question on a deeper level. It may also reflect a lack of knowledge, on the part of participants, of the government regulations around environment sustainability in civil construction. It is also possible that this group of employees see external governing bodies as responsible for identifying environmentally sustainable practices guidelines, rather than enforcing their compliance.

One (1) participant felt that it was also important for the client to accept responsibility for environmentally sustainable practices. This was justified by saying that the client is paying for the project and needs to allow for this in the project budget and timeframe. This participant also stated that it was the responsibility of management, direct supervisors, and everyone involved in a project with a top to down flow of information.

Nine (9) participants felt that management was ultimately responsible for engaging all team members from the top down, to ensure they perform their duties in an environmentally sustainable manner. All participants stated that everyone involved in a project had the responsibility to maintain environmentally sustainable practices. This can be likened to the workplace health and safety duty of care, where everyone in the workplace has a responsibility to not only ensure that what they are doing is safe but also have a responsibility to speak-up if they see others conducting unsafe practices. This shows that the participants are willing to take ownership of their responsibility to the environment but that their ability to do this is impacted by the beliefs and expectations of the client, their employer and senior management.

During the interview process, participant 7 had not been asked who they felt was responsible for ensuring environmental sustainability practices were followed. However, this question was indirectly answered when they stated “there’s a lot of drive needed by management to enforce it and engage with the work force to push it”. This is in line with the views of the majority of participants, that management is responsible for adopting a top down management style when instilling responsibility for ensuring environmentally sustainable practices are followed.

This question, although providing a positive ownership of responsibility for following environmentally sustainable practices, could have been taken further to investigate the level to which employers and upper level management make appropriate provisions for operations level employees that allow them to uphold their responsibility.

4.2.5 Environmental Sustainability Mission Statement (Q3)

When asked if the company, that participants were currently working for had an environmental sustainability mission statement, the participants responded as follows (Figure 4.10):

- 3 responded with yes
- 3 responded with no
- 4 responded that they were unsure, but thought yes
- 2 responded that they were unsure, but thought not

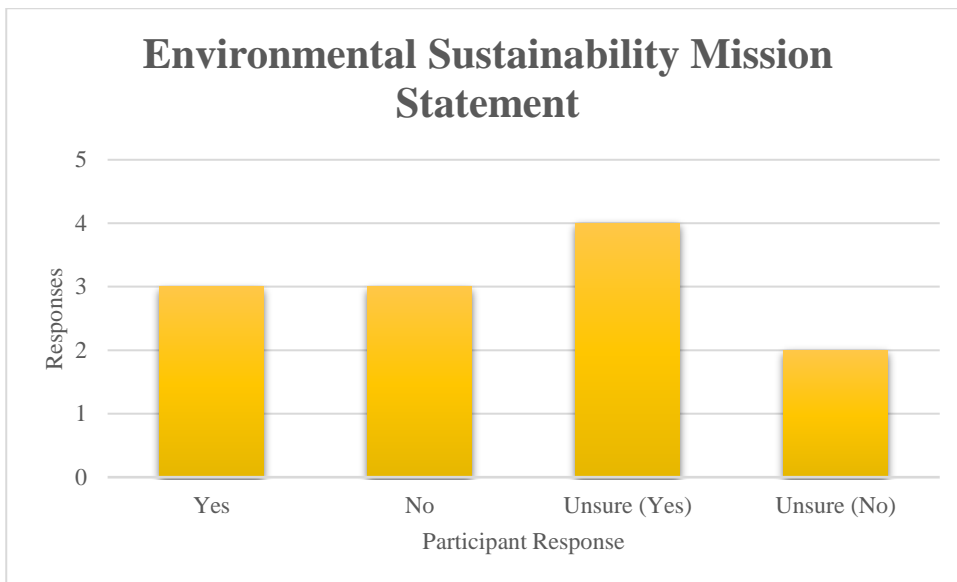


Figure 4.10: Company environmental sustainability mission statement responses

An environmental sustainability mission statement differs from environmental sustainability policies and procedures. A policies and procedures document gives details of the policies, requirements and how to achieve them, whereas a mission statement defines an organisation's values, commitment, and dedication to a particular belief (Hill 2007). A mission statement that is truly upheld by all members of an organisation indicates that an organisation is committed to going above and beyond in a particular area.

Only three (3) of the participants could confidently say the company they were working for had an environmental sustainability mission statement, and four (4) participants were unsure but thought they did. None of these 7 participants were able to give details of its content. This suggests that it is not displayed or readily available. It also indicates that the principles and beliefs of the 'environmental sustainability mission statement', although it is available is not embedded in the training of operations level employees, but is more a document developed for appearance (Kopaneva & Sias 2015).

The remaining five (5) participants stated that the company they were working for did not have an 'environmental sustainability mission statement' that they had seen or been made aware of. This indicates that the company either has no 'environmental sustainability mission statement' or they do not place importance on the document and do not fully commit to its content by instilling the principles across all levels of the company.

It is possible that participants did not differentiate between 'environmental sustainability policy and procedure' and an 'environmental sustainability mission statement'. This question could have been improved by clearly defining both 'environmental sustainability policy and procedure' and an 'environmental sustainability mission statement' and the differences between the documents.

If an organisation does have an environmental sustainability mission statement, it would be recommended that this document be covered in workplace inductions and refresher courses, and made visible in high traffic areas of the workplace as a constant reminder.

4.2.6 Reportable Environmental Incidents (Q4a & 4b)

When asked if they had witnessed or been involved in a reportable environmental incident, the participants responded as follows (Figure 4.11):

- 6 responded with yes
- 6 responded with no

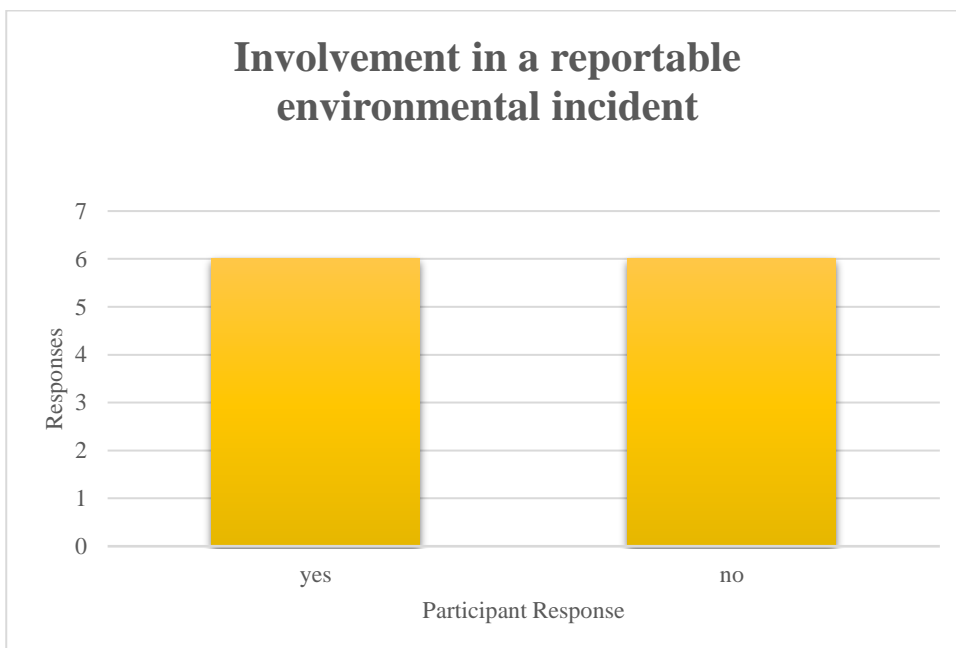


Figure 4.11: Involvement in a reportable environmental incident - responses

An environmental incident is described by the Department of Transport and Main Roads (2017, para.2) of Queensland Government in Australia, as:

“an environmental incident is where actual environmental harm occurs, or there is a situation where there is a real chance that environmental harm could occur; unauthorised damage to cultural, built heritage, artefacts or ship wrecks and unlawful under any environmental or cultural heritage legalisation”

The participants that responded with yes were asked to provide details of the particular incident they were referring to. These responses were categorised as follows:

- Minor hydrocarbon spill
- Major hydrocarbon spill
- Minor clearing breach

One (1) participant stated they had witnessed several minor land clearing breaches on one job, where land clearing occurred beyond the parameters of the clearing permit. These breaches were reported and investigated, resulting in regular memos and a review of clearing processes.

Two (2) of the participants who stated they had either witnessed or been involved in a reportable environmental incident gave details on what they would consider a minor hydrocarbon spill. These spills happened during activities such as refuelling, oil top-ups, and component failure. The participants portrayed an image of the particular incident being of minor significance which did not always lead to the expected reporting procedure but suggested that the appropriate clean-up procedure was followed. It is understood that this was a result of time pressure and the complexity of the process of reporting such a minor incident.

Three (3) participants who stated they had either witnessed or been involved in a reportable environmental incident gave details of what they would consider a major hydrocarbon spill.

Participant 2 described an incident where upon arrival to site one morning they discovered a disconnected fuel line that had resulted in approximately 100L of diesel contaminating the soil around an excavator. The incident was reported, and an immediate investigation was undertaken. The investigation concluded that the fuel line had been manually removed in an attempt to steal the diesel and the tank was then left to drain.

Participant 4 described an incident where a large dump truck burst a hose, resulting in an estimated 300 - 400L of hydraulic fluid being spilt and contaminating the soil. The participant said that the organisation's procedure for addressing an environmental incident was followed. The spill was immediately contained, and the supervisors notified. This was followed by an internal investigation, removal and disposal of the contaminated soil to the designated contaminated soil area. Post interview, the participant stated that they believed the investigation indicated the incident could have been prevented through a more thorough pre-start check of the machine as the offending hose was brittle and in poor condition. It was not stated by the participant as to whether the issue had been previously raised by the operator of the machine. While this comment wasn't recorded the participant gave their consent to have this information included in the research.

Participant 7 described an incident when they were an operator on a civil construction project for a large iron ore mining company. The participant witnessed a discharge of approximately 3,000L of diesel from a 20,000L bulk fuel storage tank. The participant was not involved in the incident but stated the clean-up and investigation

process were undertaken to a very high standard. The participant felt that the incident was well managed, largely due to the severity of the incident and the fact that the client was such a high-profile mining company. This may be an indication that a company prioritises a higher standard of environmentally sustainable practise due to the high profile of the client.

From the research it can be concluded that when an employee feels an environmental incident is significant in their opinion, the reporting and investigation process are a high priority. This being said, it also shows that in these cases the organisations are reacting to the incident more than being proactive in the prevention. This can be seen in the incident described by participant 4 where the poor condition of a hose resulted in the loss of hydraulic fluid. Not only could this have been prevented by a more thorough pre-start check, but also a more stringent maintenance and servicing program.

Although this question provided several interesting responses, it could be improved upon by differentiating between only having witnessed the incident rather than having been actually involved in the reportable environmental incident. It does however show that there are a range of environmental sustainability issues within the civil construction industry that need to be addressed.

During the analysis of the data one participant made contact to say they had responded to the question about being involved in an environmental incident with 'no', but had in fact been uncomfortable and unwilling to respond with 'yes' as they had previously worked on a project where there had been a large environmental incident that resulted in significant fines after the investigation procedure. The participant was unwilling to provide any further information on the incident or investigation process for fear of being identified, despite the de-identification of the participants. This response was not used in the data analysis. This highlights the issue of fear and participant hesitation distorting the results.

4.2.7 Requests to undertake non-environmentally sustainable practices (Q5a & 5b)

When asked if they had ever been asked to undertake a task that they felt was contrary to environmentally sustainable practices, the participants responded as follows (Figure 4.12):

- 3 responded with yes
- 9 responded with no

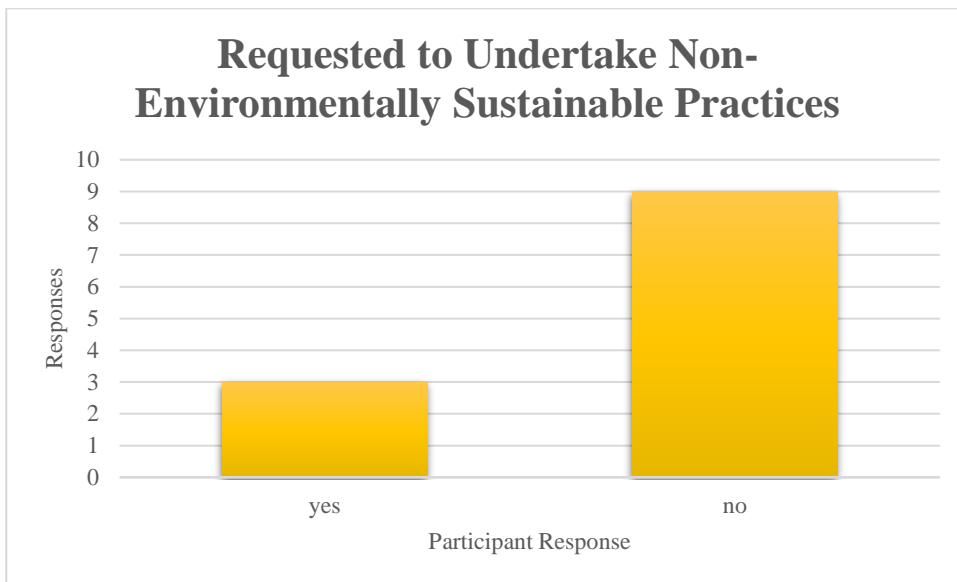


Figure 4.12: Requested to undertake non-environmentally sustainable practices responses

The participants that responded with yes were asked to provide details of the particular incident they were referring to the responses were as follows:

- Discharge of contaminated water
- Clearing of an environmentally sensitive area
- Improper disposal of construction waste

Participant 6 discussed an incident when installing a culvert when they were requested to pump-out trapped water from the culvert following a large fall of rain. The participant said that due to the silt and sediment that had collected the water was deemed as contaminated and required to be disposed of in an appropriate manner. Due to the time constraints, the participant and other employees were told to pump the water directly into the drain and load out any remaining sediment for removal and disposal. The participant stated that although it was contrary to the proper procedure and was classified as a discharge of contaminated water, they had been willing to undertake the task because they believed that the amount discharged was negligible compared to the amount of water and sediment that had been displaced during the rain event. The participant also stated that the culvert was designed for that location to ensure the unimpeded flow of water and sediment during seasonal rain. This particular incident shows that operations levels employees are willing to undertake tasks that, although technically contrary to the stated procedures, if they feel that the resulting effects are negligible in their opinion. It also shows that in some cases there may be an issue when the procedure causes an increased workload, time pressure and costs, while providing no effective benefits to the environment.

Participant 7 discussed a time when working in a quarry that had an identified environmentally sensitive area located in the centre of the site. The participant stated that they and several other operators were requested to come to work out of hours and clear the area, regardless of the consequences. They declined to be involved in

the clearing but upon arrival at work the following Monday morning, they found that the area had been cleared. they stated that it would be cheaper for the quarry owner to pay the applicable fines, rather than work around the area. They suggested that the request was made so that the daily operations were not affected resulting in an increase to the production output. The participant also believed that the operators who had performed the clearing had no regard for the environmental consequences of their actions, and that the environmental sustainability culture was incredibly poor on this particular job.

The particular request to clear an environmentally sensitive area identifies a number of issues. These include effects of poor top down environmental sustainability culture and the ineffective punishment of offending organisations and their employees. Although the participant indicated this particular event occurred several years ago, they feel that there are still people that maintain this type of attitude towards environmental sustainability. It is also an indication that there is a requirement for more stringent external regulation in relation to environmental sustainability.

Participant 9 discussed a project where there was a highly regimented process of segregating waste on site, in order to dispose of it in the appropriate way. The participant stated that the truck driver who was usually responsible for removal of the waste had called in sick and that he (the participant) was required to perform this task. The participant stated that when dumping the segregated waste, it was all dumped in a single landfill without segregation. The participant raised the issue with their supervisor and was told that they had trust in him that they would not talk to anyone about the dumping and that they had brought him into their confidence.

There are several major issues identified from this participant's response. First, the employees are required to segregate the waste, adding extra time and cost requirements to the project. Secondly, the willingness of the management team to place operators in a position such as this and manipulate them into compliance. And thirdly, the participant being made to feel they are in a position where they are unable to speak out against certain practices in the workplace as it would jeopardise their employment. The participant's response supports the previously identified contributing factor to the current status of the environmental sustainability culture, 'mixed messages from management'.

4.2.8 Additional Information (Q6)

Participants were asked if there was anything else they would like to add regarding environmental sustainability culture. The opportunity for participants to speak freely and openly, resulted in several interesting but sometimes conflicting views on environmental sustainability culture.

A number of participants stated they had seen a significant improvement in attitudes and efforts related to environmental sustainability, while one participant felt that it was in decline. The collected data provides

supporting evidence that there is an improvement rather than a decline, however, although it appears that environmental sustainability is improving, the results indicate that more effort and work is required to raise the current level of environmental sustainability culture in the civil construction industry.

Two (2) participants believed there needs to be a greater focus on environmental sustainability across the board, however, one participant felt that the majority of companies were doing all they could which was enough. The number of responses to question 1.3 regarding how to improve the current environmental sustainability culture indicate that there is need for further improvement and that there are ways in which companies can facilitate this positive change.

One (1) participant discussed the flow on effects into their personal life and their views on environmental sustainability as a result of education and practices they have undertaken in the work environment.

One (1) participant discussed that they had noticed a significant difference between the level of focus on environmental sustainability factors in relation to the size of the company, client and project. This is an interesting observation and could be an area of further research. When reviewing the data and comparing the current projects the participants were working on, the stand out factors that potentially lead to this gap are project budget, client involvement and project visibility.

4.3 Environmental Sustainability Best Practice Policy

Through a review of leading civil construction company environmental sustainability policies, in conjunction with the participants responses, this research has led to the development of an environmental sustainability best practice policy for the civil construction industry, as detailed below (Figure 4.13). This has been achieved through identifying the highest standard across all of the reviewed documents and cross referencing it with the participant's recommendations for improvement. Implementation of this environmental sustainability best practice policy is recommended to facilitate growth in civil construction company environmental sustainability culture.

Environmental Sustainability Best Practice Policy

Due to the nature of construction projects and their effect on the environment, both long and short term, this policy outlines the best practices for minimising the negative impacts and promoting the sustainability of projects from cradle to grave.

To achieve this, civil construction companies would be required to, while not being limited to:

- Adhere to ISO14001:2015 'Environmental Management Systems' as a minimum
- Maximise the efficient use of energy while reducing emissions that adversely affect the environment. If a reduction is not feasible, as a last resort it will be a requirement to meet a zero-sum balance of project related emissions using leading and reputable means.
- Provide education, training, and guidance to all stakeholders to continually improve awareness of related environmental impacts of construction and the sustainability culture within the civil construction industry.
- Continually update processes to incorporate innovation to help minimise impacts on the environment.
- Develop zero waste strategies to use resources in a manner that is efficient, eliminates or minimise any pollutants reaching the air, land or water and minimise and controlling waste, through segregation, re-use and recycling wherever practical.
- Adhere to international environmental management best practice plan
- Have environmental sustainability as a focus at all levels of construction, from concept through to demolition
- Perform regular reviews and audits of projects to ensure relevant targets are being met.
- Perform risk assessments to identify potential hazards and put in place critical control to prevent environmental incidents.
- Set measurable objectives and targets to evaluate environmental performance against.
- Ensure all plant and equipment is maintained to maximise efficiency and prevent fluid spills.
- Replace plant and equipment with emerging environmental technologies and higher efficiency rates when required.
- Manage and minimise work that has an immediate impact on the surrounding environment, e.g. lighting plans for night works, noise and water runoff.
- Ensure all environmental incidents are reported, investigate and recorded.

This policy should be reviewed annually and updated as required. Employees at all levels should be made aware of this document and take personal responsibility for upholding its principles.

Figure 4.13 Environmental Sustainability Best Practice Policy

4.4 Potential Improvements to Data Collection

Although the participants were informed that their participation was confidential and that their information would be de-identified, there were still issues with participant hesitation. This was particularly prevalent with one participant being unwilling to discuss the occurrence of a significant environment incident they had been involved in.

Although pilot interviews were conducted and the questions altered prior to the data collection, a number of participants required further clarity on some of the questions prior to providing a response. To ensure all participants were given the same information for each question, pre-written examples and explanations of each question should have been developed to a higher standard. The interview process as a whole became stronger towards the later interviews as the researcher became more comfortable with the process.

To improve the accuracy of the data collection and reduce the effects of outlying responses, a larger sample size would need to be interviewed. This could have been achieved by having a larger number of participants complete question 1.1 as a written survey only, and then interviewing a greater number of participants for the remaining questions. It would also provide insight to further investigate the responses made by participants and their experience level in the civil construction industry.

In a number of instances, the responses provided by participants in question 1.1 did not always align with the responses provided in later questions. The variation in the response may be due to the earlier identified issue of the requirement for an extra level of environmental sustainability culture. By addressing this issue, it would be possible to produce a more accurate representation of the current environmental sustainability culture within the civil construction industry.

In summary, the research suggests that there is a need for significant improvement in environmental sustainability culture in civil construction, with some companies being more proactive than others. The aim of all companies should be to have an environmental sustainability culture at Level 4 (continuous improvement culture) with all project stakeholders being intrinsically motivated to achieve high levels of environmental sustainability. The average score in this research was 2.77 (out of 4). This confirms that there is considerable improvement to be achieved, with some companies falling well below an acceptable standard while other companies with a high standard pulling the average up.

Improvement in the company environmental sustainability culture must be embedded at the top levels of the organisation with education of all levels of employees being held responsible to meet required standards. Communication between upper level employees must be consistent so that operation level employees can clearly understand their obligations and expected duty of care to environmental sustainability.

Enforcement of regulations by the statutory authorities was not considered to be of major importance to the operations level employees but this reflects a lack of knowledge of the federal and state requirements of civil construction companies to meet environmental standards. This is not surprising given the complexity of federal and state government legislative requirements with each state having its own legislation as well as additional legislation set out by the federal body.

Society's expectations of civil construction companies are that they must make all efforts to achieve environmental sustainability targets. To achieve this, companies need to develop a strong environmental sustainability culture similar to that achieved for occupational health and safety culture.

Chapter 5 – Conclusion

Although the research shows environmental sustainability to be improving across the board, it is a requirement for civil construction companies, their employees and clients to do more to help minimise the negative effects imposed upon the environment through their activities.

Through a review of the current literature and one-on-one interview-based data collection, the research determined the environmental sustainability culture in the Australian civil construction industry to currently be at a level of 2.77, a reactive culture, with some elements of the more pro-environmental active culture seen at level 3.

The research suggests that the root causes leading to this are:

- The existing environmental sustainability culture
- The current level of environmental education and training
- Issues with communication flow and clarity
- Inadequate provisions to ensure that operations level employees are able to maintain a high standard of environmental sustainability, such as time and budget allocations.
- The use of labour hire employment

The following recommendations were developed through the analysis of the collected data, and have the potential to facilitate the improvement of the current environmental sustainability culture in the civil construction industry. These recommendations include:

- Continued relevant and up to date education and training at the operations level.
- Improved communication structure that ensures the message portrayed by management is not distorted by the time it reaches the operations level.
- Making adequate budgeting and time allowances for environmentally sustainable practices when tendering for projects.
- Where possible employ team members on a fulltime continuing basis and develop their skill set to aid in employee retention.
- Implement the environmental sustainability best practice policy, as developed from this research

It is important to note that this research is limited due to the sample size of participants resulting in the research being focussed on a small proportion of the civil construction industry. The participation and sample size were affected, in part as a result of COVID-19. To further determine the environmental sustainability culture across all levels of the Australian civil construction industry, further research at different levels of civil construction organisations and external stake holders is required. Research at supervision, management and client levels using a similar approach and method of data collection should be implemented to give a more holistic determination of the current environmental sustainability culture, the reasons why it is the way it is and what needs to be done to improve it. The research has also highlighted a need to investigate the effects that labour hire has on environmental sustainability and the civil construction industry as a whole.

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Appendix A - Project Specification

ENG4111/4112 Research Project

Project Specification

For: Jack Cawdell-Smith

Title: Critical Factors Affecting Sustainability in Australian Civil Construction Industry: An Investigation into Sustainability Culture

Major: Construction Management

Supervisor:

Enrollment: ENG4111 – ONLINE S1, 2020
ENG4112 – ONLINE S2, 2020

Project Aims: To investigate the sustainability culture of civil construction workers at an operational level, identify deficiencies in sustainability culture in civil construction, and develop tools and strategies to help reduce these deficiencies.

Programme: Version 1, 2nd Feb 2020

1. Research standards related to sustainability in civil construction
2. Review sustainability policies/mission statements of different construction companies to develop an understanding of industry standards
3. Identify various elements for a best practice/benchmark model for comparing different companies
4. Develop a questionnaire based on the best practice model for civil construction workers (Operations Level) followed by face to face interviews to gain more in-depth information if required.
5. Collate collected data and analyse it against the best practice model and company's sustainability policies and reports
6. Analyze the results of the different companies to identify their positioning using a maturity model, deficiencies in sustainability culture, and effective strategies to ensure high level sustainability culture
7. Develop tools and strategies to encourage, promote and improve sustainability culture within the construction industry.

If time and resources permit:

8. Attempt to implement strategies within one of the surveyed companies whose level of sustainability could be improved upon
9. Re-survey and analyze results for improvement in sustainability

Appendix B – Ethics Approval Letter

10/21/2020

University of Southern Queensland Mail - [RIMS] USQ HRE Application - H20REA177 - Expedited review outcome -Approved



Jack Cawdell-Smith <w0072225@umail.usq.edu.au>

[RIMS] USQ HRE Application - H20REA177 - Expedited review outcome - Approved

2 messages

human.Ethics@usq.edu.au <human.Ethics@usq.edu.au>
To: W0072225@umail.usq.edu.au
Cc: Amirhossein.Heravi@usq.edu.au

Tue, Sep 8, 2020 at 10:43 AM

Dear Jack

I am pleased to confirm your Human Research Ethics (HRE) application has now been reviewed by the University's Expedited Review process. As your research proposal has been deemed to meet the requirements of the National Statement on Ethical Conduct in Human Research (2007), ethical approval is granted as follows:

USQ HREC ID: H20REA177
Project title: Critical Factors Affecting Sustainability in Australian Civil Construction Industry: An Investigation into Sustainability Culture
Approval date: 08/09/2020
Expiry date: 08/09/2021
USQ HREC status: Approved

The standard conditions of this approval are:

- a) responsibly conduct the project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments made to the proposal;
- b) advise the University (email: ResearchIntegrity@usq.edu.au) immediately of any complaint pertaining to the conduct of the research or any other issues in relation to the project which may warrant review of the ethical approval of the project;
- c) promptly report any adverse events or unexpected outcomes to the University (email: ResearchIntegrity@usq.edu.au) and take prompt action to deal with any unexpected risks;
- d) make submission for any amendments to the project and obtain approval prior to implementing such changes;
- e) provide a progress 'milestone report' when requested and at least for every year of approval.
- f) provide a final 'milestone report' when the project is complete;
- g) promptly advise the University if the project has been discontinued, using a final 'milestone report'.

The additional conditionals of approval for this project are:

- (a) Nil.

Please note that failure to comply with the conditions of this approval or requirements of the Australian Code for the Responsible Conduct of Research, 2018, and the National Statement on Ethical Conduct in Human Research, 2007 may result in withdrawal of approval for the project.
Congratulations on your ethical approval! Wishing you all the best for success!

If you have any questions or concerns, please don't hesitate to make contact with an Ethics Officer.

Kind regards

Human Research Ethics

University of Southern Queensland
Toowoomba – Queensland – 4350 – Australia
Phone: (07) 4631 2690
Email: human.ethics@usq.edu.au

<https://mail.google.com/mail/u/1?ik=b6d53e7843&view=pt&search=all&permthid=thread-f%3A1677224371730659560&simpl=msg-f%3A1677224...> 1/2

10/21/2020

University of Southern Queensland Mail - [RIMS] USQ HRE Application - H20REA177 - Expedited review outcome -Approved

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The University of Southern Queensland is a registered provider of education with the Australian Government.

(CRICOS Institution Code QLD 00244B / NSW 02225M, TEQSA PRV12081)

Jack Cawdell-Smith <w0072225@umail.usq.edu.au>
To: anguscawdellsmith@gmail.com

Wed, Oct 21, 2020 at 6:01 PM

[Quoted text hidden]

Appendix C – Research Information Sheet



University of Southern Queensland

Participant Information for USQ Research Project Interview

Project Details

Title of Project: **Critical Factors Affecting Sustainability in Australian Civil Construction Industry: An Investigation into Sustainability Culture 20005912**
Human Research Ethics Approval Number: **20005912**

Research Team Contact Details

Principal Investigator Details

Dr Amirhossein Heravi
Email: Amirhossein.heravi@usq.edu.au
Telephone: +61 7 3470 4338
Mobile:

Other Investigator Details

Mr. Jack Cawdell-Smith
Email: W0072225@umail.usq.edu.au
Telephone: +61 415358389
Mobile: +61 415 358 389

Description

This project is being undertaken as part of a Bachelor of Construction (Honors) Management

The purpose of this project is to

1. Determine the current status of the sustainability culture, at an operations level
2. Identify root causes of any deficiencies in the organisational culture in relation to environmental sustainability
3. Identify and recommend potential solutions
4. Develop a best practices framework for sustainable development

The research team requests your assistance because you are currently part of the civil construction industry and your insight and experience will help to gauge the current status of sustainability culture within the civil construction industry.

Participation

Your participation will involve participation in an interview that will take approximately 30 minutes to 1 hour of your time.

The interview will be undertaken either by teleconference or interview at your current place of employment, during ordinary working hours between August and September 2020.

Questions will include;

- In your opinion what is the current status of sustainability culture in your workplace?
- What do you feel are the major factors contributing to the current sustainability culture?

The interview will be audio recorded. If you do not wish for recording to occur, please advise the researcher and your participation will be withdrawn.

Your participation in this project is entirely voluntary. If you do not wish to take part, you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. You will be unable to withdraw data collected about yourself after the data has been analysed. If you do wish to withdraw from this project or withdraw data collected about you, please contact the Research Team (contact details at the top of this form).

Your decision whether you take part, do not take part, or to take part and then withdraw, will in no way impact your current or future relationship with the University of Southern Queensland.

Expected Benefits

It is expected that this project will not directly benefit you, except for the raffle winning participant. However, it may benefit the community and civil construction industry as a whole.

All participants will be entered into a raffle that will meet USQ's Guidelines for the Giving of Prizes as Incentives for Research Participation.

The winning participant will be contacted by phone and be informed of their win and will be sent a digital gift certificate. The raffle will be drawn after the data has been analysed. Any participants who withdraw their participation prior to the completion of analysis will be removed from the raffle.

On notification of winning the raffle, the participant will be asked to provide an email address where the digital gift card can be sent. All participants have the option to opt out of incentive at any stage.

Risks

In participating in the interview, there are no anticipated risks beyond normal day-to-day living. All risks of participant identification have been removed through de-identification of participant data.

Privacy and Confidentiality

All comments and responses will be treated confidentially unless required by law.

- The interviews will be audio recorded for transcription purposes.
- If you wish, you will be provided with a copy of the interview transcript for review and endorsement prior to inclusion in the project data.
- You will be required to provide any amendment to the interview transcript within a week of receiving the transcript.
- If the recording will not be used for any other purpose.
- Access to the recorded data will be limited to identified members of the research team. This will include transcription and data analysis.
- It is not possible for you to participate in the project without being recorded.

Your data will be made available for future research purposes for research of a similar nature. The data will be stored as re-identifiable data, *in accordance with 2.5.2 of the "Australian Code for the Responsible Conduct of Research"*.

Upon request via email (contact details at the top of this form), you will be provided with a copy of your transcript and the completed thesis.

Any data collected as a part of this project will be stored securely as per University of Southern Queensland's [Research Data Management policy](#).

Consent to Participate

We would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate in this project. Please return your signed consent form to a member of the Research Team prior to participating in your interview.

Questions or Further Information about the Project

Please refer to the Research Team Contact Details at the top of the form to have any questions answered or to request further information about this project.

Concerns or Complaints Regarding the Conduct of the Project

If you have any concerns or complaints about the ethical conduct of the project, you may contact the University of Southern Queensland Manager of Research Integrity and Ethics on +61 7 4631 1839 or email researchintegrity@usq.edu.au. The Manager of Research Integrity and Ethics is not connected with the research project and can facilitate a resolution to your concern in an unbiased manner.

Thank you for taking the time to help with this research project. Please keep this sheet for your information.

Appendix D – Consent Form



University of Southern Queensland

Consent Form for USQ Research Project Interview

Project Details

Title of Project: **Critical Factors Affecting Sustainability in Australian Civil Construction Industry: An Investigation into Sustainability Culture**
Human Research Ethics Approval Number: **20005912**

Research Team Contact Details

Principal Investigator Details

Dr Amirhossein Heravi
Email: Amirhossein.heravi@usq.edu.au
Telephone: +61 7 3470 4338
Mobile:

Other Investigator Details

Mr Jack Cawdell-Smith
Email: W0072225@umail.usq.edu.au
Telephone: +61 415358389
Mobile: +61 415 358 389

Statement of Consent

By signing below, you are indicating that you:

- Have read and understood the information document regarding this project. Yes / No
- Have had any questions answered to your satisfaction. Yes / No
- Understand that if you have any additional questions you can contact the research team. Yes / No
- Understand that the interview will be audio recorded Yes / No
- Are over 18 years of age. Yes / No
- Understand that any data collected may be used in future research activities Yes / No
- Agree to participate in the project. Yes / No

Participant Name
Participant Signature
Date

Please return this sheet to a Research Team member prior to undertaking the interview.

Appendix E – Participant Information Form

Participant Number:

Age: 18 – 25

26 – 35

36 – 45

45 – 55

55 – 65

65+

Gender: Male

Female

Other Please specify

Rather not say

Do you identify as Aboriginal or Torres Strait Islander?

Yes

No

Rather not say

Industry Experience:

Current Role:

Previous Roles:

Appendix F – Participant Response Sheet

Critical Factors Affecting Sustainability in Australian Civil Construction Industry: An Investigation into Sustainability Culture

Environmental sustainability culture is the degree to which management and employees focus on engaging in environmentally sustainable practices. For the purpose of this study, environment, environmental and environmentally refer to the natural environment, unless otherwise stated.

Table 1, is used to rate the environmental sustainability indicators in identified in Table 2.

Table 1: Environmental Sustainability Current Level

Current Level	Description	Type of Employee Motivation
Level 1 – “zero level” “Culture, of high risk”	<ul style="list-style-type: none"> • Environmental issues are not important. • Nobody cares about them. • There is lack of communication in this area. Pathological behavior is accepted. 	No motivation
Level 2 – “reactive culture”	<ul style="list-style-type: none"> • The only motivation for environmentally sustainable activities is fear of punishment. • The company focuses on ensuring the compliance of internal documentation with the relevant general legal rules. • Nobody cares about communication this area. 	Negative motivation
Level 3 – “active culture”, systematic culture”	<ul style="list-style-type: none"> • The company undertakes more activities than are required by law. • There is a formal environmental policy and environmental system. • The flow of information and the procedures are effective. • Environmental sustainability goals are formally set for individuals and teams. • Environmental sustainability performance is a subject of assessment. 	Positive but extrinsic motivation
Level 4 – “continuous improvement culture”	<ul style="list-style-type: none"> • The company undertakes more pro-environmental activities than are required by legal regulations and has a formal environmental policy Employees are involved on an individual and group level in different activities related to risk assessment or improvements in working conditions, for example They help each other and share knowledge about environmental sustainability issues. • They are not only involved but truly engaged in these activities and believe that together they can "change the world." • The company participates in global pro-environmental programs and shares best practices with other companies. 	Intrinsic motivation

Critical Factors Affecting Sustainability in Australian Civil Construction Industry: An Investigation into Sustainability Culture

Table 2: Environmental Sustainability Key Indicators

No.	Indicator	Description	Score
1	Environmental efficiency	Refers to environmentally sustainable practices, regarding services and products. Construction materials, environmental footprint, and energy consumption.	
2	Sustainable use of natural resources	Refers to minimizing resource usage, primary material input and output, waste recovery and disposal.	
3	Environmental impact assessment reporting	The process of evaluating the likely environmental impacts of a project.	
4	Environmental management systems/policy implementation	Refers to meeting environmental obligations, procedural practices to minimise negative environmental effects, implement and preserve strategies for environmental protection.	
5	Environmental education and training	Skills such as critical thinking, problem-solving, and effective decision-making, are cultivated through education and training, in order for individuals to expand their viewpoint around environmental issues.	
6	Environmental incident reporting	The process of reporting environmental incidents that have occurred during project operations.	
7	Environmental incident investigation and follow-up	The investigation and follow-up actions to prevent repeat incidents.	
8	Environmental management plan monitoring	Effective environmental management and monitoring ensures the environmental objectives of the project.	
9	Environmental responsibility	Refers to developing equity between members of different generations, and to the cooperation for the improvement of environmental quality.	